

# CHEMCENTRAL Summary Report

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Developed by EPA Region 7

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## **CHEMCENTRAL Fire Response Environmental Sample Results**

### **Introduction**

At approximately 2:45 p.m. on February 7, 2007, a large fire and smoke plume was visible from the U.S. Environmental Protection Agency (EPA) Regional Office. Shortly thereafter, EPA On-Scene Coordinators (OSCs) and other EPA staff began coordinating a large-scale response to the CHEMCENTRAL fire which would last well into the morning of February 8. Preliminary reports from the scene and other information sources indicated the likelihood of the fire being fueled by mineral spirits—a general hydrocarbon solvent. Teams from various entities including EPA deployed throughout the Kansas City metropolitan area to conduct real-time air monitoring for certain contaminants to assess the fire's impact on the surrounding population's health and welfare. Most real-time air monitoring instruments do not measure for specific contaminants, rather they give a general indication of air quality conditions. In addition, data were collected and assessed from the fixed ambient air monitoring stations which are sited to assess compliance with the National Ambient Air Quality Standards (NAAQS). (See **Attachment 1** on the NAAQS for information on these standards.) This document provides information regarding the environmental samples that were collected, what was found in those samples, and what the results mean in terms of potential impacts on public health.

### **Fixed Ambient Air Quality Monitoring Station Data Comparison (Data in Table 1)**

**Rationale** - The Kansas City metropolitan area has several fixed monitoring stations at various locations around the city to continuously measure air quality for protection of public health through comparison with the NAAQS. EPA accessed the data and monitored it throughout the night and into the morning of February 8, the time during which the fire was burning. Air monitoring data were collected from the two fixed local and state government-operated ambient air monitoring stations nearest to the incident scene. Hourly average data are reported in the attached table at 1000 hours (10:00 a.m.), several hours before the fire on February 7 (the pre-fire data are included for comparison purposes). These fixed monitoring stations were important to EPA's evaluation of air quality because both stations were predicted to be impacted by the CHEMCENTRAL smoke plume at some time based on atmospheric dispersion modeling and surface wind considerations.

EPA evaluated the airborne contaminants depicted in **Table 1** because these contaminants provide an early indication whether there was any effect on air quality. Carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), and particulate matter (PM) are all typically released as combustion by-products.

**What we found** – The results are summarized in **Table 1**.

**What this means** – The data from these fixed air monitoring stations indicate that there were no public exposures exceeding the NAAQS for CO, SO<sub>2</sub>, NO<sub>x</sub>, or PM<sub>2.5</sub> as a result of the CHEMCENTRAL fire. There were hourly values for PM<sub>2.5</sub> measured which are greater than the 15 micrograms per meter cube (µg/m<sup>3</sup>) annual NAAQS; this is normal behavior for hourly concentrations of fine PM in an urban environment. For the 24-hour data reporting period listed in **Table 1**, the average PM<sub>2.5</sub> concentration at the Troost station was 15.8 µg/m<sup>3</sup>, and the JFK station was 15.9 µg/m<sup>3</sup>, both of which are less than the 24-hour PM<sub>2.5</sub> NAAQS. *It is important to note that the PM<sub>2.5</sub> values prior to the fire were higher than those after the fire began.*

## **EPA Mobile Air Monitoring Laboratory (Data in Table 2)**

**Rationale** – To assess ambient air quality in areas of the city where there are no fixed monitors, EPA employees used the EPA Region 7 mobile air monitoring laboratory to monitor for CO, SO<sub>2</sub>, and NO<sub>x</sub> using instruments identical to those used in the fixed air monitoring locations. EPA employees collected air monitoring data using the mobile lab on February 7, 2007, from 6:00 p.m. until 5:35 a.m. on February 8, 2007, at 10 locations around the metro area to supplement the air quality data provided by the fixed monitoring network. Monitoring locations were selected in residential areas along the direction of the smoke plume, both at elevated locations and in low-lying areas near the river valleys.

Similar to the fixed stations, EPA monitored for these contaminants because CO, SO<sub>2</sub>, and oxides of nitrogen are typically released as combustion by-products. PM was not measured because the mobile laboratory is not equipped to measure PM. Note that the NAAQS is for nitrogen dioxide and EPA reports data for oxides of nitrogen. This is because oxides of nitrogen consist of nitrogen dioxide plus nitrogen oxide, thus giving a more conservative or health-protective air quality measurement for comparison to the NAAQS. Also, as the sampling progressed, shorter sampling intervals were used in order to allow greater spatial coverage in the neighborhoods around Kansas City.

**What we found** – The results are summarized in **Table 2**.

**What this means** – There were no public exposures approaching the NAAQS for CO, SO<sub>2</sub>, or NO<sub>x</sub> resulting from the CHEMCENTRAL fire detected by the mobile air monitoring laboratory.

## **EPA Field Team Sampling (Data in Table 3)**

**Rationale** – Two separate teams of EPA OSCs deployed to a total of 94 different downwind monitoring locations ranging from virtually on the fire scene to locations in Wyandotte and Johnson Counties in Kansas and Jackson County in Missouri. These teams used applicable field-portable instruments to screen the atmosphere for instantaneous concentrations of CO, volatile organic compounds (VOCs), and total particulates to determine the potential for short-term public health impacts resulting from the smoke plume. Field screening data for VOCs and CO were collected using photoionization detectors (PIDs), and particulate data were collected using the DataRAM portable particle-sizing dust monitor which uses light scattering technology to measure particles in the atmosphere. The PID was used to screen for the presence of VOCs and whether this class of compounds was present above background levels. This instrument does not have the ability to identify individual constituents so the results could not be compared to a health-based benchmark. In addition to the monitoring performed above, EPA also monitored for chlorine gas during the early phases of the response using a hand-held detector. No chlorine gas was detected near the site; and therefore, additional chlorine monitoring was suspended.

**What was found** - There were no VOCs detected greater than 1 part per million (ppm) at any monitoring location outside the immediate vicinity of the fire. The CO data did not exceed the NAAQS (see **Table 3**).

**What this means** – Reports from the fire scene and other sources indicated that the fire was likely attributable to combustion of mineral spirits—a generic term for petroleum hydrocarbons. Combustion of petroleum hydrocarbons typically results in black smoke and the release of VOCs, CO, and PM. The sampling teams were trying to determine if the smoke plume was reaching the ground and whether there was any immediate threat to public health. The monitoring data indicated that the plume was not reaching the ground and that there was no immediate public health threat for the contaminants sampled.

**EPA Temporary Air Monitoring Stations (Data in Tables 4 & 5)**

**Rationale** – In order to evaluate potential exposures of certain compounds that could not be measured in real time, additional air samples were collected at five monitoring locations in Wyandotte and Johnson Counties in Kansas and Jackson County, Missouri. These locations were selected to ensure sampling in the potentially affected areas. Locations selected also had to be capable of providing electricity and security for these sampling devices. Locations were as follows:

Sample Number	Address
101	Fire Station #25; 401 East Missouri Avenue; Kansas City, Missouri
102	Fire Station #8; 1517 Locust Street; Kansas City, Missouri
103	Fire Station #6; 9548 State Avenue; Kansas City, Kansas
104	Fire Station #1; 7550 West 75 <sup>th</sup> Street; Overland Park, Kansas
105	Residence; Bluejacket Street, Shawnee, Kansas

Samples were collected on filters and adsorbent media to document the levels of metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and pesticides present in the atmosphere. These filters and sampling media were analyzed by an independent laboratory (University of Iowa Hygienic Laboratory). In addition to the aforementioned analyses, the filter extracts from these samples were later returned to EPA for airborne dioxin/furan analysis. Measurements of the dioxin/furan compounds were grouped together into a single value termed “dioxin total equivalents” or dioxin TEQs, which is the airborne concentration used to evaluate the potential impacts on public health.

**What we found** – The five temporary air monitoring stations sited around the metro area reported nondetect for 79 different metals, nondetect for 20 different chlorinated hydrocarbon insecticides, nondetect for 7 different Aroclor PCB compounds, and nondetect for 16 different PAHs. One field sample extract contained 0.038 picograms per cubic meter (pg/m<sup>3</sup>) dioxin TEQ, and the field blank sample had 0.035 pg/m<sup>3</sup> dioxin TEQ. Because a dioxin compound detected was present in both the air sample and the field blank, this indicates the possibility of sample contamination. Nevertheless, these dioxin TEQ values are well below a level of concern for public health as discussed below. The results of these samples are found in **Tables 4 and 5**.

**What this means** – Region 7 compared the individual air sample’s analytical detection limits to health-based benchmarks to ensure they were below levels of potential health concern, except for the airborne metals where a qualitative scan was performed by the laboratory. In general, the limit of detection is defined as the lowest quantity of a substance that can be distinguished from the absence of that substance within a stated level of confidence. For all but a few of the analytes, there are no health-based benchmarks to evaluate acute or short-term exposure, so we compared the detection limits to available occupational standards applicable to daily exposure

over a 40-hour work week. In general, work place limits are established based on the assumption that nearly all workers may be repeatedly exposed on a daily basis without experiencing adverse health effects. The analytical reporting limits were compared to the lowest (most conservative or health-protective) of three separate occupational limits, including the National Institute for Occupational Safety and Health recommended exposure limits (NIOSH RELs), the Occupational Safety and Health Administration permissible exposure limits (OSHA PELs), and the American Conference of Industrial Hygienists threshold limit values (ACGIH TLVs). The detection limits were all significantly below the respective work place exposure limits except for the Aroclors, which are commercial mixtures of PCB compounds (see **Table 4**). The analytical reporting limits for the Aroclors ranged from 2.9 to 3.4  $\mu\text{g}/\text{m}^3$ , while the NIOSH REL is 1  $\mu\text{g}/\text{m}^3$ . We note that the OSHA PEL and ACGIH TLV for PCBs are both 500  $\mu\text{g}/\text{m}^3$ . In addition, we would not expect to find appreciable levels of PCBs from this type of fire.

There are no short-term or occupational exposure limits for dioxins and furans so we derived a health-based screening value based on significantly increased risks of cancer from inhalation of ambient air. More specifically, we derived a dioxin TEQ screening level of 850  $\text{pg}/\text{m}^3$ , which is the airborne concentration associated with an excess individual lifetime cancer risk of  $1 \times 10^{-4}$  or 1 in 10,000. The screening level assumes continuous inhalation exposure by a young child for 30 consecutive days, which is health-protective because it is highly unlikely that dioxins and furans generated by the CHEMCENTRAL fire would remain airborne for this duration.

As mentioned above, there was only one field sample extract that contained 0.038  $\text{pg}/\text{m}^3$  dioxin TEQ, which is significantly below the screening level of 850  $\text{pg}/\text{m}^3$ . We also evaluated the possibility that dioxins and furans were generated by the fire, but were present at levels below the analytical detection limits. We calculated a dioxin TEQ assuming all undetected analytes were actually present at the analytical detection limit and also at one-half the detection limit. The results in **Table 5** show that these hypothetical concentrations do not exceed the health-based dioxin TEQ screening level.

Therefore, the samples from the temporary monitoring stations did not contain airborne contaminants above health-based benchmarks or screening levels.

### **U.S. EPA Airborne Spectral Photometric Environmental Collection Technology (ASPECT)** **(Data in Table 6)**

**Rationale** – The ASPECT system was used to collect airborne infrared (IR) images and data over the site. ASPECT is an emergency response aircraft which permits remote chemical detection in support of the first responder. The system consists of an airborne high-speed Fourier Transform Infrared Spectrometer (FTIR) coupled with a wide-axis IR line scanner. This system allows for remote detection of organic compounds in the atmosphere and provides thermal imagery of the targeted site.

At 1540 (3:40 p.m.) on February 7, 2007, the aircraft was airborne from Waxahachie, Texas, and arrived at the CHEMCENTRAL location (target area) at approximately 1815. Near the target, the crew reported heavy black smoke rising to about 2,000 feet aboveground level. The aircraft collected data during 15 different flyovers.

**What we found** – The aircraft mounted detection system detected less than 1 ppm of trimethylbenzene, ammonia, methanol, and VOCs immediately above the fire on the site. There

were no detections of VOCs by the ASPECT system downwind of the fire. See **Attachment 2 for the ASPECT Report**.

**What this means** – The absence of any VOC signal immediately downwind of the site indicates that the resulting plume was low in VOC content. The concentrations detected immediately above the fire were compared to Acute Exposure Guideline Limits (AEGLs) established by the National Advisory Committee, which is composed of several state and federal (including EPA) agencies, industry, academia, and other organizations. AEGLs are exposure limits below which adverse effects are not likely to occur for the general public and include infants, children, the elderly, and persons with illnesses (e.g., asthma or heart disease). Three levels (i.e., AEGL-1, AEGL-2, AEGL-3) were developed for five exposure periods of 10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours. The three AEGL levels are distinguished by the degree of severity of potential adverse health effects with an AEGL-1 representing the lowest severity.

In this case, the ambient air concentrations were compared to AEGL-1 values for eight hours, which is the most health-protective value and consistent with the length of the event. An AEGL-1 is defined as the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. The effects are not considered disabling, but are transient and reversible upon cessation of exposure.

Because exposures may have exceeded a duration of eight hours, we also compared the results to the occupational exposure limits discussed above. Once again, we used the lowest of the three separate occupational limits, NIOSH RELs, OSHA PELs, and ACGIH TLVs.

The detected concentrations immediately above the fire are well below the AEGL-1 values and the work place limits listed in Table 6. Thus, we conclude that VOCs potentially downwind of the smoke plume did not present a significant health risk to the general public.

### **Ash Samples (Data in Table 7)**

**Rationale** – EPA anticipated questions about the ash material from residents; therefore, ash samples were collected from four locations in the neighborhood west of the site. These samples consisted of relatively large pieces of carbonaceous ash material that could likely contain significant quantities of chemicals either generated by the fire or present on the site. The ash samples provided an opportunity to screen for low-level compounds with very high sensitivity because of the relative mass of the ash versus the likelihood of collecting a similar mass of airborne soot from the atmosphere. Analysis of the ash samples provided the additional benefit of characterizing for condensable chemical species such as semi-volatile organic compounds (SVOCs) and dioxin TEQ. It is important to note that all fires—both structural and chemical—can produce SVOCs and dioxins. Also, these compounds as well as metals and VOCs are present in the environment every day at low levels. What was most important about these samples was the ability to determine if levels of these chemicals were present in the ash that may be of public health concern.

**What we found** – The ash samples contained low levels of metals, VOCs, SVOCs, and dioxins. **Table 7** contains the results of the ash analysis along with corresponding health-based screening levels.

**What this means** – Because there are no health-based benchmarks for ash, Region 7 used screening levels established for residential exposure to surface soil. More specifically, the contaminant concentrations in ash were compared to the EPA Region 9 residential soil preliminary remediation goals (PRGs) (EPA 2004). The Region 9 PRGs account for direct contact with surface soil via incidental ingestion, inhalation of particulates or volatiles, and skin contact. There are no national PRGs; therefore, EPA Region 7 has adopted the EPA Region 9 PRGs as screening levels for evaluating environmental data. The residential soil PRGs are a good surrogate for ash because the routes of exposure are expected to be similar. The PRGs represent the soil concentration equal to an excess individual lifetime cancer risk of  $1 \times 10^{-6}$  or 1 in 1,000,000, which is the probability that an individual may develop cancer over a 70-year lifetime as a result of long-term exposure to a particular substance. PRGs are also derived for noncancer health effects based on a hazard quotient (HQ) of 1.0. A HQ of less than or equal to 1.0 means it is unlikely for even sensitive subpopulations to experience adverse health effects as a result of exposure to a substance. The residential soil PRGs are based on assuming exposure to a residential receptor for 350 days per year over a period of 30 years for cancer effects and 6 years for noncancer effects. We multiplied the PRGs based on cancer effects by 100 to equal a cancer risk of  $1 \times 10^{-4}$  or 1 in 10,000, which is the level that EPA typically considers a health concern.

Comparing the compound concentrations to these values significantly overestimates the potential health risks from ash that may have fallen into residential areas for several reasons. First of all, it is unlikely that these compounds will remain in the environment at the current levels detected in ash due to environmental degradation processes. Secondly, the ash did not fall out in such a manner that it would uniformly cover residential yard soil. Thus, individuals would only be exposed to the ash on an intermittent basis.

**Table 7** shows that compounds detected in ash were all significantly below the residential soil screening levels. However, there were several compounds, i.e., 1,2-dibromoethane, 2,4,6-trichlorophenol, etc., (see **Table 7** for these compounds) for which detection limits slightly exceeded the health-based benchmarks. In general, the limit of detection is defined as the lowest quantity of a substance that can be distinguished from the absence of that substance within a stated level of confidence. It is unlikely these compounds are actually present above the residential soil screening levels given that only a few compounds were actually detected in the ash. There are also several compounds where the presence or absence of the analyte could not be determined due to laboratory quality control problems, e.g., benzo(a)pyrene, benzo(g,h,i)perylene, etc., as designated by the “R” code in **Table 7**. While there is some uncertainty regarding their presence in ash, most of these compounds are PAHs and there were similar PAHs, such as benzo(a)anthracene and benzo(b)fluoranthene, which were not found above analytical detection limits and health-based screening levels. Based on the results of the ash samples collected, we conclude the ash did not present a significant health risk to the general public.

### **School Air Sampling (Data in Table 8)**

**Rationale** – Indoor and outdoor air monitoring was performed at six schools (see **Table 8** for schools and addresses) in close proximity to the CHEMCENTRAL site on February 8, 2007. EPA worked with the Kansas City, Missouri School District to sample at those schools which were evacuated on the previous day due to the fire. Monitoring was performed for particulates,

CO, and VOCs inside the schools using a dataRAM and PID. In addition, air samplers were set up outside the school to collect samples for asbestos.

**What we found** – CO and VOCs were not detected at any indoor school sample locations, particulates found were below levels of concern. There were no reported detectable levels of asbestos in the outdoor air samples. Results are found in **Table 8**.

**What this means** – The PID was used to screen for the presence of VOCs and whether this class of compounds was present above background levels. This instrument does not have the ability to identify individual constituents so the results could not be compared to a health-based benchmark. However, the results indicate that there were no significant levels of VOCs or particulates present inside these six schools.

No asbestos was detected as determined by transmission electron microscopy. This method was used to ensure the analytical detection limit could achieve EPA's standard under the Asbestos Hazard Emergency Response Act (AHERA). The AHERA standard is used to determine whether children may reenter a school building after asbestos has been removed and is based on assuming long-term exposure. We conclude that asbestos was not a health concern at these schools because there is no evidence of asbestos contamination.

### **School Playground Wipe Sampling (Data in Table 9)**

**Rationale** – Since children come in direct contact with playground equipment on a daily basis, wipe samples were collected at the six schools to determine if excess chemical compounds may have been deposited on the playground surfaces as a result of the fire. Of course, wipe samples represent a *worst case* type of exposure because there is no way to determine if the chemicals detected were previously deposited from the environment prior to the fire. Wipe samples were collected by wiping a 100-centimeter square area with a 4-inch by 4-inch sterile gauze wetted with sterile water. Using this sampling technique provides very low levels of detection for environmental contaminants and very high sensitivity. The samples were analyzed for metals, mercury, and PAHs based on contaminants which may have been released during the fire. See sample locations listed in **Table 9**.

**What we found** – One wipe sample had very low levels of mercury detection. All wipe samples had very low-level detections for both metals and PAH compounds. Results are summarized in **Table 9** along with the risk-based screening levels.

**What this means** – Wipe samples are a measure of surface loading, i.e., mass per surface area, and are typically used to document the presence or absence of surface contamination. The results are difficult to interpret from a public health perspective because they are not expressed in concentration terms, thus estimating potential exposure is very uncertain. We are not aware of any generic health-based screening levels for wipe samples collected on outdoor surfaces. However, we determined that the best available screening levels were health-based benchmarks developed by a task force led by EPA Region 2 for evaluating settled dust on interior surfaces (EPA 2003).

The health-based screening levels for interior surfaces account for incidental ingestion from hand-to-mouth activity and dermal contact with contaminants in settled dust. The settled dust benchmarks are based on a cancer risk of  $1 \times 10^{-4}$  or 1 in 10,000 and a hazard quotient of 1.0 for

noncancer endpoints, with the lowest value being used as the actual screening level. For those compounds where screening levels were not available, we derived values using a slightly modified approach. We assumed that no dissipation will occur over time and accounted for incidental ingestion only, which is the most significant exposure pathway.

While these health-based benchmarks are appropriate for screening purposes, they significantly overestimate the potential health risks because they assume incidental ingestion of contaminants for 350 days per year over 30 years for cancer effects and 6 years for noncancer effects. The benchmarks also assume continuous exposure for 12 hours per day. In addition, these screening levels are based on the hand-to-mouth activity of a toddler, which will greatly exceed that of older children and adults. Lastly, we assumed that compounds found on these surfaces would not dissipate over time as a result of volatilization, chemical degradation, and transfers to skin or clothing.

The results in **Table 9** show that nearly all compounds fall well below their respective health-based benchmarks or screening levels. Two wipe samples contained lead at levels above its benchmark of 2.7  $\mu\text{g}/\text{cm}^2$ . However, this value is based on a screening level for lead in interior dust established by the U.S. Department of Housing and Urban Development for young children. Exposure to lead on the surface of playground equipment will be significantly less than from interior dust. In addition, lead is not a compound that we would expect to see emitted in large quantities from this type of fire. Overall, we conclude the compounds found on surfaces outside of these schools are not of health concern.

## **Conclusions**

Overall, EPA Region 7 did not identify the release of any specific compounds at levels of public health concern. We detected a variety of compounds including metals, PAHs, and dioxins in the ash at very low levels. These compounds are ubiquitous, and they were found at levels below what is normally produced from everyday activities, i.e., gasoline engines, diesel exhaust, combustion processes, etc. The environmental sampling results are consistent with what one would expect to see from the combustion of organic materials such as oil, gasoline, wood, tobacco, garbage, etc.

We conclude there should not be a significant adverse impact on public health from the smoke plume based on multiple lines of evidence:

- The compounds known to exist at the facility were primarily hydrocarbons and not particularly hazardous.
- No acutely toxic compounds of concern were identified during the environmental sampling effort.
- The exposure duration was relatively short (hours).
- Most individuals were likely indoors during most of the event due to weather conditions and the time of day.
- The compounds we did identify were consistent with combustion of organic material.
- There were no significant detections above health-based benchmarks or screening levels except for short-duration measurements of PM from the smoke present on the site at the CHEMCENTRAL facility during the fire itself.

## **References**

U.S. EPA. 2003. World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks. EPA Region 2, New York, NY. Note: In February 2002, a multi-agency task force headed by EPA was specifically formed to evaluate indoor environments for the presence of contaminants that might pose long-term health risks to local residents. As part of this evaluation, a task sub-committee was established to identify contaminants of potential concern for the incident and also establish health-based benchmarks. A systematic risk-based approach was used. This very detailed methodology and the equations used to develop values for various contaminants were utilized for this CHEMCENTRAL report and conclusions. Previously, there were no health-based benchmarks available for some of these contaminants in residential settings.

U.S. EPA. 2004. Region 9 PRGs 2004 Table. EPA Region 9, San Francisco, CA.