BACKGROUND

- Sierra-Crete® was sold commercially as a road sub-base material and used in approximately 18 miles of new road construction in residential developments in Antioch (additional ~18 miles in the adjacent communities of Bay Point, Oakley, and Pittsburg).

- Within the past several years, some road surfaces have deteriorated, leading to the appearance of stain-like residues on the surface.

- In 2002, testing by DuPont established that Sierra-Crete® contained trace concentrations of dioxins (<300 parts per trillion on average TEQWHO basis).

- The surface of streets using Sierra-Crete® with stains or cracking have measurable levels of dioxins.

- The Sierra-Crete® Task Force has worked to understand the health risks associated with the use of Sierra-Crete® beneath roads.

KEY STEPS IN THE TASK FORCE EVALUATION PROCESS

1. Identify potential hazard
2. Develop and approve sampling plan
3. Conduct sampling
4. Evaluate and verify results of sampling
5. Determine exposure scenarios
6. Perform human health risk assessment (HHRA) and apply sampling results to exposure scenarios
7. Determine actions to protect public health where necessary
February: Dioxin testing of Sierra-Crete® conducted beneath roads at DuPont’s former Oakley plant.

March: Preliminary HHRA submitted to Contra Costa County Health Services and California DTSC.

April/May: Additional dioxin testing of road surfaces in Antioch.

June: Screening environmental evaluation submitted to CCC Health Services, California DTSC, and both the Central Valley and San Francisco RWQCBs.

September: Additional road surface and subsurface sampling conducted in East County.

November: Results of environmental sampling reported to the Sierra-Crete® Task Force.

February: Final HHRA submitted to the Sierra-Crete® Task Force.

March: Sierra-Crete® Task Force hosts public meetings in East County.

2002

2003

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A mixture of roughly equal parts of water, portland cement and the byproduct of mineral ore processing.
1. What are dioxins?

“Dioxins” refers to a group of chemical compounds that share certain similar chemical structures and biological characteristics. Several hundred of these toxic compounds exist and are members of three closely related families: the chlorinated dibenzo-p-dioxins (CDFs), chlorinated dibenzofurans (CDFs) and certain polychlorinated biphenyls (PCBs). Sometimes the term dioxin is also used to refer to the most well-studied and one of the most toxic dioxins, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). CDDs and CDFs are not created intentionally, but are produced inadvertently by a number of human activities. CDDs and CDFs are also produced by natural processes. PCBs are man-made, but are no longer produced in the U.S.

Dioxins are released into the air from combustion processes such as commercial or municipal waste incineration and from burning fuels (like wood, coal, or oil). Dioxins can also be formed when household trash is burned and during forest fires. Chlorine bleaching of pulp and paper, certain types of chemical manufacturing and processing, and other industrial processes all can create small quantities of dioxins. Cigarette smoke also contains small amounts of dioxins. Over the past decade, EPA and industry have worked together to dramatically reduce dioxin emissions. Because dioxins are extremely persistent compounds, levels of dioxins still exist in the environment, from both man-made and natural sources, and will take years to decline. A large part of the current exposures to dioxins in the U.S. are due to man-made dioxins from releases that occurred in the past, even decades ago. Even if all human-generated dioxins could somehow be eliminated, low levels of naturally produced dioxins will remain. EPA is continuing to look for ways to reduce dioxin levels entering the environment and reducing exposure.

2. Why are people concerned about dioxins?

Scientists and health experts are concerned about dioxins because studies have shown that exposure to them may cause a number of adverse health effects. Because dioxins exist throughout the environment, almost every living creature including humans has been exposed to dioxins. The health effects associated with dioxins depend on a variety of factors including: the level of exposure, when someone was exposed, and how long and how often. Because dioxins are so widespread, we all have some level of dioxins in our bodies.

The most noted health effect in people exposed to large amounts of dioxin is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other effects of exposure to large amounts of dioxin include skin rashes, skin discoloration, excessive body hair, and possibly mild liver damage. One of the main health effects of concern is dioxins’ cancer risk in adults. Several studies suggest that workers who were exposed to high levels of dioxins at their workplace over many years have an increased risk of cancer. Animal studies have also shown an increased risk of cancer from long term exposure to dioxins. Finally, although not seen in human studies, based on data from animal studies there is also some concern that exposure to low levels of dioxins over long periods (or high level exposures at sensitive times) might result in reproductive or developmental effects. These could include weakened immune responses and behavior changes in offspring.

3. What happens to dioxins when they enter the environment?

When released into the air, some dioxins may be transported long distances. Because of this, dioxins are found in most places in the world. When dioxins are released into water, they tend to settle into sediments where they can be further transported or ingested by fish and other aquatic organisms. Dioxins are broken down in the environment very slowly and can be deposited on plants and taken up by animals and aquatic organisms. Dioxins may be concentrated in the food chain so that animals have higher concentrations than plants, water, soil, or sediments. Within animals, dioxins tend to accumulate in fat.

4. How might I be exposed to dioxins?

Most of the population has low level exposure to dioxins. EPA estimates that most dioxin exposure occurs through the diet, with over 95% coming through dietary intake of animal fats. Small amounts of exposure occur from breathing air containing trace amounts of dioxins on particles and in vapor form, from inadvertent ingestion of soil containing dioxin, and from absorption through the skin contacting air, soil, or water containing minute levels. Some people may have higher exposures than the general population. They may have experienced elevated exposures to dioxins as a result of particular food contamination incidents, through workplace exposures, from industrial accidents, or from consumption of unusually high amounts of fish, meat, or dairy products containing elevated levels of dioxins.

5. Do all dioxin compounds pose the same amount of danger?

No. Different dioxin compounds have different toxicities and dioxins are most often found in mixtures rather than as single compounds in the environment. The most toxic forms of dioxins are 2,3,7,8-TCDD and 1,2,3,7,8-PeCDD. Scientists use a shorthand method for comparing the toxicity of different types or mixtures of dioxins to the toxicity of 2,3,7,8-TCDD and 1,2,3,7,8-PeCDD. This method is called the “Toxicity Equivalence” or TEQ.

6. What are the major sources of dioxins?

The amounts of dioxin that have been released from various sources have changed significantly over time. Historically, commercial or municipal waste incineration, manufacture and use of certain herbicides and chlorine bleaching of pulp and paper resulted in the major releases of dioxins to air and water. Regulatory actions along with voluntary industry actions have resulted in dramatic reductions in each of these sources and they are no longer major contributors of dioxins to the environment in the United States. While the United States has taken action to control this type of emission, these sources of dioxin still occur in the world. Currently, the uncontrolled burning of residential waste and accidental fires at landfills are thought to be among the largest sources of dioxins to the environment in the U.S.

7. How can I reduce my personal dioxin levels?

We recognize people’s concern over their potential dioxin exposure. Dioxins have existed in our environment for a long time. We all have some levels of dioxins in our bodies. Unfortunately, there are no safe and effective treatments to get rid of dioxins that may be in your body now. Dioxins are metabolized slowly (over years), and if exposure is sufficient to elevate body levels, dioxin levels will go down over time. The best way to reduce your personal dioxin level (and your risk from dioxins) is to reduce exposure and intake of dioxins.

For most people, following existing Federal Dietary Guidelines will result in reduced fat consumption and, consequently, reduced dioxin exposure (see question G4). The dietary guidelines provide for moderate amounts of fats which are part of a balanced diet. Eliminating all fats is not recommended. Overall, the best strategy for lowering the risk of dioxins while maintaining the benefits of a good diet is to follow the recommendations in the Federal Dietary Guidelines to choose fish, lean meat, poultry, and low or fat free (skim) dairy products and to increase consumption of fruits, vegetables and grain products. Lean meat includes meats that are naturally lower in fat, and meat where visible fat has been trimmed. For fish and poultry you can reduce fat by removing the skin. Reducing the amount of butter or lard used in the preparation of foods and cooking methods that reduce fat (such as broiling) will also lower the risk of exposure to dioxins. These strategies help lower the intake of saturated fats as well as reduce the risk of exposure to dioxin.

For information on the Federal Dietary Guidelines see www.health.gov/dietaryguidelines/.
A Human Health Risk Assessment is a scientific method used to evaluate “the potential adverse health effects from exposures to environmental hazards” (NRC, 1983).

1. **Hazard Identification**
   - Hazard Identification is the process of collecting and evaluating data to determine the levels in the environment and understanding whether exposure to a chemical is possible.

2. **Dose-Response Evaluation**
   - Dose-Response Evaluation is the process of quantitatively evaluating the amount of chemical a person might receive that could potentially cause a health effect.

3. **Human Exposure Evaluation**
   - Human Exposure Evaluation describes how people may be exposed either through inhalation, ingestion, and/or dermal contact with a chemical.

4. **Risk Characterization**
   - Risk Characterization uses the information gathered in the previous steps to form conclusions about the likelihood that people will be exposed and the possible health effects.
# Potential Health Risk Associated with Exposure to Sierra-Crete®

## What is the Significance of a Non-Cancer Hazard Index Value of 1.07?

Potential non-cancer risks are evaluated by comparing the calculated average daily exposure to each chemical in Sierra-Crete® to its toxicity value set by the State of California. The ratio of the average daily exposure of a chemical to its toxicity value is called a "Hazard Quotient". If the hazard quotient is less than one, that means that non-cancer risks are insignificant. In this diagram, the hazard quotients for each chemical in Sierra-Crete® are added together and the total potential non-cancer risk shown for residents and road workers. Because the combined hazard quotients are less than a value of one, non-cancer risks are insignificant for residents and road workers.

## What is the Significance of the Total Incremental Cancer Risk?

Potential cancer risks are evaluated by multiplying the calculated average daily exposure to each chemical in Sierra-Crete® by its toxicity value set by the State of California. The resulting number is referred to as the incremental risk of cancer. In California, the risk of cancer is considered insignificant if the level of exposure to a known or suspected chemical carcinogen multiplied by its toxicity value results in a value that is less than 0.000001 (also referred to as one in one million, or 1 x 10⁻⁶). USEPA uses a range of risks from 10⁻⁴ to 10⁻⁶ as acceptable for environmental exposures. In this diagram, the cancer risks for each chemical in Sierra-Crete® are added together and the total potential cancer risk shown for residents and road workers.

## Table: Average Exposure Levels

<table>
<thead>
<tr>
<th>Exposure Category</th>
<th>Hazard Quotient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Construction Worker</td>
<td>0.0057</td>
</tr>
<tr>
<td>Trespasser at a Construction Site</td>
<td>0.02</td>
</tr>
<tr>
<td>Resident Living along Sierra-Crete® Roads</td>
<td>0.003</td>
</tr>
<tr>
<td>Road Maintenance &amp; Utility Repair Worker</td>
<td>0.001</td>
</tr>
<tr>
<td>Resident adjacent to Road Maintenance Trench</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

## Graph: Theoretical Cancer Risk

- Past Exposure During Road Construction
- Current & Future Exposure from Road Use
- Current & Future Exposure from Road Maintenance

Note: not to scale

Prepared by Environ
POTENTIAL SIERRA-CRETE® EXPOSURES
EVALUATED THROUGHOUT THE LIFE CYCLE OF A ROAD

Assumptions

<table>
<thead>
<tr>
<th>Road Construction Workers</th>
<th>Residents</th>
<th>Road Maintenance Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingests up to 330 milligrams (or 1/2 tablespoon) of soil per day</td>
<td>Lives in the same house for 30 years</td>
<td>Works in short sleeves, long pants, and doesn’t wear gloves</td>
</tr>
<tr>
<td>Works between 1–8 hours on the job site each day, and spends 2–28 days on the site during each job, and over 4 years completes 12 jobs</td>
<td>Adults spend 1 day a week outdoors and children spend 5 days a week outdoors for 40 weeks per year (which accounts for vacation and bad weather)</td>
<td>Ingests 330 milligrams (1/2 tablespoon) of soil per day</td>
</tr>
<tr>
<td>Works in short sleeves, long pants, and doesn’t wear gloves</td>
<td>Everyone is barefoot and children of different ages (0–2, 2–6, 6–12, 12–18 years old) play ball on the street when outdoors</td>
<td>Works 8 hours/day on the job site for 3 days during each job, and over 10 years completes 20 jobs</td>
</tr>
<tr>
<td>8 different job activities evaluated, ranging from foreman to laborer</td>
<td>Material is tracked indoors on shoes and barefeet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adult and older children do laundry 5 days a week</td>
<td></td>
</tr>
</tbody>
</table>

Prepared by ENVIROMENT
Experts have taken a comprehensive look at all possible ways that people could come into contact with Sierra-Crete®. This included construction workers who installed the roads, residents who have lived next to streets underlain with Sierra-Crete® and maintenance workers who occasionally dig in the street to do their work.
How to Stay Informed

- For more information about Sierra-Crete® and/or dioxins, please visit the following websites:

Information from Contra Costa Health Services
www.cchealth.org

Information from DuPont
www.sierra-creteinfo.com

- For more information about Sierra-Crete® or the Task Force, you may contact Michael Kent, Hazardous Materials Ombudsman, Contra Costa Health Services, 925-313-6587