

**PART 201 GENERIC DRINKING WATER CRITERIA  
TECHNICAL SUPPORT DOCUMENT**

**Michigan Department of Environmental Quality  
Environmental Response Division**

**August 31, 1998**

This Technical Support Document (TSD) presents the methodology for development of the Part 201 generic drinking water criteria (DWC) pursuant to sections 20120a(1)(a), (b) and (d) and 20120(a)(3) and (5) of Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. It also provides general information about the implementation of the criteria. This document replaces the information related to the DWC presented in Operational Memoranda 8 and 14 which were last published in 1995.

The DWC are presented in the first and second columns of the Environmental Response Division Interim Operational Memorandum #18: Part 201 Generic Cleanup Criteria Tables. Residential and Commercial I DWC are presented in column #1 and Industrial-Commercial II, III and IV criteria are presented in column #2 of the Groundwater table. The DWC represent water concentrations of contaminants in units of micrograms per liter (ug/l) or parts per billion (ppb). To convert to units of parts per million or milligrams per liter (mg/l) in water, divide the DWC by 1,000.

**IMPLEMENTATION OF THE DRINKING WATER CRITERIA**

The DWC represent concentrations in drinking water which are safe for long-term, daily consumption. Health-based DWC lower than the method detection limit (MDL) default to the MDL and are footnoted accordingly {M}. Where a State Drinking Water Standard (SDWS) has been established pursuant to Act No. 399 of the Public Acts of 1976, the SDWS becomes the health-based DWC, as indicated in Section 20120a(5) of Part 201. Criteria based on a SDWS are indicated with a footnote {A}. DWC for some inorganic hazardous substances may default to background when the criteria are less than background. Background concentrations for groundwater must be determined on a regional or facility-specific basis.

Rule 299.5709, referenced in Section 20120a(5), requires that remediation of an aquifer address adverse aesthetic impacts (e.g., odor, taste, color, or precipitate) resulting from one or a combination of hazardous substances. However, aesthetic criteria are available for only a limited number of individual hazardous substances. Aesthetic criteria are based on Federal Secondary Maximum Contaminant Levels (SMCLs) or the results of an appropriately conducted taste or odor test. Where available and lower than the health-based DWC or the SDWS, the aesthetic value becomes the DWC. Footnote {E} identifies the DWC based on adverse aesthetics characteristics. If adverse aesthetic impacts remain when health-based criteria/SDWS or individual aesthetic criteria have been achieved, further remedial measures may be required. Consult your Supervisor or the Toxicology Unit if you encounter such a situation.

The drinking water pathway is relevant for all groundwater in an aquifer. The remedial action plan (RAP) should identify whether each saturated zone underlying the site is an aquifer. Any formation which serves or may serve as a drinking water source meets the definition of "aquifer" in R 299.5101(c). The drinking water pathway may also be relevant for groundwater not in an aquifer if it transports a hazardous substance into an aquifer that is or could be used for drinking

at a concentration that exceeds the generic residential criteria. Otherwise, cleanup criteria for groundwater not in an aquifer must be determined by consideration of other exposure pathways and their associated criteria.

Drinking water criteria are applicable to all groundwater in an aquifer unless drinking water use is prohibited by enforceable land use restrictions in a restrictive covenant [Section 20120b(4)] or an approved institutional control [Section 20120b(5)].

The generic industrial and commercial DWC are applicable for property that is zoned or being used for industrial or commercial II, III, or IV purposes, provided that a notice of approved environmental remediation (NAER) or restrictive covenant will limit the property use to commercial or industrial as appropriate. The absence of nonconforming residential use must be confirmed. These criteria are applicable unless drinking water use is prohibited by enforceable land use restrictions in a restrictive covenant or an approved institutional control that is part of the RAP. Generic residential DWC are applicable at the property boundary unless off-property use of the aquifer is controlled by a restrictive covenant, NAER or approved institutional control, and the control mechanism is included in the RAP for the facility.

#### **GENERAL INFORMATION ABOUT THE DWC ALGORITHMS**

All exposure assumptions within these equations represent current United States Environmental Protection Agency (EPA) guidance. The averaging time (AT) represents the number of days over which the exposure is averaged. The selection of an appropriate AT is dependent upon the type of toxic effect being evaluated. When evaluating long-term exposure to noncarcinogenic compounds, exposures are calculated by averaging over the period of exposure (i.e., subchronic or chronic exposures). For carcinogenic compounds, exposures are calculated by prorating the total cumulative dose over a lifetime (also called lifetime average daily dose). The approach for carcinogens is based on the assumption that a high dose of a carcinogen received over a short period of time is equivalent to a corresponding low dose spread over a lifetime.

The acceptable level of risk for carcinogens is one in one hundred thousand ( $10^{-5}$ ). Exposure to noncarcinogens is evaluated through the use of a hazard quotient (HQ). The HQ is the ratio of a single substance exposure level over a specified time period to a reference dose for that substance derived from a similar exposure period. An acceptable HQ is equal to or less than one. An  $HQ > 1$  indicates an unacceptable exposure (i.e., the exposure level is greater than the reference dose).

The relative source contribution factor (RSC) of 20 percent is included in the algorithm for noncarcinogens to maintain consistency with the EPA and state of Michigan in their development of drinking water standards. An RSC has also been incorporated into the Great Lakes Initiative risk assessment process and is used by the Waste Management Division in establishing groundwater permit limits for noncarcinogens. The 20 percent RSC represents a default value to be replaced with a chemical-specific value when data are available. The RSC accounts for the fact that there are many chemicals to which people are exposed through a variety of media and activities. The default RSC of 0.2 (20 percent) assumes that a receptor gets only 20 percent of his/her exposure to a contaminant from drinking water; 80 percent of the exposure to on-site contaminants comes from other sources. For example, solvents are common industrial contaminants which are also commonly found in products routinely used by the general consumer. Ignoring exposures from other sources could underestimate the risk posed by that type of chemical. In light of the fact that chemical-specific data pertaining to this issue is

extremely limited and significant exposures to certain chemicals do occur from a variety of sources, it is necessary to identify a conservative default for this generic approach. As chemical-specific source data become available, they will be used to develop chemical-specific RSCs.

### **GENERIC HEALTH-BASED DRINKING WATER ALGORITHMS**

#### **Generic Residential Drinking Water Criteria**

These criteria were developed using the residential drinking water algorithms presented below for carcinogens and noncarcinogens.

#### CARCINOGENS:

$$DWC = \frac{10^{-5} \times BW \times AT \times CF}{SF \times EF \times ED \times IR_{dw}}$$

where,

DWC (risk-based drinking water concentration)	= in ug/l (ppb)
10 <sup>-5</sup> cancer risk	= target risk
BW (body weight)	= 70 kg
AT (averaging time in days)	= 25,550 days (70 x 365)
CF (conversion factor)	= 1000 ug/mg
SF (oral cancer slope factor)	= chemical-specific, (mg/kg-day) <sup>-1</sup>
EF (exposure frequency)	= 350 days/year
ED (exposure duration)	= 30 years
IR <sub>dw</sub> (drinking water ingestion rate)	= 2 liters/day

#### NONCARCINOGENS:

$$DWC = \frac{HQ \times RfD \times BW \times AT \times RSC \times CF}{EF \times ED \times IR_{dw}}$$

where,

DWC (risk-based drinking water concentration)	= in ug/l (ppb)
HQ (hazard quotient)	= 1
RfD (oral reference dose)	= chemical-specific, mg/kg-day
BW (body weight)	= 70 kg
AT (averaging time)	= 10,950 days (30 x 365)
RSC (relative source contribution)	= 0.2
CF (conversion factor)	= 1000 ug/mg
EF (exposure frequency)	= 350 days/year
ED (exposure duration)	= 30 years
IR <sub>dw</sub> (drinking water ingestion rate)	= 2 liters/day

The exposure duration of 30 years represents the national upper-bound time (90th percentile) at one residence (EPA, 1989). The exposure frequency (EF) of 350 represents the number of days per year that a resident is exposed to drinking water at their home; it assumes that people spend approximately 15 days per year away from their homes for vacations or other reasons.

**Generic Industrial and Commercial Drinking Water Criteria**

The generic industrial/commercial DWC are designed to protect workers whose drinking water is from an on-site groundwater source. The algorithms follow:

**CARCINOGENS:**

$$DWC = \frac{10^{-5} \times BW \times AT \times CF}{SF \times EF \times ED \times IR_{dw}}$$

where,

DWC (risk-based drinking water concentration)	= in ug/l (ppb)
10 <sup>-5</sup> cancer risk	= target risk
BW (body weight)	= 70 kg
AT (averaging time in days)	= 25,550 (70 x 365)
CF (conversion factor)	= 1000 ug/mg
SF (cancer slope factor)	= chemical-specific, mg/kg-day <sup>-1</sup>
EF (exposure frequency)	= 245 days/year
ED (exposure duration)	= 21 years
IR <sub>dw</sub> (drinking water ingestion rate)	= 1 liter/day

**NONCARCINOGENS:**

$$DWC = \frac{HQ \times RfD \times BW \times AT \times RSC \times CF}{EF \times ED \times IR_{dw}}$$

where,

DWC (risk-based drinking water concentration)	= in ug/l (ppb)
HQ (hazard quotient)	= 1
RfD (oral reference dose, mg/kg/d)	= chemical-specific
BW (body weight)	= 70 kg
AT (averaging time)	= 7,665 days (21 x 365)
RSC (relative source contribution)	= 0.2
CF (conversion factor)	= 1000 ug/mg
EF (exposure frequency)	= 245 days/year
ED (exposure duration)	= 21 years
IR <sub>dw</sub> (drinking water ingestion rate)	= 1 liter/day

The Department's use of 21 years as the exposure duration (ED) for a worker is based on 1991 statistics from the United States Department of Labor (EPA, 1991b). However, since the United States Department of Labor Statistics did not detail the distribution for employees working greater

than 19 years at one location, 25 years was assumed to be a 95th percentile estimate by the EPA. The 90th percentile was estimated to be 21 years. Although an ED of 21 years differs from EPA's recommendation of 25 years, an ED of 21 years is derived from more recent data. In addition, use of an ED of 21 years follows EPA guidance which recommends using a combination of exposure assumptions which represent 50<sup>th</sup>, 90<sup>th</sup>, and 95th percentiles.

The exposure frequency (EF) for the drinking water scenario is derived assuming 260 work days per year minus 3 work weeks (15 days) of vacation and sick time. The assumed amount of water ingested at work (1 liter/day) is based on EPA's recommendation (EPA, 1991a). However, parties preparing RAPS should consider that workers routinely engaged in hard, physical labor could ingest a greater volume of water. If this condition exists at a facility, the  $IR_{dw}$  may need to be adjusted to more accurately reflect the long-term uptake of greater amounts of water.

An RSC of 0.2 (20 percent) is used for noncarcinogens. See the discussion on RSCs in the residential section.

---

---

This memorandum is intended to provide guidance to Division staff to foster consistent application of Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, and associated Administrative Rules. This document and matters addressed herein are subject to revision.

## REFERENCES

- EPA (U.S. Environmental Protection Agency). 1989. Risk Assessment Guidance for Superfund. Volume I. Human Health Evaluation Manual (Part A). Interim Final. EPA/540/1-89/002. December 1989.
- EPA (U.S. Environmental Protection Agency). 1991a. Risk Assessment Guidance for Superfund: Volume I. Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). Interim. Publication 9285.7-01B. December 1991.
- EPA (U.S. Environmental Protection Agency). 1991b. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors." Interim Final. OSWER Directive: 9285.6-03. March 25, 1991.