

Neighborhood Cleanup: Threats to Human Health from Hazardous Waste at the former Fort Ord

*Information to Encourage Community Involvement in the Remediation of a Superfund Site
Requested by the Fort Ord Environmental Justice Network*

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How did hazardous waste get into my neighborhood?

Poisonous chemicals and military munitions are hidden in plain sight among the serene, natural setting at Fort Ord. Fort Ord was originally purchased by the US Army in 1917 as a combat training facility. The property encompasses almost 28,000 acres in Monterey County. Over decades of weapons training and the Army's day-to-day activities, the land became contaminated with hazardous waste and military munitions. The problem was first noticed when toxic chemicals were found under the Fort Ord landfill off Imjin Road; as a result, Fort Ord was listed on the United States' National Priorities List (NPL) in 1994 as one of the most contaminated areas in the country. Further investigation by the US Environmental Protection Agency indicated that military explosive devices were

scattered haphazardly across thousands of acres. These munitions, including rockets, grenades, bullets, and more, can still be live today and capable of exploding if handled.

Below the ground's surface, toxic chemicals have drifted through the sandy soil down

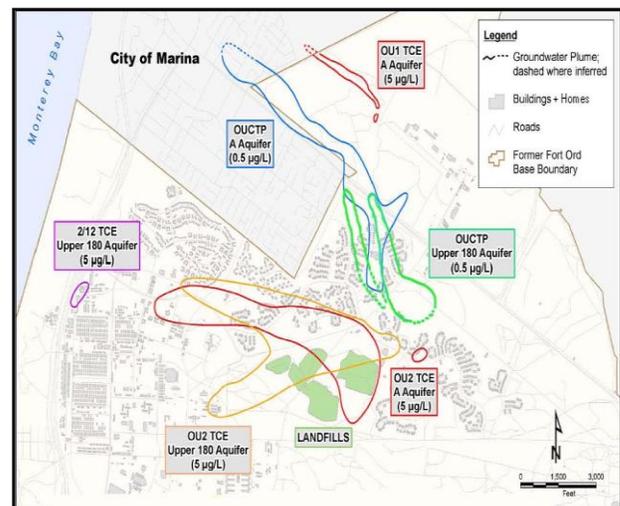


Figure 1 The colored lines in the map outline the groundwater plumes below Fort Ord and the City of Marina. It is likely that homes, schools, and businesses in these areas will eventually draw their drinking water from these water

into the groundwater. These areas, called aquifers, contain freshwater that is vital to drinking water supplies and agricultural irrigation.

The site consists of several contaminated areas. Four contaminated groundwater plumes exist under the air field, the landfill, sites 2 and 12 (a former sewage treatment plant and a former waste disposal site) and one containing carbon tetrachloride, possibly from a cleaning facility. The landfill also poses contamination problems for the soil and air due to lack of maintenance and improper disposal of toxic wastes. The firing ranges, one by the sand dunes formerly used for small arms and another for munitions, are contaminated with shell casings and other explosive debris.

What does it mean to live near a toxic waste site?

More and more research is demonstrating real risks associated with living near landfills and Superfund sites. In California, scientists found that mothers living in the same census tract as the location of an NPL site bore children with 1.5 to 5 times higher risk of birth defects than those that did not live in close proximity to hazardous waste.ⁱ There is also an association between the education and income levels of residents living in close proximity to hazardous waste sites. The same study from California indicated that 42% of the neighborhoods studied qualified as “less educated” under the Census Bureau definition, meaning that 34% or more of adults 18 and older did not

graduate from high school. Children attending school within 10-20 miles of a Superfund site are twice as likely as children attending school farther away to have autism.ⁱⁱ Various studies have shown reports of headaches, fatigue, and sleepiness from residents living near waste sites, symptoms that may be the result of chemical exposure and/or emotional distress due to such living conditions.ⁱⁱⁱ Scientists are currently studying clusters of rare cancers found in populations living near hazardous waste to determine if the environmental contamination is a factor in developing the disease.^{iv}

How can the Greater Fort Ord Community be exposed?

Fort Ord is one of the most complex waste sites in the country. The groundwater below Fort Ord is contaminated with chemicals that reach past the borders of the Fort and under the City of Marina. The soil is filled with lead, unexploded ordnance, and other debris; and the air is filled with particulate matter and chemicals when the Army conducts annual burns to clear vegetation. The final cleanup decision mandated 100-foot buffer zones around the landfills and munitions response areas to protect surrounding properties; nevertheless, the routes of exposure that follow do present ways the public can still come into contact with the contaminants.

1. Groundwater

The sandy substrate beneath the former Fort Ord boundary and neighborhoods

adjacent to it (including the City of Marina) is highly porous, meaning that groundwater is not bound by underground geological formations and travels easily. The water crisis in California complicates the groundwater cleanup because drinking water is becoming increasingly scarce. Even though the public does not currently use groundwater immediately beneath Fort Ord for its water supply, the municipal water supply does draw from the same aquifer, in which chemicals have been detected in the past. The public must be confident that the Army has left the water clean enough to drink once the remediation is complete.

Three aquifers

Chemicals from activities at Fort Ord have spread through the soil downward into three aquifers at different levels below the ground's surface. The Army is currently predicting that one of the contamination plumes, Operable Unit Carbon Tetrachloride, will be cleaned up by 2035. When anticipating cleanup in decades to come, it is very important to keep in mind that global climate change is expected to drastically change the weather and precipitation patterns to which the Fort Ord community has been accustomed. The *2009 California Climate Adaptation Strategy Discussion Draft* issued by various California state agencies warns that sea levels are expected to rise 12-18 inches by 2050. As salty seawater creeps inland, it threatens freshwater deposits like the three aquifers contaminated at Fort Ord, creating salty drinking water for locals. Not only could

the water become salty, but also supplies could grow scarcer as temperatures rise. Less water means that chemical concentrations increase because they are less diluted. As the population and economy grow in Monterey County, demand for water will increase. Fort Ord is intended for redevelopment, but without adequate drinking water, the redevelopment will be futile. Currently, the Army's remediation plan lacks a long-term vision statement that incorporates the likelihood of severe consequences of global warming into its cleanup strategy. Overlooking the effects of heavy bursts of rainfall, increased drought, and sea-level rise could be detrimental to a successful remediation of Fort Ord.

Exposure to these chemicals can occur not only by drinking water, but also by cooking and bathing with contaminated water. During these activities, the chemicals in the water can be volatilized into the air and then inhaled.

Landfills

When cleanup at Fort Ord first began, the



Army set up a 100-foot buffer zone to

reduce landfill gas migration to adjoining properties. California State University – Monterey Bay (CSUMB) developed student housing facilities adjacent to the landfills after the land was cleared for development. The closest housing to the landfill, on Gettysburg Court, is located 368 feet from the landfill boundary.^v The buffer zone, however, does not protect the public against the problem of contaminated groundwater. The landfills contain toxic chemicals that seep through the soil into the aquifers below. One of these chemicals is vinyl chloride, a carcinogen found in plastics used in our everyday lives. At Fort Ord, the Army relies on the removal of vinyl chloride from the landfill through a landfill gas extraction system. This action is meant to prevent the vinyl chloride and other chemicals from ever reaching the groundwater. In a 2004 response to comments from Environmental Stewardship Concepts, the Army stated that the OU2 Groundwater Treatment Plant is not configured to treat vinyl chloride if the landfill gas extraction system fails. Essentially, the groundwater treatment plant would not treat the chemical, allowing it to pass into aquifers that may be used Marina, Seaside, or neighboring communities. If vinyl chloride gets into the public water supply, it could then be released into the air when cooking or showering, thus leading to exposure through inhalation. Breathing high levels of vinyl chloride over many years has led to kidney and liver damage, birth defects, miscarriages, immune disorders and an

increased chance of liver cancer^x. Vinyl chloride is present in plastics and other common waste, and other chemicals in the landfill can degrade into this carcinogen.

2. Soil

The public could be exposed to the high concentrations of chemicals in the soil at Fort Ord through inhalation or ingestion of particles. This exposure can occur by breathing suspended dust particles or incidentally; if, for example, you touch contaminated dirt and then eat without washing your hands. Children are especially susceptible (actually two times more so than adults^{xi}) to incidental ingestion; for instance, they have the inexplicable tendency toward putting dirty toys into their mouths. In addition, the chemicals currently in the soil could leach into the groundwater or be volatilized into the air during the prescribed burnings and subsequently inhaled. Redevelopment plans at Fort Ord include residential areas, such as East Garrison, and parks. In order to provide the highest quality of life after redevelopment, the remediation must ensure that children can safely play in their yards, that munitions will not be discovered during construction, and that soil erosion will not transport chemicals to local water supplies.

Beach Range

What is now Fort Ord Dunes State Park used to be a training range for the US Army known as the Beach Range. Though the Army has declared the site clean and passed it on to the California Department of Parks

and Recreation, lead remains in the soil at levels unsafe for human contact. The bullets, shrapnel, and military debris left behind caused lead, a heavy metal, to contaminate the sandy soil at the Beach Range. When the Army began its clean of the Range, it set a “health-based” cleanup standard of 1,860ppm of lead in soil. The EPA’s soil screening guidance for recreational soil removal is 400ppm^{vi}, almost five times lower than the remediation goal set by the Army, while California’s standard is 1000ppm^{xii}. Before assuming the state park is a safe site for your children or family pets to play, it is important to keep in mind that there is no safe level for lead. Both the EPA and the Center for Disease Control have stated that they have been unable to declare a safe level due to health effects detected at levels below the regulatory standard of 10 µg/dL. The Army’s Human Health Risk Assessment declared the site safe, despite the fact that children could still have a blood lead level of 8.2µg/dL due to regular contact with the contaminated soil in the dunes. Based on current literature, this level is unacceptably high. One study has shown that the largest drops in a child’s IQ occurred during fetal exposure to *less than* 10 µg/dL of lead in the womb (through the mother’s bloodstream).^{vii} How can the Army call the Beach Range cleaned up when there is still such a high potential for human harm? This seemingly overlooked problem is why citizen input is critical to ensuring the cleanup at Fort Ord is completed to achieve the highest standards of human and

ecological health, prioritizing the best interests of your family. The quality of the cleanup depends on the strength of the community’s voice.

Military Debris and Weapons

Much of the debris and other munitions have been removed, but there are still sites where weapons are located beneath the ground’s surface. Most likely they were detonated long ago and do not present an explosive risk, but live munitions have been



Figure 2 Military debris recovered from Fort Ord

found during the course of cleanup, so citizens should take caution if they discover any debris on reclaimed property. Detonated weapons also pose a hazard because of the chemicals released into the soil after exploding and the breakdown of the munitions themselves, which are often made of heavy metals. Flooding or erosion could cause the chemicals to leach into the groundwater or the munitions to resurface. For these reasons, there is particular concern about several burial pits at Munitions Response Site 16, which is slated for reuse as habitat reserve. The Army removed more than 48,000 pounds of

bazookas from these pits in 2009 but did not complete the job. The Army states in its report that there was “no indication of an end” after digging to nine feet below the ground’s surface and simply covered the pits back up.^{viii} The Army cannot guarantee that these munitions will never impact the human or ecological communities. The Army is abusing the community’s trust by purposefully leaving untold amounts of military munitions at Ford Ord without knowledge of the explosive risk or potential for contamination.

3. Air

Many of the chemicals detected in the air cause respiratory problems that are exacerbated by the prescribed burns. They are also linked to developmental problems in children and cancers. Since wind and other atmospheric conditions can move these airborne chemicals across the boundaries of Fort Ord, the effects of prescribed burning are often much more widespread than those associated with soil and groundwater contamination.

Burning

The prescribed burning at Fort Ord is intended to clear vegetation in order to facilitate the recovery and removal of unexploded ordnance and munitions. However, there have been many problems with this method, including loss of control over a 2003 burn that burned twice as much acreage as was planned. Also, such high levels of smoke lead to poor air quality due to an increase in fine particulate matter

(PM). Inhalation of PM has been linked to increased risks of heart attacks, strokes and respiratory ailments^{ix}. The increased occurrences of these health problems have yet to be investigated following the prescribed burnings, but should be included as part of the Army’s study. Burning also presents the danger of setting off unexploded ordnance, thus releasing toxic chemicals and worsening related health problems. Dioxin, most well-known as a chemical in Agent Orange used as a defoliant during the Vietnam War, has been shown in a study on forest fires to be released into the air during burning. Inhalation of dioxin-contaminated air can lead to cancer, reproductive harm and chloracne, a severe acne-like skin condition. It can also eventually settle out of the air and contaminate food chains beyond the Fort Ord boundary. Dioxin accumulates in animals and, if consumed by humans, can again cause cancer, reproductive problems and impaired liver function. In addition to these known complications from air pollution, the Army’s own air monitoring data indicate that burning jeopardizes the community’s health. Yet the Army will not consider alternatives. A burn in December 2008 exceeded the National Ambient Air Quality

Standards at Marshall Elementary School, meaning that the air was unsafe and schoolchildren were exposed to it for an eight-hour period. Despite the failure to comply with air quality standards, the Army labeled the burn a success. Safer methods are available, including mechanical clearing of the vegetation, which would avoid the problem of excessive smoke altogether. Another option is reinstating the Voluntary Evacuation Program that provides funding for residents who want to relocate when a burn is scheduled. There are ways of protecting yourself from the harmful effects of burning, but the Army has to hear from the community that these options are what they want before this harmful and dangerous cleanup method will change for the better.

What is the community exposed to?

There are forty-five chemicals of concern in the air, soil and water at Fort Ord. These chemicals include heavy metals such as lead and volatile organic compounds like TCE. The chemicals at Fort Ord are known to cause liver and kidney damage, birth defects, respiratory illness, and lower IQ levels in children, among others. While not yet extensively understood, the synergistic or additive effects of the separate chemicals interacting may cause further health problems. Notable contaminants, by category, are displayed in Table 1.

Solvents	Metals, Metalloids, Nonmetals	Pesticides & Chemicals	PAHs
Benzene	Copper	4,4'-DDT	Pyrene
Chloroform	Manganese	Diethylephthalate	Toluene
1,1-Dichloroethane	Mercury	Di-n-butylphthalate	cPAH
1,2-Dichloroethane	Nickel	Dioxin	
Methyl Ethyl Ketone	Beryllium		
Tetrachloroethane	Cadmium		
1,1,1-Trichloroethane	Chromium		
Trichloroethane	Lead		
Methylene Chloride	Silver		
Acetone	Zinc		
Bis(2-ethylhexyl)phthalate	Thallium		
Tetrachloroethane	Antimony		
Titanium Dioxide	Arsenic		
	Selenium		

Table 1. List of Chemicals of Concern Identified at Fort Ord

For a more extensive list, including the health effects for each contaminant, please see Table 2 at the end of this document.

Can I get cancer?

Yes. There are chemicals at Fort Ord that are known to cause cancer if humans are

Health statistics - How does Monterey County compare to California averages?

Monterey is above the state average for

- lung-cancer
- breast cancer in women over 50
- bladder cancer
- lung or bronchus cancer
- non-hodgkins lymphoma

Monterey has the highest incidence of thyroid cancer in the state.

exposed to them. In fact, one-third (33%) of the forty-five chemicals of concern at Fort Ord are probable or known carcinogens. Among the cancers known to occur from these contaminants are leukemia, renal cancer, colon cancer, rectal cancer, and lung cancer.

Who is most vulnerable?

Children, the elderly, and those with previously diagnosed conditions are most at risk when exposed to toxic chemicals. According to 2008 estimations, 17.8% of Monterey County's population falls in a vulnerable age category (0-5 years or 65+ years). In addition, low-income individuals and families are often among those most impacted by environmental contamination because they live directly adjacent to the pollution. In Monterey County, 9.7% of the population is below the poverty level.

What about the future?

The quality of the cleanup today will determine the quality of life for the residents living on or near Fort Ord in the future. With the added threat of climate change, it is imperative that the remediation be completed as soon as possible. Increased droughts will cause the concentration levels of the chemicals of concern to rise, thus increasing the risk to

human health. In addition, a projected sea level rise of 12-18 inches by 2050 will lead to salt water contamination of drinking water, as well as possible introduction of other contaminants. The intensity and frequency of wildfires are also expected to escalate, putting residents at risk for smoke inhalation and subsequent respiratory problems. With these anticipated problems, the environmental contamination present at Fort Ord must be cleaned up now in order to lessen future health risks.

How can I ensure that my family's health is protected while Fort Ord is being cleaned up and after it is developed?

Voicing your concerns is key to raising awareness of the project in the community and local government. Contact with senators and other state representatives, even if only to simply state your opinion on the project, will insure that this issue remains at the forefront until its completion. Oversight of the military's cleanup techniques must be pushed so that the public can be assured the process is detailed and complete, leaving no hazardous materials at Fort Ord. Be a voice for a healthy community, now and in the future!

There are local, regional, and state contacts available for you to contact and weigh in on the cleanup at Fort Ord.

Monterey Health Dept
 1270 Natividad Rd, Salinas, CA 93906
 (831) 755 – 4500
www.co.monterey.ca.us/health/

Monterey County Board of Supervisors
 District 4 (Fort Ord’s district) Supervisor – Jane Parker
 (831) 883-7570

district4@co.monterey.ca.us

Board of Supervisors Website:

www.co.monterey.ca.us/cob/supervisor.htm

Has schedule of board meetings so citizens can attend & voice concerns

Monterey County Legislators:

Congressman Sam Farr (831) 424-2229

State Senator Abel Maldonado (831) 657-6315

Assemblymember John Laird (831) 649-2832

State Senator Jeff Denham (831) 769-8040

Assemblymember Anna Caballero (831) 759-8676

Visit website to send an email directly to the legislators

www.co.monterey.ca.us

U.S. Senator

Barbara Boxer

Visit website to send an email voicing concerns

www.Boxer.senate.gov

Table 2. Chemicals of Concern at Fort Ord and Associated Health Effects

Chemical	Health Effects
	<i>Groundwater</i>
Benzene	Causes temporary nervous system disorders, immune system depression, anemia Known human carcinogen, can cause leukemia and chromosome aberrations ¹
Chloroform	Increased childhood leukemia and adult renal cancer ²
1,1-Dichloroethane	Short term: liver damage Long term: liver & kidney damage, toxicity to developing fetus, cancer ¹
1,2-Dichloroethane	Short term: central nervous system disorders, and adverse lung, kidney, liver circulatory and gastrointestinal effects Long term: cancer; colon and rectal cancer ¹
Methyl Ethyl Ketone	Synergistic effects with chloroform on nervous system and liver ³
Tetrachloroethane	Liver destruction, nervous system & gastrointestinal effects Group C possible human carcinogen ¹

1,1,1-Trichloroethane	Possible liver, nervous system & circulatory system problems ¹
Trichloroethane	Probable carcinogen Nervous system ¹
Antimony	Can cause vomiting if ingested and skin irritation if left on skin ⁵
Copper	Nausea, vomiting, stomach cramps, diarrhea Long term, high level exposure may cause kidney & liver damage in infants ⁴
Manganese	Neurological effects Affects elderly most severely and results in lethargy, tremors and mental disturbances if present at high levels in drinking water ¹
Mercury	Kidney damage; brain and heart damage to fetuses ¹
Methylene Chloride	A probable human carcinogen ⁵
Nickel	Stomach aches, negative effects on blood and kidneys ⁵
Nitrate	Short term, excessive exposure can cause death because of conversion from nitrate to nitrite inhibits oxygen transportation in blood Long term exposure can cause diuresis, increased starchy deposits and hemorrhaging of the spleen ¹
	Soil
Antimony	Attaches to small particles and can be inhaled, causing irritation of eyes, skin & lungs; also known to cause can heart and lung problems, stomach pain, diarrhea, vomiting, and stomach ulcers ⁵
Arsenic	No effects found through dermal exposure Inhalation of soil particles containing arsenic may increase cancer risk ⁵
Beryllium	No effects found through dermal exposure Inhalation of soil particles containing arsenic may increase cancer risk ⁶
Cadmium	Inhalation of high concentrations of cadmium causes severe damage to lungs & kidneys, and may cause cancer ⁷
Chromium	May cause allergic contact dermatitis, but mostly in workplace settings where high levels of exposure occur ⁶ Inhalation increases the risk of lung cancer ¹

Copper	Most copper compounds in soil cannot easily enter the body ⁴
Lead	Ingestion of lead in soil can lead, especially in developing children, to damage to the brain and nervous system, hyperactivity (ADD/ADHD), slowed growth, hearing problems and headaches In adults it can cause reproductive problems, high blood pressure, nerve disorders, memory problems and muscle and joint pain ¹
Mercury	Kidney damage; brain and heart damage to fetuses ¹
Nickel	Dermal contact can cause an allergic reaction in some ⁵
Selenium	Ingestion of plants or animals containing high levels of selenium (the ultimate source being soil, from which plants can take up selenium) can cause selenosis, a loss of feeling in arms in legs. In small amounts, however, selenium is a part of a healthy diet as an essential nutrient ⁵
Silver	Repeated, long term exposure to silver can cause argyria (turns areas of skin blue/grey) Exposure to dust with high amounts of silver can cause breathing problems ⁵
Thallium	Ingesting high levels of thallium results in vomiting, diarrhea, temporary hair loss, and has effects on the nervous system, lungs, heart, liver, and kidneys. The effects of ingesting small amounts over long periods of time are unknown ⁵
Zinc	Most likely route of exposure to zinc at hazardous waste sites is through drinking contaminated water, so zinc in soil should not be much of a cause for concern unless it leaches into the ground water ⁵
Acetone	Acetone concentrations in soil may increase due to acetone-contaminated waste buried in landfills Swallowing high amounts can induce unconsciousness, dermal contact can cause irritation ⁵
B(a)P-TE	No information available
Bis(2-ethylhexyl)phthalate (DEHP)	Introduced orally, causes gastrointestinal problems Probable carcinogen ¹
4,4'-DDT	Most common exposure route via food chain Mildly irritating to skin and eyes Carcinogen ⁸
Di-n-butylphthalate	Low toxicity, no reported adverse effects ⁵

Diethylephthalate	No studies have been done on health effects
Pyrene	Toxic to liver and kidneys ¹
Tetrachloroethene	When ingested: Liver destruction, nervous system & gastrointestinal effects Group C possible human carcinogen ¹
Toluene	Can affect the nervous system, high levels can affect kidneys ⁵
cPAH	Carcinogenic Prenatal exposure associated with lower IQ Damage to lungs, liver, skin, and kidneys Reproductive problems ⁵
Trichloroethene	When ingested: Probable carcinogen Nervous system ¹ Air
Acrolein	Eye, nose and throat irritation, aggravates asthma ⁵
Aluminum	Inhalation of high concentrations (higher than those measured after the 2003 burn) may cause respiratory & nervous system problems ⁵
Antimony	Causes antimony pneumoconiosis (inflammation of the lungs due to irritation caused by the inhalation of dust), alterations in pulmonary function, chronic bronchitis, chronic emphysema, inactive tuberculosis, pleural adhesions, and irritation. In high doses, may also cause high blood pressure and heart muscle damage. ¹
Arsenic	Inhalation increases risk of lung cancer, miscarriages, congenital malformations and decreased birth weight in offspring, neurological effects ⁵
Cadmium	Over long term, may result in kidney disease A probable human carcinogen, as classified by the EPA, and may cause lung cancer ⁵
Copper	Liver and kidney damage Not yet known if carcinogen Lower IQ associated with high exposure in children ⁵
Dioxin	Carcinogen, reproductive problems, cloracne ¹
Mercury	nhalation of vapor caused harmful effects on nervous, respiratory and digestive systems ³

PM-10 (Particulate Matter, 10 micrograms in size)	Respiratory problems, aggravates asthma ⁵ , may increase likelihood of stroke and heart attack ^{ix}
Silver	Possible respiratory tract irritation ⁹
Thallium	Effects on nervous system and heart
Titanium Dioxide	Temporary hair loss, vomiting, and diarrhea ⁵ , Possible carcinogen ³

Chemicals gathered from : Vol. 1 of Basewide Remedial Investigation Feasibility Study, Table 8, Vol. III of Basewide Remedial Investigation Feasibility Study, Tables 3.5 and 3.9. Harding Lawson Associates for US Army Corps of Engineers. 1995.

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3. Canadian Centre for Occupational Health and safety www.ccohs.ca/oshanswers/chemicals
4. Wisconsin Department of Natural Resources www.dnr.state.wi.us
5. Agency for Toxic Substances & Disease Registry www.atsdr.cdc.gov/
6. United States Department of Labor Occupational Safety & Health Administration www.osha.gov
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^v Fort Ord OU2 Landfill FAQ. <http://csumb.edu/site/x9470.xml#faq>

^{vi} 40 CFR Part 745, 2001

^{vii} Schnaas, et al. 2006. Reduced Intellectual Development in Children with Prenatal Lead Exposure. *Environmental Health Perspectives.* 114(5): 791-797.

^{viii} Draft Final MRS-16 Munitions and Explosives of Concern Remedial Action Report, Former Fort Ord, Marina, CA, page 5-3

^{ix}Kunzli et al.2005. Ambient Air Pollution and Atherosclerosis in Los Angeles. Environmental Health Perspectives. 113(2): 201-206.

^x Agency for Toxic Substances & Disease Registry www.atsdr.cdc.gov/

^{xi}Risk Assessment Guidance for Superfund <http://www.epa.gov/oswer/riskassessment/ragsa/>

^{xii}California Department of Public Health <http://www.cdph.ca.gov/Pages/default.aspx>

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