

Health Concerns Associated with Oil Fires

Background

Oil fires may, depending on their size, locations and duration, create a serious threat to environmental and human health. Smoke plumes containing a hazardous mixture of gaseous emissions and particulate matter could reach responders and populations in the immediate vicinity and downwind. Potential for offsite impacts as well as their severity will depend on incident magnitude, meteorological factors, use of respiratory-protection equipment and proximity of receptors.

Hazards

Oil fires produce dense clouds of soot, liquid, aerosols, and gases with variable concentrations of particulate matter, metals, sulfur compounds and oxides of nitrogen — similar to typical constituents of smog. In general, smoke produced by burning unrefined petroleum or crude oil contains a mixture of gaseous and particulate compounds including carbon dioxide (CO₂), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxides (NO_x), volatile organics compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), hydrogen sulfide (H₂S), acidic aerosols, and soot. The elements and chemical compounds present in the smoke vary with the composition of the oil and factors related to how it is burned. The source of the specific product burned will influence the constituents of the smoke, such as concentrations of heavy metals (e.g., nickel, vanadium, arsenic) due variable amounts of impurities in unrefined oil.

Exposure and Health Risks

Inhalation of the smoke particles, gases, and other components can cause acute or chronic

health effects. Known immediate health effects from inhaling large amounts of smoke and particulates are primarily respiratory, including coughing, wheezing, increased airway resistance, and respiratory infections. Toxic gases that can be found in oil-fire smoke—such as hydrogen sulfide and sulfur dioxide—can cause eye and nose irritation, decreased pulmonary function, and increased airway reactivity.

Most of the non-cancer risk is due to fine particles or soot. If measured concentrations were available they could be compared to toxicity values or air-quality standards established to protect sensitive subpopulations, such as children and the elderly. Studies of large scale crude oil fires have found harmful airborne chemicals like VOCs, PAHs, and heavy metals but at a distance the concentrations dropped to levels comparable or lower than in major US cities with major petrochemical industries and generally below guidelines recommended by health and industrial regulators.

Some chemicals contained in oil fire smoke, such as benzene and PAHs, are also human carcinogens. Because the airborne amounts of carcinogenic pollutants measured or estimated in studies of large scale oil fires have generally been low and have lasted only a relatively short duration, their contribution to excess cancer risk is generally expected to be small and measurable increases in the rates of cancers would not be expected to result.

Known immediate health effects from inhaling large amounts of particulate matter and irritant gases in smoke are primarily respiratory. High



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levels of airborne particulates are associated with increased rates of asthma and cardiovascular effects and can exacerbate other chronic respiratory conditions (e.g., emphysema, bronchitis). However, the amount of the various pollutants that an individual is exposed to is the most important factor which determines the risk of any subsequent biological and harmful effects. Absent measurements to represent exposures it is only possible to speculate on potential health effects based on the degree of exposure experienced.

Risks to Responders

Exposure to a significant level of these types of chemicals can cause irritation or chemical burns to exposed tissue. Inhalation of large amounts of gases, vapors, fumes, and smoke can affect tissues of the respiratory tract and produce effects ranging from minor immediate irritation, to rapid or delayed airway and lung diseases. Corrosive or irritant species can produce serious effects. The onset of some dangerous conditions may appear suddenly after a period of time following exposure has elapsed. Individuals directly exposed to the heat and smoke of an oil-fire should be evaluated by a medical professional for signs of thermal and chemical burns, and acute inhalation exposure.

Risks to General Population

Individuals who were not directly involved with fighting the fire or who were not in its immediate vicinity are unlikely to have experienced exposures that are medically significant; rather they may have much smaller exposures to diluted levels of pollutants dispersed in the atmosphere. Such exposures are likely to only result in mild, transitory effects (if any) associated with relatively low levels of typical urban pollutants. Signs and symptoms could include irritation of eyes, nose, or mouth that could produce temporary sputum production, nasal secretions, tearing, shortness of breath, hoarseness, and cough. Any initial or early signs and symptoms should

resolve in a few days and complete recovery after a limited period of discomfort is expected.

For Additional Information

See *Air Quality: Particles and Your Health* at www.health.state.mn.us/divs/eh/air/pm.htm