

California Air Resources Board

**Proposed Identification of**  
*TRICHLOROETHYLENE*  
**as a Toxic Air Contaminant**

**STAFF REPORT  
EXECUTIVE SUMMARY**

**State of California  
Air Resources Board  
Stationary Source Division**

**AUGUST 1990**

PROPOSED IDENTIFICATION OF TRICHLOROETHYLENE  
AS A TOXIC AIR CONTAMINANT

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Prepared by the Staffs of  
The Air Resources Board and  
The Department of Health Services

August 1990

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## STAFF REPORT

### WHAT IS A TOXIC AIR CONTAMINANT?

Health and Safety Code section 39655 defines a toxic air contaminant as an air pollutant which the Air Resources Board or the Department of Food and Agriculture finds "may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose present or potential hazard to human health."

### WHY WAS TRICHLOROETHYLENE CHOSEN FOR REVIEW?

Trichloroethylene (TCE) was chosen for evaluation for the following reasons: (1) The U.S. Environmental Protection Agency (EPA) classified TCE as a probable human carcinogen, (2) there are a wide variety of sources in California; and (3) TCE is mobile in the environment and is not naturally removed or detoxified at a rate that would significantly reduce public exposure.

### DOES AIRBORNE TRICHLOROETHYLENE QUALIFY AS A TOXIC AIR CONTAMINANT?

Yes. The staffs of the Air Resources Board (ARB) and the Department of Health Services (DHS) have reviewed the available scientific evidence on the presence of TCE in the atmosphere of California and its potential adverse effect on public health. Based on the finding of carcinogenicity and the results of the risk assessment, the ARB and DHS staffs have concluded that TCE meets the definition of a toxic air contaminant.

### DOES THE ARB STAFF RECOMMEND TCE BE IDENTIFIED AS A TOXIC AIR CONTAMINANT?

Yes. The staff of the Air Resources Board recommends that the Board adopt the proposed amendment to section 93000, Title 17 and 26, California Code of Regulations

identifying TCE as a toxic air contaminant. Furthermore, the staff of the DHS found that there is not sufficient available scientific evidence at this time to support the identification of an exposure level below which no significant adverse health impacts are anticipated; the ARB and DHS staffs therefore recommend that TCE be considered as having no threshold for carcinogenicity.

### **WHY DOES THE ARB STAFF RECOMMEND TCE BE IDENTIFIED AS A TOXIC AIR CONTAMINANT?**

Based on criteria set by the International Agency for Research on Cancer (IARC), the DHS staff considers TCE to be carcinogenic. Consequently, the DHS staff has concluded that “at ambient concentrations, Trichloroethylene may cause or contribute to an increase in mortality or serious illness and may therefore pose a potential hazard to human health.”

TCE is emitted from a variety of sources in the state and has been detected in the ambient air throughout California. TCE is not removed or detoxified at a rate that would significantly reduce public exposure.

### **HOW LONG DOES TCE REMAIN IN THE ATMOSPHERES**

The atmospheric lifetime of TCE ranges from 4 to 15 days. The primary removal mechanism of airborne TCE is its reaction with hydroxyl (OH) radicals in the troposphere.

### **WHAT ARE THE FINDINGS OF THE SCIENTIFIC REVIEW PANEL?**

In accordance with the provisions of Health and Safety Code section 39661, the Scientific Review Panel (SRP) has reviewed the reports of the staffs of the ARB and DHS on the public exposure and biologic and health effects of Trichloroethylene, and the public comments on these reports. Based on this review, the SRP finds that the reports are without serious deficiencies and agrees with the staff of the ARB and DHS that:

1. Trichloroethylene has been identified as an animal carcinogen and should be regarded as a potential human carcinogen.
2. Trichloroethylene is emitted into the air by a variety of stationary sources in California. It is emitted indoors and can give rise to concentrations approximately five times higher than outdoors.
3. Based on its gas-phase reactivity with hydroxyl radicals, Trichloroethylene has an atmospheric lifetime estimated to range from 4 to 15 days.
4. Approximately 20 million people in California represented by the toxics air monitoring network are estimated to be exposed to a population weighted mean Trichloroethylene concentration of 0.22 parts per billion (ppb).
5. Adverse health effects other than cancer are not known to occur at predicted concentrations of Trichloroethylene in ambient outdoor air.
6. Based on available scientific information, a Trichloroethylene exposure level below which carcinogenic effects are not expected to occur cannot be identified.
7. Based on an interpretation of available scientific evidence, DHS staff estimated the range of lifetime excess cancer risk from exposure to 0.19 ppb ( $1 \mu\text{g}/\text{m}^3$ ) of atmospheric Trichloroethylene based on the upper 95 % confidence limit is from  $4.2 \times 10^{-6}/\text{ppb}$  to  $5.3 \times 10^{-5}/\text{ppb}$ . Based on available data,  $1.1 \times 10^{-5}/\text{ppb}$  is the most plausible estimate of the upper limit of risk. These upper bound excess lifetime risks are health-protective estimates; the actual risk may well be below these values.

8. Exposure to the statewide mean ambient concentration (weighted by population) of 0.22 ppb for a population of 20 million people represented by the taxies air monitoring network, could result in up to 41 excess lifetime cancers, based on the DHS' best estimate for unit risk. Assuming that this applies to the California state population of 28 million, this could result in up to 56 excess lifetime cancers, based on the DHS' best estimate for unit risk.
  
9. The conclusions are based on limited animal data. As a result, the numbers cited here are subject to a significant degree of uncertainty.

### **WHAT ARE THE SOURCES OF AIRBORNE TCE EMISSIONS?**

Degreasing operations are the largest sources of TCE emissions to the atmosphere. Other significant sources of TCE emissions in California include paints and coatings, adhesive formulations, publicly owned treatment works (POTWs), PVC production, distribution facilities, and solvent reclamation.

### **HOW MUCH TCE IS RELEASED INTO CALIFORNIA'S AIR?**

The Air Resources Board staff estimated that approximately 960 tons of TCE were emitted to the atmosphere in California in 1987.

### **WHAT ARE THE AMBIENT CONCENTRATIONS OF TCE IN THE STATE?**

Mean concentrations of airborne TCE vary from 0.14 ppb in the South Central Coast Air Basin to 0.26 ppb in the San Francisco Bay Area Air Basin. The mean concentration of TCE in the South Coast Air Basin is 0.19 ppb. The estimated mean statewide population-weighted exposure for 20.3 million persons to TCE is 0.22 ppb.

### **ARE THERE HOT SPOT EMISSIONS OF TCE IN THE STATE?**

Yes. People living near facilities which emit TCE may be exposed to above ambient concentrations of TCE. The ARB staff modeled emissions from three of the largest sources of TCE in the state; the results indicate that nearby residents are exposed to a maximum annual average concentration ranging from two to five times above ambient TCE concentrations.

### **WHAT ABOUT INDOOR EXPOSURE TO TCE?**

Indoor concentrations appear to be dependent upon the use of consumer products containing TCE. Median indoor air concentrations of TCE have been measured to be from two to five times greater than simultaneous median outdoor concentrations. Therefore, indoor inhalation may be the mayor route of exposure to TCE for most people.

### **ARE THERE OTHER ROUTES OF EXPOSURE TO TCE?**

Yes. In addition to exposure to airborne TCE, exposure can also occur from consumption of TCE-contaminated drinking water and TCE-tainted food. Results from a 1984 study indicate that median concentrations of TCE in drinking water range from 0.03 to 0.05  $\mu\text{g}/\text{liter}$  (0.03 to 0.05 ppb).

The available information on TCE concentrations in food is limited. In a recent study, concentrations ranging from undetected to 500 ppb have been found in certain margarines. TCE has also been detected in salmon and wine in studies conducted overseas.

## **WHAT ARE THE HEALTH EFFECTS OF TCE EXPOSURE?**

The health effects of TCE exposure have been reviewed and evaluated to determine whether TCE meets the definition of a toxic air contaminant.

### **Carcinogenic Health Effects**

The DHS concurs with the EPA finding that there is sufficient evidence of carcinogenicity of TCE in animals and their placement of TCE in group B2 (probable human carcinogen); IARC has not classified TCE as to its carcinogenicity in humans. The EPA considers the evidence for the epidemiologic data on TCE carcinogenicity to be inconclusive.

Carcinogenic responses to TCE inhalation studies include: increased incidences of hepatocellular carcinoma and adenoma in male mice; lung adenocarcinomas and malignant lymphomas in female mice; malignant liver tumors in B6C3F1 mice; and renal tumors in rats.

### **Non-Carcinogenic Health Effects**

Adverse health effects other than cancer are not expected to occur at predicted concentrations in ambient outdoor air.

## **WHAT IS THE RISK ASSESSMENT FOR EXPOSURE TO TCE?**

The DHS' best estimate for the unit risk for TCE is  $2 \times 10^{-6} (\mu\text{g}/\text{m}^3)^{-1}$ . Using California's population-weighted annual TCE exposure of 0.22 ppb ( $\sim 1 \mu\text{g}/\text{m}^3$ ), the DHS staff estimates the excess carcinogenic risk from a 70-year lifetime exposure to be 2 cases per million persons exposed. Assuming a California population of 20.3 million, an excess of 41 additional potential lifetime cancer cases might result from continuous exposure to airborne TCE.



The DHS staff estimates the range of the unit risk for TCE to be from  $8 \times 10^{-7}$  to  $1 \times 10^{-5}$   $(\mu\text{g}/\text{m}^3)^{-1}$ . Using California's population-weighted annual TCE exposure of 0.22 ppb, the DHS staff estimates the excess carcinogenic risk from a 70-year lifetime exposure to be 1 to 10 cases per million persons exposed. Assuming a California population of 20.3 million, an excess of 20 to 203 potential lifetime cancer cases might result from continuous exposure to airborne TCE.

### **WHAT ARE THE ALTERNATIVES TO IDENTIFYING TCE AS A TOXIC AIR CONTAMINANT?**

Government Code Section 11346.14 requires agencies to describe alternatives to the regulation considered by the agency and the agency's reasons for rejecting those alternatives. The only alternative to identifying TCE as a toxic air contaminant is to not identify it. We are not recommending this alternative because we believe that TCE meets the statutory definition of a toxic air contaminant.

### **WHAT WOULD BE THE ENVIRONMENTAL IMPACT OF THE IDENTIFICATION OF TCE AS A TOXIC AIR CONTAMINANT?**

The identification of TCE as a toxic air contaminant is not in itself expected to result in any environmental effects. The identification of TCE as a toxic air contaminant by the Board may result in the Board and air pollution control districts adopting control measures in accordance with the provisions of state law (Health and Safety Code sections 39665 and 39666). Any such toxic control measures would result in reduced emissions of TCE to the atmosphere, resulting in reduced ambient concentrations, thereby reducing the health risk due to TCE exposure. Therefore, the identification of TCE as a toxic air contaminant may ultimately result in environmental benefits. Environmental impacts identified with respect to specific control measures will be included in the consideration of such control measures pursuant to Health and Safety Code sections 39665 and 39666.