

# Cleaner Air Oregon Toxicity Reference Values and Risk-Based Concentrations

## Explanation of Authoritative Sources of Toxicity Reference Values Used in Cleaner Air Oregon

The Cleaner Air Oregon program developed by the Oregon Department of Environmental Quality and the Oregon Health Authority evaluates potential toxic air contaminant risks to people near industrial and commercial facilities, and reduces those risks below action levels adopted in law or rules. The agencies use toxicity reference values, or TRVs, to assess these risks. A TRV is the concentration of a toxic air contaminant below which health effects are not expected to occur, even in sensitive people, based on the best available science. A TRV depends on the type of health effect and whether exposure is for a long or short period of time. TRVs used for toxic air contaminants only consider health risks related to breathing in the toxic air contaminant. A toxic air contaminant could have up to three different TRVs:

- **Chronic cancer TRV** is the air concentration of a toxic air contaminant that contributes no more than 1 in 1 million additional cancer risk when that air is breathed all the time over a lifetime.
- **Chronic noncancer TRV** is the level below which no noncancer health effects are expected over a year or more of constantly breathing that air.
- **Acute noncancer TRV** is the level below which no noncancer health effects are expected over 24 hours or less of breathing that air.

## How Cleaner Air Oregon selects TRVs

A number of governmental scientific agencies have developed TRVs, and they use different names for their TRVs. These authoritative sources do not all have TRVs for every toxic air contaminant. Sometimes, multiple authoritative sources have slightly different TRVs for the same toxic air contaminant. This is often because they have different schedules for reviewing the underlying science and updating their TRVs. DEQ and OHA used different strategies to select TRVs from among authoritative sources for chronic and acute TRVs. The authoritative sources all assume the same exposure time when developing their chronic TRVs and their scientific processes are equally rigorous. DEQ and OHA selected the most recently published TRV from among the authoritative sources listed in Table 1 for each toxic air contaminant. This ensures that chronic TRVs are based on the most recent review of scientific studies by an authoritative source.

Table 1. Authoritative scientific agencies for selecting chronic toxicity reference values

Name of agency	Name of Chronic TRV	TRV Available
Oregon Department of Environmental Quality	Ambient Benchmark Concentration*	cancer and noncancer
U.S. Environmental Protection Agency Integrated Risk Information System (IRIS)	Inhalation Unit Risk (IUR)	cancer
	Reference Concentration (RfC)	noncancer
EPA Provisional Peer Reviewed Toxicity Values (PPRTV)	IUR	cancer
	RfC	noncancer
U.S. Agency for Toxic Substances and Disease Registry (ATSDR)	Chronic Minimal Risk Levels	noncancer
California EPA Office of Environmental Health Hazard Assessment (OEHHA)	IUR	cancer
	Chronic Reference Exposure Level	noncancer

\*Note: DEQ Ambient Benchmark Concentrations are derived from a review of existing TRVs, and generally not by a separate peer review of scientific literature.

Through an existing technical advisory committee to DEQ, the Air Toxics Science Advisory Committee (ATSAC), DEQ has established a set of Ambient Benchmark Concentrations (ABCs) as chronic TRVs for 55 toxic air contaminants. These ABCs were adopted in rule and published on May 11, 2018. This makes them the most recently published TRVs for each toxic air contaminant for which an ABC has been established. It is important to note that the ATSAC only considered values from the authoritative sources shown in Table 1. DEQ does not intend to develop, or ask ATSAC to develop, its own TRVs.

Acute TRVs are different because fewer authoritative sources create them and because the authoritative sources make different assumptions about how long people are exposed. Health risks from inhaling toxic air contaminants are the result of how concentrated the contaminants are in the air and the amount of time people spend breathing them. DEQ and OHA assume 24 hours of exposure for acute TRVs. CAO is not intended to be a mechanism to address emergency situations where exposures of less than an hour could affect health. There are other mechanisms to address emergency situations caused by very high accidental releases. Therefore, DEQ and OHA selected acute TRVs from among authoritative sources by preference for which authoritative source used assumptions about exposure times that best matched DEQ and OHA's assumed exposure time of 24 hours. Table 2 shows the authoritative sources listed in order of preference based on how well their TRVs match DEQ and OHA's assumed 24-hours of exposure.

Table 2. Order of authoritative scientific agencies for acute noncancer toxicity reference values

Order of Preference	Name of agency	Name of Acute TRV	Assumed Exposure Time
1	Oregon Department of Environmental Quality	Short-term Guideline Concentrations	24 Hours
2	U.S. Agency for Toxic Substances and Disease Registry	Acute Minimal Risk Levels	Less than 2 weeks (includes 24 hours)
3	California EPA Office of Environmental Health Hazard Assessment	Acute Reference Exposure Level	1 Hour
4	U.S. Agency for Toxic Substances and Disease Registry	Intermediate Minimal Risk Levels	2 Weeks to 1 year

### Rationale for using TRVs from authoritative agencies

- The agencies included in the hierarchy tables go through extensive peer-reviewed processes** to establish health-based TRVs using the best available science and research. They convene panels of scientists with expertise in the chemicals being evaluated. For each chemical, these expert panels spend years reviewing hundreds of scientific studies to evaluate the weight of scientific evidence. The evaluations are then shared for public comment. This public process is lengthy and requires substantial investments of federal tax dollars.
- Establishing new TRVs is beyond the capacity of agencies in Oregon.** In order to establish new TRVs, Oregon would have to undergo a rigorous and costly process, similar to the one mentioned above. That kind of work is far beyond the current capacity of state agencies and would result in state tax dollars being spent to do work that is already being done at the federal level. The results of a state level review would likely confirm the conclusions of other authoritative sources.
- Other states confidently rely on agency TRVs** as the basis for health-based industrial toxic air contaminant programs. Programs in Washington State, New Jersey, Rhode Island, Massachusetts, New Hampshire, New York, Georgia, Minnesota, Michigan, and North Carolina all rely primarily on TRVs from the EPA and U.S. Agency for Toxic Substances and Disease Registry. However, these states do not all draw from these sources in the exact same order.

# How Cleaner Air Oregon's Risk-Based Concentrations Are Developed from Toxicity Reference Values

Risk is a combination of how harmful a contaminant is (toxicity), and how and for how long a person might come into contact with the contaminant (exposure). When they develop TRVs, the authoritative sources do so using an assumption of constant exposure to a toxic air contaminant. These authoritative sources have also developed steps to adjust TRVs to match more common real-life exposure scenarios, such as adults working 40 hours per week. DEQ and OHA used TRVs from the authoritative sources in the tables above to calculate adjusted values, called "risk-based concentrations," or RBCs. RBCs are the tool agencies will use to evaluate health risks from individual facility toxic air contaminant emissions, and determine whether the risk is above a level requiring a facility to take some action. Graphic 1 shows how selection of TRVs result in identified risk-based concentration levels.

## Approach used to calculate Cleaner Air Oregon RBCs

DEQ and OHA developed RBCs for each toxic air contaminant for which an authoritative source has established a TRV. The agencies then applied adjustment factors appropriate for calculating RBCs as shown in Graphic 1. There are separate RBCs for cancer risk, chronic (long-term exposure) noncancer risk, and acute (short-term exposure of 24 hours or less) noncancer risk.

## Adjustment Factors

The agencies apply adjustment factors to TRVs in order to convert TRVs to RBCs that consider both toxicity and amount of exposure to a toxic air contaminant. DEQ and OHA used the following adjustment factors to calculate cancer and chronic noncancer RBCs. Adjustment factors are not appropriate or necessary for acute RBCs, which are concerned with health effects that may occur from short periods of exposure (generally less than one day).

- **Exposure time, frequency and duration.** Exposure time is the number of hours per day exposed. Exposure frequency is the number of days per year exposed and exposure duration is the number of years exposed. The amount of risk often depends on how often and for how long a person is exposed to a toxic air contaminant. For example, a worker exposed to a toxic air contaminant for 8 hours/day for 25 years has less exposure, and therefore less risk than a resident exposed for 24 hours/day for 70 years.
- **Early-life exposure.** An early-life adjustment factor is used for some cancer-causing (carcinogenic) contaminants. These carcinogens may have greater toxicity to infants or children than is reflected in the related TRV.
- **Multi-pathway exposure.** A multi-pathway adjustment factor (MPAF) for exposure considers other ways people could be exposed to a contaminant. Some toxic air contaminants can be deposited on soil where someone may be exposed to the contaminants by routes other than inhalation. MPAFs are only used for contaminants that can build up in the body (bioaccumulate) and contaminants that can stay a long time in the environment.

## Using RBCs in Cleaner Air Oregon

The approach DEQ and OHA use to calculate RBCs is consistent with other state and federal programs, and with DEQ's existing Cleanup Program. The agencies will use RBCs to calculate risks for an individual facility. Calculated risks for a facility would then be compared with Risk Action Levels (RALs), the levels at which facilities must take action.

Graphic 1. Process to identify Risk-Based Concentrations

