State of Oregon
Department of Environmental Quality Memorandum

To: **File** **Date: March 26, 2018**

From: **Toxicology Workgroup**
Cleanup Program

Subject: **Calculation of Trichloroethene RBCs using Early-Life Exposure**

The U.S. Environmental Protection Agency's Integrated Risk Information System completed a final evaluation of trichloroethene toxicity on September 28, 2011. The new toxicity values replace 2001 draft values previously used by DEQ in developing risk-based concentrations (RBCs). Risk-based decision making guidance and RBC spreadsheets are available at: http://www.oregon.gov/deq/Hazards-and-Cleanup/env-cleanup/Pages/Risk-Based-Decision-Making.aspx

One issue that complicates the derivation of RBCs for TCE concerns the incorporation of early-life exposure. There are three cancer endpoints considered in the development of the slope factor and inhalation unit risk (IUR) factor for TCE: kidney cancer, liver cancer, and non-Hodgkins lymphoma. EPA determined that TCE was carcinogenic by a mutagenic mode of action for kidney cancer (renal cell carcinoma). Age-dependent adjustment factors (ADAFs) should therefore be used to evaluate early-life exposure to TCE for this endpoint. However, EPA did not determine that there is a mutagenic mode of action for the other two cancer endpoints. The precise method for calculating RBCs for TCE is to use slope factors and IURs for each cancer endpoint, determine an RBC for kidney cancer using ADAFs, determine RBCs for liver cancer and non-Hodgkins lymphoma without assuming early-life exposure, and combine the individual endpoint RBCs to get a comprehensive RBC using the following equation:

$$RBC_{TCE\text{-}total} = \frac{1}{(1/RBC_{TCE\text{-}kidney}) + (1/RBC_{TCE\text{-}liver}) + (1/RBC_{TCE\text{-}lymphoma})}$$

DEQ used this approach to develop the current RBCs for TCE using default exposure assumptions. This is similar to the past approach used to develop RBCs for vinyl chloride. However, unlike for vinyl chloride, the methodology for TCE is not programmed into the RBC spreadsheet. If you wish to develop site-specific RBCs for TCE, you will need to determine RBCs separately for each toxic endpoint, and then combine the RBCs to derive a total RBC as shown above. The toxicity values for each endpoint are the following:

Toxic Endpoint	Oral Cancer Slope Factor SFo $(mg/kg/day)^{-1}$	Inhalation Unit Risk IUR $(ug/m^3)^{-1}$
Kidney cancer	0.0093	1.0×10^{-6}
Liver cancer	0.016	1.0×10^{-6}
Non-Hodgkins Lymphoma	0.022	2.1×10^{-6}
Total	0.046	4.1×10^{-6}

Because the current RBC spreadsheet does not actually perform the calculations for TCE, you will first need to add three new chemicals to the spreadsheet (TCE-kidney, TCE-liver, and TCE-

lymphoma) to represent the three toxic endpoints for TCE. You can copy over the existing chemical information for TCE, and use the toxicity values shown above. For ease of calculation, liver cancer and non-Hodgkins lymphoma toxicity can be combined to develop one RBC, which can be combined with the kidney endpoint to calculate a total RBC for TCE. Note that this effort is only required for residential or urban residential exposure where infants and children are of interest.

For exposure to adults (occupational, construction, and excavation workers), consideration of early-life exposure is not needed, and site-specific RBCs can be calculated using the total toxicity values for TCE. However, first you must change the Risk Type in the ToxData tab from NA to either “c” for cancer effects or “nc” for non-cancer effects. Then you can make site specific revisions to exposure factors and recalculate the adult RBCs.