R 299.5721 Rescinded.

R 299.5722 Generic cleanup criteria for soil based on leaching of hazardous substances into groundwater.

Rule 722. (1) To assure that soils do not pose a threat of aquifer contamination, the concentration of the hazardous substance in soil shall be below that which produces a concentration in leachate that is equal to the least restrictive of the applicable groundwater criteria specified in subdivisions (a) to (c) of this subrule, or below a criterion based on the soil-water partitioning characteristics of a hazardous substance as provided in subrule (4) of this rule, whichever is higher. The selection of the least restrictive value listed below, and comparison to the soil-water partitioning value, shall be done separately for each pathway that is relevant at the facility.

(a) The groundwater criteria developed under R 299.5708 to 299.5716.

(b) The leachate concentration generated by background soil.

(c) The groundwater concentration allowed by R 299.5707, if it is higher than a risk-based criterion that would otherwise be the most restrictive.

(2) Leachate testing is not required to demonstrate compliance with subrule (1) of this rule if the total concentration of a hazardous substance in soil does not exceed 20 times the lowest groundwater cleanup criterion that is applicable at the facility or does not exceed the soil-water partitioning value established under subrule (4) of this rule, whichever is higher.

(3) Leachate concentrations shall be determined by a method that best represents in-situ conditions. For the purposes of this rule, the following test methods are acceptable:

(a) The United States environmental protection agency's toxicity characteristic leaching procedure (TCLP) (revised as of July 1992) or the synthetic precipitation leachate procedure (SPLP) (revised as of September 1994) as set forth in SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (revised to include Update III, June 13, 1997), published by the United States Environmental Protection Agency, which are adopted by reference in these rules and which are available for inspection at the Lansing office of the department, 525 West Allegan Street, Lansing, Michigan. Copies of the provisions may be purchased at a cost as of the time of adoption of these rules of $239.00 from the National Technical Information Service, United States Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161 (publication number PB97-156111GEI), or from the Department of Environmental Quality, Remediation and Redevelopment Division, 525 West Allegan, Lansing, Michigan 48909, at cost.

(b) Other methods accepted by the department to more accurately simulate conditions at the site than the test methods specified in subdivision (a) of this subrule.

(4) The department may, if adequate data are available, establish acceptable soil concentrations based on soil-water partitioning characteristics of a hazardous substance.

R 299.5723 Rescinded.

R 299.5724 Generic cleanup criteria for soil based on indoor inhalation of hazardous substance vapors volatilized from soil.

Rule 724. (1) Indoor inhalation of hazardous substance vapors volatilizing to indoor air from soil shall be considered a reasonable and relevant exposure pathway only for hazardous substances that have a Henry's law constant greater than or equal to 0.00001 atm-m^3/mole.

(2) Except as provided in subrule (1) of this rule, if any of the following conditions exist, the generic criteria developed pursuant to this rule shall not apply and a site-specific evaluation of indoor inhalation risks shall be conducted:

(a) There is a structure present or planned to be constructed at the facility which does not have a concrete block or poured concrete floor and walls.

(b) There is a sump present that is not completely isolated from the surrounding soil by its materials of construction.

(3) Soil cleanup criteria based on indoor inhalation of volatile emissions from hazardous substances in soil shall be called soil volatilization indoor air inhalation criteria ("SVIIC"). The SVIIC is determined by the following series of calculations, except as provided in R 299.5734(3):

EQUATION FOR CARCINOGENIC EFFECTS:

$$SVIIC = \frac{TR \times AT \text{ X } AIR}{IURF \times EF \times ED \times CR_{building}}$$

where,

SVIIC	(Soil volatilization indoor air inhalation criterion)	= chemical-specific, ug/kg
TR	(Target risk level)	= 10^{-5}
AT	(Averaging time)	= 25,550 days (70 x 365)
AIR	(Adjusted inhalation rate)	= 1 (residential) = 2 (commercial/industrial)
IURF	(Inhalation unit risk factor)	= chemical-specific, $(ug/m^3)^{-1}$
EF	(Exposure frequency)	= 350 days/year (residential) = 245 days/year (commercial/industrial)
ED	(Exposure duration)	= 30 years (residential) = 21 years (commercial/industrial)

$CR_{building}$	(Ratio of indoor air concentration to soil concentration)	= chemical-specific, $(ug/m^3)/(ug/kg)$

EQUATION FOR NONCARCINOGENIC EFFECTS:

$$SVIIC = \frac{THQ \times AT}{(1/ITSL) \times EF \times ED \times CR_{building}}$$

where,

SVIIC	(Soil volatilization indoor air inhalation criterion)	= chemical-specific, ug/kg
THQ	(Target hazard quotient)	= 1
AT	(Averaging time)	= 10,950 days (residential) = 7,665 days (commercial/ industrial)
EF	(Exposure frequency)	= 350 days/year (residential) = 245 days/year (commercial/industrial)
ED	(Exposure duration)	= 30 years (residential) = 21 years (commercial/ industrial)
ITSL	(Initial threshold screening level)	= chemical-specific, ug/m^3
$CR_{building}$	(Ratio of indoor air concentration to soil concentration)	= chemical-specific, $(ug/m^3)/(ug/kg)$

The contaminant vapor concentration in the building indoor air is written as:

$$CR_{building} = CR_{source}^{soil} \times \alpha$$

where,

$CR_{building}$	(Ratio of indoor air concentration to soil concentration)	= chemical-specific, $(ug/m^3)/(ug/kg)$
α	(Attenuation coefficient)	= chemical-specific, unitless
CR_{source}^{soil}	(Ratio of soil vapor concentration to soil/source concentration)	= chemical-specific, $(ug/m^3)/(ug/kg)$

The vapor-phase contaminant concentration at the source for soil is written as:

$$CR_{source}^{soil} = \frac{H' \times TAF \times C_s \times \rho_b \times 10^{-3}\ kg/g \times 10^{6}\ cm^3/m^3}{\theta_w + (k_d \times \rho_b) + (H' \times TAF \times \theta_a)}$$

where,

CR_{source}^{soil}	(Ratio of soil vapor concentration to soil/source concentration)	=	chemical-specific, $(ug/m^3)/(ug/kg)$
H'	(Dimensionless Henry's law constant, where H' = HLC x 41)	=	chemical-specific, unitless
HLC	(Henry's law constant at 25 degrees Celsius)	=	chemical-specific, $(atm\text{-}m^3/mol)$
TAF	(Temperature adjustment factor)	=	0.5, unitless
C_s	(Uniform concentration in soil)	=	1 ug/kg
ρ_b	(Dry soil bulk density)	=	1.5 g/cm^3
θ_w	(Soil water-filled porosity)	=	0.3 cm^3/cm^3
k_d	(Soil-water partition coefficient)	=	chemical-specific, cm^3/g (equivalent to L/kg)
	For organic compounds	=	K_{oc} (cm^3/g) x f_{oc} (g/g)
	For inorganic compounds	=	chemical-specific, cm^3/g
K_{oc}	(Soil organic carbon partition coefficient)	=	chemical-specific, cm^3/g
f_{oc}	(Fraction of organic carbon content of soil)	=	0.002 g/g (0.2%)
θ_a	(Soil air-filled porosity)	=	0.13 cm^3/cm^3

The intrusion rate of hazardous substance vapors into buildings is predicted using an analytical solution which couples both diffusive and convective transport of vapors emanating from subsurface soil into enclosed spaces. An attenuation coefficient (α) is calculated that is expressed as the ratio of building indoor air concentration to the vapor-phase concentration at the source. Values of α are calculated assuming infinite source conditions. For infinite source conditions α is written as follows:

$$\alpha = \frac{\left[\left[\frac{D_v^{eff} A_b}{Q_{building} L_T}\right] \times \exp\left(\frac{Q_{soil} L_{crack}}{D^{crack} A_{crack}}\right)\right]}{\left[\exp\left(\frac{Q_{soil} L_{crack}}{D^{crack} A_{crack}}\right) + \left[\frac{D_v^{eff} A_b}{Q_{building} L_T}\right] + \left[\frac{D_v^{eff} A_b}{Q_{soil} L_T}\right]\left[\exp\left(\frac{Q_{soil} L_{crack}}{D^{crack} A_{crack}}\right) - 1\right]\right]}$$

where,

α	(Attenuation coefficient)	= unitless
D_v^{eff}	(Effective diffusion coefficient through vadose zone)	= chemical-specific, cm^2/s
D^{crack}	(Effective diffusion coefficient through crack)	= cm^2/s, ($D^{crack} = D_v^{eff}$, see equation for D_v^{eff} below)
A_b	(Area of enclosed space below grade)	= 1.96E+6 cm^2 (residential) = 3.83E+6 cm^2 (commercial/ industrial)
$Q_{building}$	(Building ventilation rate)	= 1.51E+5 cm^3/s (residential) = 5.04E+5 cm^3/s (commercial/ industrial)
L_{crack}	(Building foundation thickness)	= 15 cm
L_T	(Source-building separation distance)	= 15 cm (All land use categories)
Q_{soil}	(Volumetric flow rate of soil vapor into the building)	= 0.81 cm^3/s (residential) = 2.10 cm^3/s (commercial/ industrial)
A_{crack}	(Total area of cracks below grade)	= 196 cm^2 (residential) = 383 cm^2 (commercial/ industrial)
exp(p)	(The base of the natural logarithm raised to power p)	= e^p

The effective diffusion coefficient calculation for the vadose zone (D_v^{eff}) is written as:

$$D_v^{eff} = \left[D_a\left(\theta_a^{3.33}/n^2\right)\right] + \left[\frac{D_w}{H' \times TAF}\left(\theta_w^{3.33}/n^2\right)\right]$$

where,

D_v^{eff}	(Effective diffusion coefficient through vadose zone)	=	chemical-specific, cm^2/s
D_a	(Diffusivity in air)	=	chemical-specific, cm^2/s
θ_a	(Soil air-filled porosity)	=	0.13 cm^3/cm^3
n	(Total soil porosity)	=	0.43 cm^3/cm^3
D_w	(Diffusivity in water)	=	chemical-specific, cm^2/s
H'	(Dimensionless Henry's law constant, where H' = HLC x 41)	=	chemical-specific, unitless
HLC	(Henry's law constant	=	chemical-specific, (atm-m^3/mol)
θ_w	(Soil water-filled porosity)	=	0.3 cm^3/cm^3

(4) Facility-specific measurements of the following parameters may be substituted individually for the generic assumptions and still allow the facility to satisfy the categorical criteria in section 20120a(1)(a) to (e) of the act:

(a) Dry soil bulk density.

(b) Fraction of organic carbon in soil.

(c) Soil vapor permeability.

(d) Temperature adjustment factor for Henry's law constant.

Facility-specific measurements shall be based on representative characterization. documentation of all facility specific values shall be provided in the remedial action plan.

(5) The department may approve of methods to demonstrate compliance with criteria for this exposure pathway if those methods are more representative of in-situ conditions at the facility. Methods acceptable to the department may include, but are not limited to, evaluation of representative soil gas concentrations.

(6) A site-specific SVIIC may be developed for remedial action plans prepared pursuant to section 20120a(2) of the act that is based on demonstration of compliance with 1974 PA 154, MCL 408.1001 et seq. and the rules promulgated pursuant to that act. This subrule shall apply only when all of the following conditions are satisfied:

(a) The risk being evaluated results from inhalation by workers of hazardous substances in indoor air within an active workplace that is regulated by 1974 PA 154, MCL 408.1001 et seq. and the rules promulgated pursuant to that act.

(b) The exposure to hazardous substances from environmental contamination is a portion of the exposure to which workers are otherwise subject from process-related sources of the same hazardous substance.

(c) The risk to the non-worker population, if any, from inhalation of indoor air at the property has been evaluated using generic residential GVIIC or a site-specific evaluation has been conducted for the non-worker population according to methods acceptable to the department, and the risk is not unacceptable on the basis of the risk management objectives set forth in section 20120a of the act.

R 299.5725 Rescinded.

R 299.5726 Generic cleanup criteria for soil based on inhalation of hazardous substances in ambient air.

Rule 726. (1) Inhalation of hazardous substance emissions in ambient air from soil shall be considered a reasonable and relevant pathway for all facilities.

(2) Generic cleanup criteria for soil based on inhalation of volatile hazardous substance emission to ambient air shall be called volatile soil inhalation criteria (VSIC). Generic cleanup criteria for soil based on inhalation of particulate hazardous substance emission to ambient air shall be called particulate soil inhalation criteria (PSIC). The generic residential VSIC and PSIC are calculated as follows, except as provided in R 299.5734(3):

EQUATIONS FOR CARCINOGENS:

$$VSIC = \frac{TR \times AT}{IURF \times EF \times ED \times (1/VF)}$$

where,

VSIC	(Volatile soil inhalation criterion)	= chemical-specific, ug/kg or ppb
TR	(Target risk level)	= 10^{-5}
AT	(Averaging time)	= 25,550 days (70 years x 365 days/year)
IURF	(Inhalation unit risk factor)	= chemical-specific $(ug/m^3)^{-1}$
EF	(Exposure frequency)	= 350 days/year
ED	(Exposure duration)	= 30 years
VF	(Volatilization factor)	= chemical-specific, m^3/kg

and,

$$PSIC = \frac{TR \times AT}{IURF \times EF \times ED \times (1/PEF)}$$

where,

PSIC	(Particulate soil inhalation criterion)	= chemical-specific, ug/kg or ppb
TR	(Target risk level)	= 10^{-5}
AT	(Averaging time)	= 25,550 days (70 years x 365 days/year)
IURF	(Inhalation unit risk factor)	= chemical-specific $(ug/m^3)^{-1}$
EF	(Exposure frequency)	= 350 days/year
ED	(Exposure duration)	= 30 years
PEF	(Particulate emission factor)	= chemical-specific, m^3/kg

EQUATIONS FOR NONCARCINOGENS:

$$VSIC = \frac{THQ \times AT}{EF \times ED \times (1/ITSL \times 1/VF)}$$

where,

VSIC	(Volatile soil inhalation criterion)	=	chemical-specific, ug/kg or ppb
THQ	(Target hazard quotient)	=	1
AT	(Averaging time)	=	10,950 days (30 years x 365 days/year)
EF	(Exposure frequency)	=	350 days/year
ED	(Exposure duration)	=	30 years
ITSL	(Initial threshold screening level)	=	chemical-specific, ug/m^3
VF	(Volatilization factor)	=	chemical-specific, m^3/kg

and,

$$PSIC = \frac{THQ \times AT}{EF \times ED \times (1/ITSL \times 1/PEF)}$$

where,

PSIC	(Particulate soil inhalation criterion)	=	chemical-specific, ug/kg or ppb
THQ	(Target hazard quotient)	=	1
AT	(Averaging time)	=	10,950 days (30 years x 365 days/year)
EF	(Exposure frequency)	=	350 days/year
ED	(Exposure duration)	=	30 years
ITSL	(Initial threshold screening level)	=	chemical-specific, ug/m^3
PEF	(Particulate emission factor)	=	chemical-specific, m^3/kg

(3) The soil to air volatilization factor (VF) relates the concentration of a contaminant in the soil to the concentration of volatilized contaminant in the ambient air. If the vertical extent of the contaminant source has not been characterized, then the VF shall be calculated based on the infinite equation presented in subdivision (a) of this subrule. If the vertical extent of the contaminant source has been adequately characterized throughout the facility, then the VF shall be calculated either by the finite source equation presented in subdivision (b) of this subrule or the mass balance equation presented in subdivision (c) of this subrule, whichever yields the highest VSIC.

(a) $VF = (Q/C) \times (1/J_s^{ave})$

J_s^{ave}, using the infinite source model shall be calculated as follows:

$$J_s^{ave} = \rho_b (4D_A/\pi t)^{1/2} \times 10^4 \, cm^2/m^2$$

and D_A shall be calculated as:

$$D_A = \frac{[(\theta_a^{3.33} D_a (H' \times TAF) + \theta_w^{3.33} D_w)/n^2]}{\rho_b K_d + \theta_w + \theta_a (H' \times TAF)}$$

where,

VF	(Volatilization factor)	=	chemical-specific, m^3/kg
J_s^{ave}	(Normalized average flux from soil)	=	chemical-specific, g/m^2-second
D_A	(Apparent diffusivity)	=	chemical-specific, cm^2/second
Q/C	(Dispersion factor for 1/2 acre)	=	82.33, g/m^2-second per kg/m^3
t	(Exposure time)	=	seconds (ED x 3.1536E+7 seconds/yr)
θ_a	(Soil air-filled porosity)	=	0.28 L_{air}/L_{soil}
n	(Total soil porosity)	=	0.43 L_{pore}/L_{soil}
θ_w	(Soil water-filled porosity)	=	0.15 L_{water}/L_{soil}
ρ_b	(Dry soil bulk density)	=	1.5 g/cm^3
D_a	(Diffusivity in air)	=	chemical-specific, cm^2/second
D_w	(Diffusivity in water)	=	chemical-specific, cm^2/second
H′	(Dimensionless Henry's law constant, where H′ = HLC x 41)	=	chemical-specific, unitless
HLC	(Henry's law constant at 25^0 C)	=	chemical-specific, atm-m^3/mol
TAF	(Temperature adjustment factor)	=	0.5
K_d	(Soil-water partition coefficient)	=	chemical-specific, cm^3/g
	For organic compounds	=	K_{oc} (cm^3/g) x f_{oc} (g/g)
	For inorganic compounds	=	chemical-specific, cm^3/g
K_{oc}	(Soil organic carbon partition coefficient)	=	chemical-specific, cm^3/g
f_{oc}	(Organic carbon content of soil)	=	0.006 g/g (0.6%)

(b) The simplified finite source model equation for VF shall be calculated as follows:

$$VF = (Q/C) \times (C_0 / \rho_b) \times (1/J_s^{ave})$$

and,

$$J_s = C_o (D_A / \pi t)^{1/2} \left[1 - \exp\left(-d_s^2 / 4 D_A t\right)\right]$$

where,

VF	(Volatilization factor)	=	chemical-specific, m^3/kg
Q/C	(Dispersion factor for 1/2 acre)	=	82.33, g/m^2-second per kg/m^3
C_0	(Uniform contaminant concentration at t=0)	=	1.5 E-6 g/cm^3
ρ_b	(Dry soil bulk density)	=	1.5 g/cm^3
J_s^{ave}	(Normalized average flux from soil)	=	chemical-specific, g/m^2-second
J_s	(Instantaneous flux from soil at time t)	=	chemical-specific, g/m^2-second
D_A	(Apparent diffusivity - see equation above)	=	chemical-specific, cm^2/second
t	(Time)	=	seconds
d_s	(Thickness of source)	=	site-specific, meters
exp(p)	(The base of the natural logarithm raised to power (p))	=	e^p

(c) Mass balance VF shall be calculated as follows:

$$VF = (Q/C) \times \frac{AT \times (3.15 \times 10^{-7} \text{ seconds/year})}{\rho_b \times d_s \times 10^6 \text{ g/Mg}}$$

where,

VF	(Volatilization factor)	=	chemical-specific, m^3/kg
Q/C	(Dispersion factor for 1/2 acre)	=	82.33, g/m^2-second per kg/m^3
AT	(Exposure period)	=	scenario-specific, years
ρ_b	(Dry soil bulk density)	=	1.5 mg/m^3
d_s	(Average source depth)	=	site-specific, meters

(4) The particulate emission factor shall be calculated as follows:

$$PEF = (Q/C) \times 1/[(Ew \times (1 - V)) + Ev]$$

where,

PEF	(Particulate emission factor)	=	chemical-specific, m^3/kg
Q/C	(Dispersion factor for 1/2 acre)	=	82.33, g/m^2-second per kg/m^3
Ew	(Emission due to wind)	=	g/m^2 per second
Ev	(Emission due to vehicle traffic)	=	g/m^2 per second
V	(Vegetative cover)	=	0.5 (50%), unitless

(5) VSIC and PSIC for industrial/commercial facilities shall be calculated as follows, except as provided in R 299.5734(3):

EQUATIONS FOR CARCINOGENS:

$$VSIC = \frac{TR \times AT \times AIR}{IURF \times EF \times ED \times (1/VF)}$$

where,

VSIC	(Volatile soil inhalation criterion)	=	chemical-specific, ug/kg or ppb
TR	(Target risk level)	=	10^{-5}
AT	(Averaging time)	=	25,550 days (70 years x 365 days/year)
AIR	(Adjusted inhalation rate)	=	(20 m^3/day)/(10 m^3/day)
IURF	(Inhalation unit risk factor)	=	chemical-specific $(ug/m^3)^{-1}$
EF	(Exposure frequency)	=	245 days/year
ED	(Exposure duration)	=	21 years
VF	(Volatilization factor)	=	chemical-specific, m^3/kg

and,

$$PSIC = \frac{TR \times AT \times AIR}{IURF \times EF \times ED \times (1/PEF)}$$

where,

PSIC	(Particulate soil inhalation criterion)	=	chemical-specific, ug/kg or ppb
TR	(Target risk level)	=	10^{-5}
AT	(Averaging time)	=	25,550 days (70 years x 365 days/year)

AIR	(Adjusted inhalation rate)	= (20 m^3/day)/(10 m^3/day)
IURF	(Inhalation unit risk factor)	= chemical-specific (ug/m^3)$^{-1}$
EF	(Exposure frequency)	= 245 days/year
ED	(Exposure duration)	= 21 years
PEF	(Particulate emission factor)	= chemical-specific, m^3/kg

EQUATIONS FOR NONCARCINOGENS:

$$VSIC = \frac{THQ \times AT}{EF \times ED \times (1/ITSL \times 1/VF)}$$

where,

VSIC	(Volatile soil inhalation criterion)	= chemical-specific, ug/kg or ppb
THQ	(Target hazard quotient)	= 1
AT	(Averaging time)	= 7,665 days (21 years x 365 days/year)
EF	(Exposure frequency)	= 245 days/year
ED	(Exposure duration)	= 21 years
ITSL	(Initial threshold screening level)	= chemical-specific, ug/m^3
VF	(Volatilization factor)	= chemical-specific, m^3/kg

and,

$$PSIC = \frac{THQ \times AT}{EF \times ED \times (1/ITSL \times 1/PEF)}$$

where,

PSIC	(Particulate soil inhalation criterion)	= chemical-specific, ug/kg or ppb
THQ	(Target hazard quotient)	= 1
AT	(Averaging time)	= 7,665 days (21 years x 365 days/year)
EF	(Exposure frequency)	= 245 days/year
ED	(Exposure duration)	= 21 years
ITSL	(Initial threshold screening level)	= chemical-specific, ug/m^3
PEF	(Particulate emission factor)	= chemical-specific, m^3/kg

(6) The generic SIC are calculated for a source area size of 1/2 acre. The generic SIC shall be adjusted for other source area sizes by multiplying the generic SIC by the modifiers given in the following table. Where the actual source area size falls between the sizes given in this subrule, generic SIC shall be multiplied by the modifier for the next largest source size.

Modifiers		
Source Size (ft^2 or acres)	Q/C (g/m^2-s per kg/m^3)	Modifier
400 ft^2	261.26	3.17
1000 ft^2	180.76	2.2
2000 ft^2	144.91	1.76
¼ acre	94.56	1.15
½ acre	82.33	1
1 acre	71.74	0.87
2 acres	63.51	0.77
5 acres	54.62	0.66
10 acres	49.13	0.6
32 acres	41.55	0.5
100 acres	35.66	0.43

(7) Facility-specific measurements of the following parameters may be substituted for the generic assumptions and still allow the facility to satisfy the categorical criteria in section 20120a(1)(a) to (e) of the act:

(a) Dry soil bulk density (ρ_b).

(b) Soil water-filled porosity (θ_w).

(c) Soil air-filled porosity (θ_a).

(d) Fraction of organic carbon in soil (f_{oc}).

(e) Emission due to wind (Ew).

(f) Dispersion factor (Q/C).

Facility-specific measurements shall be based on representative characterization. Documentation of all facility-specific values shall be provided in the remedial action plan or other response activity documentation.

(8) A person who is implementing response activity may demonstrate compliance with the generic criteria developed under this rule through the collection and analysis of ambient air samples within the facility boundaries, if the hazardous substance concentration in surficial soil is representative of facility conditions.

R 299.5727 Rescinded.

R 299.5728 Cleanup criteria for contaminated environmental media based on other injury which requires consideration.

Rule 728. (1) To assure that hazardous substances in contaminated environmental media do not pose unacceptable risks not accounted for by other rules in this part, the concentration of a hazardous substance in a given environmental medium shall meet cleanup criteria based on sound scientific principles and determined by the department to be necessary to protect the public health, safety, and welfare and the environment from any of the following:

(a) Food chain contamination.

(b) Damage to soil or biota in the soil that impairs the use of such soil for agricultural purposes.

(c) Phytotoxicity.

(d) Physical hazards.

(e) Nonsystemic or acute toxicity.

(f) Injury that may result from the direct transport or runoff of hazardous substances in soil into surface water.

(g) Injury to the groundwater resource which may impair its use for other purposes that are determined by the department to be reasonable and relevant considerations at a facility.

(h) Other injury that requires consideration.

(2) The basis for, and information used by the department to develop, cleanup criteria under this rule shall be made available to the public upon request.

R 299.5730 Cleanup criteria for surface water and surface water sediments.

Rule 730. (1) Any remedial action plan that addresses surface water or sediments associated with waters of the state shall include site-specific cleanup criteria established by the department on the basis of sound scientific principles and evaluation of bulk sediment chemistry, sediment toxicity and benthic community populations. Criteria shall be established considering the need to eliminate or mitigate the following use impairments, as appropriate to the facility in question:

(a) Restrictions on fish or wildlife consumption.

(b) Tainting of fish and wildlife flavor.

(c) Degraded fish or wildlife populations.

(d) Fish tumors or other deformities.

(e) Bird or animal deformities or reproductive problems.

(f) Degradation of benthos.

(g) Restrictions on dredging activities.

(h) Eutrophication or undesirable algae.

(i) Restrictions on drinking water consumption or taste or odor problems.

(j) Beach closings.

(k) Degradation of aesthetics.

(l) Added costs to agriculture, industry, or a local unit of government.

(m) Degradation of phytoplankton or zooplankton populations.

(n) Loss of fish and wildlife habitat.

(o) Unacceptable risk through human contact as a result of absorption of hazardous substances through the skin or by incidental ingestion of sediments.

(p) Other unacceptable risks to human receptors exposed to hazardous substances in sediments.

(2) The basis for, and information used by the department to develop, cleanup criteria under this rule shall be made available to the public upon request.

R 299.5732 Limited category and site-specific cleanup criteria generally; use of occupational health standards as limited or site-specific cleanup criteria under section 20120a of the act.

Rule 732. (1) A remedial action plan which relies on cleanup criteria other than the generic cleanup criteria provided for in section 20120a(1)(a) to (e) of the act and these rules shall be based on either limited category cleanup criteria or on site-specific cleanup criteria that are documented in a remedial action plan. It is the responsibility of the person proposing the plan to adequately document the basis for limited or site-specific cleanup criteria in any remedial action plan.

(2) Limited or site-specific cleanup criteria may be based on reliable exposure control measures, including work schedule limitations and personal protective equipment used by workers at a facility to prevent exposure to hazardous substances. The specific exposure control measures shall be described in the remedial action plan and the land or resource use restriction document for the facility, including an explanation of how the measures will reliably and effectively reduce risk to the allowable levels set forth in section 20120a of the act. The remedial action plan shall also provide for appropriate monitoring of the use of exposure control measures, if appropriate.

(3) If the exposure control measures called for in a remedial action plan are based on measures used to assure compliance with 1974 PA 154, MCL 408.1001 et seq. and known as the occupational safety and health act, and the rules promulgated under that act, then that remedial action plan complies with part 201 of the act only if the level of risk reduction achieved is consistent with the requirements of section 20120a of the act. Such remedial action plans shall be either limited or site-specific remedial action plans under the provisions of section 20120a(1)(f) to (j) or (2) of the act.

(4) A site-specific cleanup criterion under section 20120a(2) of the act and subrule (3) of this rule that is based on demonstration of compliance with 1974 PA 154, MCL 408.1001 et seq. And the rules promulgated pursuant to that act shall be allowed only when the risk to the non-worker population, if any, at the facility has been evaluated using generic residential cleanup criteria or a site-specific evaluation has been conducted for the non-worker population according to methods acceptable to the department, and the risk is not unacceptable on the basis of the risk management objectives set forth in section 20120a of the act.

R 299.5734 Special considerations for risk assessment and development of cleanup criteria for certain substances.

Rule 734. (1) All polychlorinated and polybrominated dibenzodioxins and dibenzofurans shall be considered as 1 hazardous substance, expressed as an equivalent concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin, based upon the relative potency and concentration of the congeners present at the facility.

(2) If 2 or more hazardous substances are present and known to result in toxicological interaction, then the interactive effects shall be considered in

establishing levels that are protective of the public health, safety, and welfare and the environment.

(3) The department may calculate generic cleanup criteria for certain hazardous substances using exposure assumptions other than those shown in the algorithms in part 7 of these rules if either of the following conditions is satisfied:

(a) A hazardous substance causes an adverse effect in a sensitive subpopulation that is not adequately protected or represented by the generic exposure assumptions.

(b) The toxicokinetics of a hazardous substance are not best represented by the average daily dose, when accounting for the most sensitive effect.

R 299.5736 Minimum toxicity data for calculation of criteria based on noncarcinogenic endpoints.

Rule 736. (1) The minimum data required to calculate a cleanup criterion for a noncarcinogen when the route of exposure is ingestion or dermal absorption shall be the reference dose that is determined on the basis of the best available information and considering the weight of evidence.

(2) The minimum data required to calculate a cleanup criterion for a noncarcinogen when the route of exposure is inhalation shall be the minimum data required for calculation of an initial threshold screening level developed under part 55 of the act, and rules promulgated under part 55.

R 299.5738 Determination of cancer slope factors for use in calculation of criteria based on carcinogenic endpoints.

Rule 738. (1) A non-threshold mechanism of carcinogenesis shall be assumed unless biological data adequately demonstrate the existence of a threshold on a hazardous substance-specific basis.

(2) All appropriate human epidemiologic data, animal cancer bioassay data, and all other pertinent data shall be considered and a cancer slope factor developed if the weight of evidence for carcinogenicity is sufficient. Preferred data are those from studies which use the same route of exposure addressed by the criteria. However, in the absence of such data, route-to-route extrapolations may be conducted where appropriate, considering whether the critical effect is systemic and thus possible for each different route of exposure. The risk-associated dose shall be set at a level corresponding to an increased cancer risk of 1 in 100,000. If acceptable human epidemiologic data are available for a hazardous substance, then those data shall be used to derive the risk-associated dose. If acceptable human epidemiologic data are not available, then the risk-associated dose shall be derived from available animal bioassay data. Data from a species that is considered most biologically relevant to humans, that is, responds most like humans, is preferred where all other considerations regarding quality of data are equal. In the absence of data to distinguish the most relevant species, data from the most sensitive species tested,

that is the species showing a carcinogenic effect at the lowest administered dose, shall generally be used.

(3) If animal bioassay data are used and a non-threshold mechanism of carcinogenicity is assumed, then the data shall be fitted to a linearized multistage model, for example, a Global ‘86 or equivalent computer model. Global ‘86 is the linearized multistage model that was derived by Howe, Crump, and Van Landingham (1986), which was prepared for the United States environmental protection agency under subcontract 2-251u-2745 to Research Triangle Institute, contract 68-01-6826, and which the United States environmental protection agency uses to determine cancer potencies. The upper-bound 95% confidence limit on risk, or the lower 95% confidence limit on dose, at the 1 in 100,000 risk level shall be used to calculate a risk-associated dose for individual hazardous substances. Other models, including modifications or variations of the linearized multistage model that are more appropriate to the available data may be used where scientifically justified.

(4) If the duration of the study is significantly less than the natural lifespan of the test animal, then the slope factor may be adjusted on a case-by-case basis to compensate for latent tumors that were not expressed. The lifespan of a rat is assumed to be 104 weeks and the lifespan of a mouse is assumed to be 90 weeks. If the test animal is a rat and the study duration is less than 90 weeks, or if the test animal is a mouse and the study duration is less than 78 weeks, then the slope factor shall be multiplied by the following factor: the expected lifespan (L) divided by the study duration (L_e) raised to the third power, $[(L/L_e)^3]$.

(5) A species scaling factor shall be used to account for differences between test species and humans. It shall be assumed that scaling daily administered doses by body mass raised to the 3/4 power achieves equivalence in lifetime carcinogenic risk in different mammalian species. To derive a human slope factor from animal data, the default procedure shall be to multiply the animal slope factor by the ratio of human to animal body weights raised to the 1/4 power. However, if adequate pharmacokinetic and metabolism studies are available, then these data may be factored into the adjustment for species differences on a case-by-case basis.

(6) Additional adjustments shall be made to the data as appropriate. For some cancer data sets, it may be appropriate to combine incidences of multiple tumor types or combine benign and malignant tumors of the same histogenic origin. All doses shall be adjusted to give an average daily dose over the study duration. Adjustments shall be made to the tumor incidence for early mortality. Animals dying before the appearance of the first tumor within their dose group shall be removed from the data set. Before quantification of the dose response, a goodness-of-fit evaluation of the data shall be conducted.

(7) If human epidemiologic data, animal bioassay data, or other biological data indicate that a chemical causes cancer via a threshold mechanism, then the risk-associated dose may, on a case-by-case basis, be calculated using a method that assumes a threshold mechanism is operative.

(8) Inhalation unit risk factors shall be calculated in the same manner as cancer risk screening levels for inhalation risk under part 55 of the act.

R 299.5740 Availability of information used by department to establish cleanup criteria; public review and comment on revised criteria.

Rule 740. (1) The department shall make available to the public the detailed basis for calculation of any cleanup criterion established under these rules, including the references for original studies, papers, or other sources of information that were used or considered. Requests for information under this rule shall specify the hazardous substance and exposure pathways for which information is desired.

(2) Any proposed change to a criterion shall be published by the department and subject to review and comment as part of the rule-making process.

R 299.5742 Evaluation of data to establish compliance with criteria.

Rule 742. (1) If the criterion in question is below the practical quantitation level, then the following procedure shall be used to determine whether available data demonstrate compliance with the criterion:

(a) If a hazardous substance is not detected in a sample at or below the target detection limit and the target detection limit is higher than the criteria to be achieved for that substance, then the criteria shall be considered to have been achieved.

(b) If a hazardous substance is reported to be present in a sample above the target detection limit, but below the practical quantitation level, then the significance of that data shall be determined by a method acceptable to the department, considering the number of samples, the distribution of data, and other factors influencing the selection of a statistical method.