

CHAPTER 133
RULES FOR DETERMINING AND RESPONDING TO
CONDITIONS WARRANTING REMEDIAL ACTIONS
BY RESPONSIBLE PARTIES

567—133.1(455B,455E) Authority, purpose and scope.

133.1(1) Authority: This chapter is adopted under the authority of Iowa Code Supplement chapter 455B, division IV, part 4 and chapter 455E.

133.1(2) Purpose: The purpose of this chapter is to establish criteria for conditions that warrant remedial action resulting from the release of a hazardous substance that is within the scope of this chapter, determine the parties responsible for such conditions, and prescribe response actions by the responsible party or parties. The chapter primarily prescribes remedial provisions involving environmental contamination, not preventative provisions.

This chapter is intended to address current conditions and conditions reasonably anticipated to occur in the foreseeable future. Absent comprehensive requirements for proactively identifying contamination, some determinations under this chapter will necessarily be based on limited information. A determination that a response action is not required under this chapter is subject to change due to new information, changes to code or rules, or unanticipated change in site conditions. Parties desiring a more definitive determination may enroll in the Iowa Land Recycling Program per 567—Chapter 137.

133.1(3) Scope. This chapter is applicable to situations involving releases that are not under the jurisdiction of another regulatory program. As such, this chapter does not apply to the initial response to a release under the purview of 567—Chapter 131. However, this chapter may apply to any condition that exists upon completion of actions required under 567—Chapter 131. This chapter does not apply to contamination resulting from a permitted discharge or an allowed practice under any other chapter of the Iowa Administrative Code unless specifically provided for in rule. This chapter also does not apply to contamination that is actively regulated by a federal program such as the Resource Conservation and Recovery Act; the Occupation Safety and Health Administration; and the Comprehensive Environmental Response, Compensation and Liability Act. This chapter is applicable to contamination associated with all environmental media. In situations where a viable party who contributes to contamination has not been identified, this chapter affords no means for providing response actions to address the contamination other than limited use of the hazardous substance remedial fund at the department's discretion.

133.1(4) Dispute resolution. This chapter provides objective means for determining when remedial action is required and when it has been successfully completed. However, due to the diversity of situations that fall under the purview of this chapter, the use of professional judgment by the department is also recognized as being necessary. The department shall provide the rationale for all decisions under this chapter, including a written narrative explanation of all discretionary decisions. Persons subject to these rules may challenge a decision by the department under this chapter by submitting a written response to the department or seeking a

meeting with the department. If resolution to a dispute cannot be negotiated, persons subject to these rules retain all applicable appeal rights provided in Iowa Code chapter 455B.

567—133.2 (455B,455E) Definitions.

“*Background standard*” means the concentration of a contaminant that is naturally occurring or is generally present in an environmental medium, and is not related to a readily identifiable release. A site-specific background standard may be established in accordance with 567—137.4(455B, 455H). A universal background standard may be established by the department using generally available information. A universal background standard is applicable anywhere in the state.

“*Condition warranting remedial action*” means a hazardous condition under Iowa Code Supplement chapter 455B, division IV, part 4, or a significant risk to human health and the environment under Iowa Code Supplement chapter 455E, for which response action by a viable party is required.

“*Contaminant*” means a hazardous substance associated with a release, including a *contaminant* as defined in Iowa Code Supplement section 455E.2(2).

“*Contaminant of concern*” means a contaminant that has been detected at a concentration in excess of its practical quantification limit and a background standard, if any, and to which human or ecological exposure is occurring or is likely in the foreseeable future.

“*Contamination*” means a situation where one or more contaminant of concern exists in one or more environmental medium causing a condition warranting remedial action or an indeterminate condition.

“*Enclosed space*” means an enclosed or partially enclosed area potentially occupied by humans in which contaminants in air may accumulate. Examples of enclosed spaces are buildings in which people live or work and excavations where a person may work. Confined spaces defined in 29 CFR 1910.146 are enclosed spaces.

“*Evidence of contamination*” means information that indicates a condition warranting remedial action or an indeterminate condition exists.

“*Environmental medium*” means drinking water, groundwater, surface water, soil, sediment, or air.

“*Exposure point concentration*” means the concentration of a contaminant of concern in an environmental medium at a location of exposure to that environmental medium.

“*Fate and transport modeling*” means numerical methods for predicting future exposure point concentrations such as described in 567—subrule 137.9(4).

“*Finished drinking water*” means water from a public or private drinking-water supply as it is furnished to the user.

“*Foreseeable future*” means the period of time over which use of land and water resources are planned or are anticipated based on current information.

“*Hazardous substance*” means a substance as defined in Iowa Code Supplement section 455B.381(5).

“*Hazardous substance remedial fund*” means the fund established in Iowa Code Supplement section 455B.423.

“*Hazard quotient*” means the ratio of the dose of a contaminant of concern from a known or estimated exposure to what is considered a safe dose.

“*Immediate and substantial threat to human health or the environment*” means a situation requiring prompt action to prevent a significant harm to a person or the environment that is occurring or imminent. Situations that will be considered to pose a possible immediate and substantial threat to human health or the environment under this chapter, subject to the department’s review, include but are not limited to:

1. The existence of contaminants of concern in drinking water per subrule 133.3(1).
2. An ongoing release per subrule 133.3(6).
3. An explosive condition per subrule 133.3(7).
4. An imminent failure of a structure containing a hazardous substance per subrule 133.3(9).

“*Impacted area*” means the area of contamination in a specific medium as it currently exists and is predicted to exist in the foreseeable future.

“*Indeterminate condition*” means a situation where there is evidence of a release, but insufficient information exists to confirm or refute the existence of a condition warranting remedial action.

“*Institutional control*” means a land-use restriction or a non-physical action that prevents a potentially unsafe exposure to contaminants of concern in the foreseeable future.

“*Iowa Land Recycling Program*” means the voluntary cleanup program established in Iowa Code Supplement chapter 455H and administered under the rules in 567—Chapter 137.

“*Location of exposure*” means the location in an environmental medium where the exposure to one or more contaminant of concern from a site is reasonably expected and poses the largest risk.

“*Mass discharge*” means the mass of a contaminant in a groundwater contaminant plume that passes through a plane perpendicular to the direction of groundwater flow over a given period of time. Mass discharge can be determined using contaminant concentrations and the pumping rate of a well that captures an entire contaminant plume or using the area and average contaminant concentration of a plume perpendicular to the groundwater flow and measured

hydraulic properties of the geologic formation in which the plume is moving. Mass discharge, in units of mass/day (e.g., mg/day), divided by the actual or predicted pumping rate (e.g., L/day) of a potentially impacted drinking-water well yields the contaminant concentration in water (e.g., mg/L) from the potentially impacted drinking water well. Mass discharge divided by stream flow rate yields the concentration of the contaminant that may result from the groundwater plume discharging to the stream.

“*MCL*” means the legally enforceable maximum contaminant level for a contaminant in public water supply per 567—Chapter 41.

“*Medium*” (see *environmental medium*)

“*No further action condition*” means situation where there is no evidence of a release or there is evidence of a release and the department requires no additional response action. A *no further action condition* determination by the department is subject to change based on new information, a change in conditions, or a change in regulations.

“*Nonprotected groundwater source*” means a saturated bed, formation, or group of formations that is not a protected groundwater source.

“*Nonresidential area*” means an area that is not a residential area.

“*Normal groundwater table*” means the elevation below the ground surface that is saturated with groundwater during normal climatological conditions, i.e., not during extended periods of excess or shortage of precipitation. This is not intended to be a precise value and its determination will rely largely on professional judgment.

“*Off-site*” refers to property impacted by a contaminant of concern that did not originate from the property.

“*On-site*” refers to property impacted by a contaminant of concern that originated from that property.

“*Practical quantification limit*” means the lowest concentration that can be measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions. The practical quantification limit is a laboratory-specific value.

“*Protected groundwater source*” means a saturated bed, formation, or group of formations which has a hydraulic conductivity of at least 0.44 meters per day and a total dissolved solids concentration of less than 2,500 milligrams per liter or is currently used or likely to be used as a source for water supply in the vicinity. This term is intended to apply to geologic formations that have the potential to be used locally as sources of drinking water and are likely to be used as such.

“*Release*” means the introduction of a contaminant into an environmental medium as defined in Iowa Code Supplement section 455B.381(9).

“*Remedial action*” means action taken to eliminate a condition warranting remedial action. Such action may include measures that permanently remove contaminants from a site, institutional controls, technological controls, or combination thereof.

“*Residential area*” means an area where frequent, long-term, close contact with soils or indoor air occurs or is likely to occur in the foreseeable future, including areas where people have permanent residence or children are likely to play on a regular basis.

“*Response action*” means the investigative or remedial actions used to respond to an indeterminate condition or a condition warranting remedial action.

“*Responsible party*” means a person having control over a hazardous substance per Iowa Code Supplement subsection 455B.381(7). A person who exacerbates a condition warranting remedial action, without notifying the department per 567—Chapter 131 upon its discovery and taking response action approved by the department, is also a responsible party.

“*Route of exposure*” means the path by which human exposure to a contaminant occurs, i.e., oral ingestion, dermal absorption, or inhalation.

“*Site*” means real property where contamination exists.

“*Source water protection zone*” means an area where groundwater is drawn into a public water supply well as designated by the department based on an estimated 10-year capture zone plus surface drainage into that area.

“*Statewide standard*” means a standard for soil or groundwater as prescribed in 567—137.5(455H).

“*Synthetic organic compound (SOC)*” means an organic contaminant of anthropogenic origin.

“*Target organ*” means an organ or system of the human body (e.g., liver, respiratory system) that may be adversely affected by a contaminant. The department will assign target organs to contaminants of concern pursuant to 567— paragraph 137.5(3)“c”.

“*Technological control*” means a physical action, barrier or condition that prevents exposure to contaminants thereby preventing a condition warranting remedial action. A technological control may limit migration of contaminants or prevent access to areas with contamination, but is not intended to eliminate the source of contaminants in the foreseeable future.

“*Vapor intrusion*” means the migration of vapors from VOCs in subsurface soil or groundwater to an enclosed space where exposure to humans may occur.

“*Viable party*” means a responsible party who has adequate resources to conduct necessary response actions. Determination of viability will be made in general conformance with relevant portions of 567—135.17(455B).

“*VOC*” means a volatile organic contaminant that has a unitless Henry’s Law coefficient greater than 4×10^{-4} at standard temperature and pressure.

567—133.3(455B,455E) Conditions warranting remedial action.

The following subrules define situations that constitute a condition warranting remedial action when due to a release under the scope of this chapter.

133.3(1) *Contaminants in drinking water.* A contaminant of concern that is an SOC in finished drinking water in excess of the larger of 10 percent above its background standard or 10 percent of its statewide standard for a protected groundwater source is a condition warranting remedial action, unless the affected water supply notifies the department that it accepts a greater concentration not to exceed the statewide standard for a protected groundwater source. A non-SOC contaminant of concern in finished drinking water in excess of its statewide standard for a protected groundwater source is a condition warranting remedial action.

133.3(2) *Exceedence of a surface water standard.* The existence of a contaminant of concern in surface water in excess of its applicable water quality standard per 567—subrule 61.3(3) is a condition warranting remedial action.

133.3(3) *Lead in soil.* A condition warranting remedial action exists when an exposure point concentration per subparagraph 133.11(5)“b”(2) for a compliance human health risk assessment of lead in soil not covered by a building or pavement at a concentration greater than:

- a. 400 mg/kg in the top three inches of soil in residential areas.
- b. 1,200 mg/kg in the top three inches of soil in a nonresidential area.
- c. 1,200 mg/kg in soil three inches to two feet deep in a residential area.
- d. 2,000 mg/kg is in soil three inches to one foot deep in a nonresidential area.
- e. 6,000 mg/kg in soil two feet deep to the normal groundwater table in a residential area and soil one foot deep to the normal groundwater table in a nonresidential area.

133.3(4) *Failure of a human-health compliance risk assessment.* The existence of one or more contaminant of concern that causes an unacceptable risk to human health based on a human health risk assessment conducted in the compliance mode in accordance with rule 133.11(455B,455E) is a condition warranting remedial action. This is the primary mechanism by which direct exposure to contaminants in soil (other than solely lead-related) and vapor intrusion are addressed. A human health risk assessment shall include exposure to contaminants in drinking water only when exposure to contaminants via at least one other medium is possible.

133.3(5) *Acute risk to human health.* The existence of one or more contaminant of concern in a single sample of soil to which exposure is reasonably possible that poses an unacceptable acute risk per subrule 133.11(7) is a condition warranting remedial action.

133.3(6) *Ongoing release.* The existence of a continuing release of contaminants that can be reasonably ceased, such as from a leaking tank or pipeline or buried waste, is a condition warranting remedial action even if the release does not otherwise create a condition warranting remedial action.

133.3(7) *Explosive condition.* The existence of one or more contaminant of concern in air that results in more than 10 percent of the lower explosive limit in an enclosed space, subsurface structure, conduit or excavation is a condition warranting remedial action.

133.3(8) *Ecological risk.* The existence of one or more contaminant of concern that causes an unacceptable risk to the environment based on a site-specific ecological risk assessment per subparagraph 133.8 (1) is a condition warranting remedial action.

133.3(9) *Impending risk.* A situation that does not currently pose a condition warranting remedial action per subrules 133.3(1)-(8), but is predicted by the department to become such a condition in the foreseeable future, is a condition warranting remedial action. Situations involving the prediction of contaminant migration will be considered to be an indeterminate condition until there is a high level of confidence in the prediction that a condition warranting remedial action exists. The department shall provide a narrative explanation—supported with calculations when appropriate—of the rationale used to classify a situation as being an impending risk. Examples of situations where this may occur include, but are not limited to:

- a. A contaminant of concern in groundwater that is migrating toward a drinking water well.
- b. A contaminant of concern in groundwater that is migrating toward a surface water.
- c. A contaminant of concern in soil in a nonresidential area where a change to residential land use is planned.
- d. A contaminant of concern that is a VOC in soil, groundwater, or soil vapor posing a vapor intrusion threat in an area where a building is planned.
- e. A contaminant of concern that is a VOC in soil, groundwater, or soil vapor posing a worker-exposure threat from inhalation during subsurface construction activities that are likely to occur in the area in the foreseeable future (e.g., utility work).
- f. A contaminant of concern that is a VOC in soil or groundwater posing a threat of water-line permeation in an area where a water line is planned.
- g. Failure of a structure containing a hazardous substance is imminent (e.g., buried drums or a structurally unsound above-ground storage tank).
- h. A contaminant of concern detected in the subsurface as a non-aqueous phase liquid (NAPL) that has potential to migrate as a NAPL and create an unacceptable risk to human health or the environment.
- i. Bulk amounts of a hazardous substance that were buried illegally or prior to the existence of applicable regulations.

567—133.4(455B,455E) Indeterminate condition.

The following subrules specify situations that constitute an indeterminate condition when due to a release under the scope of this chapter. The criteria under this rule do not apply when sufficient information exists to demonstrate that a condition warranting remedial action per rule 133.3(455B,455E) or subrule 133.9(9) does not exist. Subrules 133.4(4), (5), (6), (8), (9) and (11) prescribe means of estimating contaminant concentration in one medium based on migration

of the contaminant from another medium in which a measured concentration exists. In such situations, a contaminant concentration in a sample of the receiving medium, which has been collected along the expected path of contaminant migration, will take precedence over the estimated concentration. An indeterminate condition under this subrule will be based on the applicable exposed individual as prescribed in paragraph 133.11(4)“a”. If there is uncertainty as to who is whether the applicable exposed individual is a resident or a nonresident, a resident will be assumed. . The department will address an indeterminate condition in accordance with rule 133.8(455B, 455E).

133.4(1) *SOC contaminants in a drinking water supply.* The detection of any contaminant that is an SOC in a drinking water supply (before or after treatment) that is not an artifact of treatment is an indeterminate condition.

133.4(2) *High levels of contaminants in groundwater.* A contaminant identified in groundwater at a concentration more than 100 times greater than its applicable statewide standard is an indeterminate condition.

133.4(3) *Potential impact of groundwater contaminant on existing or planned drinking water well.* An indeterminate condition exists when a contaminant is found above its applicable statewide standard in groundwater from an aquifer that is a source of water for an existing or planned drinking water well, or from the geologic formation directly overlying the aquifer, if the groundwater is within:

- a. the source water protection zone for a public water supply,
- b. 1,000 feet of a planned public water supply well or public water supply well not included in a source water protection zone designated by the department, or
- c. 400 feet of an existing or planned private drinking water well.

133.4(4) *Potential impact of groundwater contaminant on possible new private well.* An indeterminate condition exists when a contaminant is found in groundwater in excess of its appropriate statewide standard within 400 feet of a location where a new private drinking water well is reasonably possible. A new private drinking water well will *not* be considered to be reasonably possible if conditions described in one of the following subparagraphs are satisfied:

- a. An institutional control prohibits installation of a private drinking water well within 400 feet of the location where the contaminant has been found. Forms of institutional controls that may accomplish this are listed in subrule 133.10(1).
- b. A public water supply is readily available and installation of a new private drinking water well within 400 feet of the location where the contaminant has been found is unlikely due to one of the following conditions:
 - 1) all properties within 400 feet of the location where the contaminant has been found are already connected to the public water supply for drinking water;
 - 2) the affected groundwater formation is not used for drinking-water wells in the vicinity;
 - 3) the cost (without contamination) of installation and operation of a private well in the affected groundwater formation would be substantially higher than the costs associated with a connection to the public water supply.
- c. A non-affected public water supply is not readily available, but no demand for use of groundwater is anticipated in the foreseeable future within 400 feet of the location where

the contaminant has been found (e.g., the impacted area is in a remote location, undeveloped area, or floodplain; a better, non-affected aquifer exists in the vicinity).

133.4(5) *Potential impact of groundwater contaminant on a water line.* Groundwater containing a VOC contaminant in excess of its statewide standard for a nonprotected groundwater source that is or may be located within 50 feet of an actual or planned water line is an indeterminate condition due to potential permeation of contaminants into the water line.

133.4(6) *Potential impact of a groundwater contaminant on surface water.* An indeterminate condition may exist when groundwater containing a contaminant may discharge to a surface water, which has a designated use per subrule 567—61.3(1), and cause an exceedence in the surface water of an applicable water quality standard per 567—subrule 61.3(3). Such a determination may be made based on the assumption that groundwater containing a contaminant will discharge to the nearest surface water with a designated use per subrule 567—61.3(1). It will further be assumed that the resulting concentration of a contaminant in the surface water will be the maximum concentration found in groundwater times the area of the contaminant plume in square miles divided by the drainage area in square miles of the designated surface water at location where groundwater discharge is expected. Absent site-specific information, a groundwater plume will be assumed to comprise 1 square mile.

133.4(7) *Lead in soil.* An indeterminate condition exists when lead found in soil not covered by a building or pavement is greater than:

- a. 400 mg/kg in the top three inches of soil in residential areas.
- b. 1,200 mg/kg in the top three inches of soil in a nonresidential area.
- c. 1,200 mg/kg in soil three inches to two feet deep in a residential area.
- d. 2,000 mg/kg is in soil three inches to one foot deep in a nonresidential area.
- e. 6,000 mg/kg in soil two feet deep to the normal groundwater table in a residential area or soil one foot deep to the normal groundwater table in a nonresidential area.

133.4(8) *Potential impact of soil contaminant on groundwater.* A contaminant found in soil at a concentration that may leach to groundwater and cause a concentration in groundwater greater than its statewide standard for nonprotected groundwater is an indeterminate condition. Formula I may be used to estimate the contaminant concentration in groundwater as a result of leaching from soil. Site-specific values for the factors used in Formula I may be used in lieu of default values when available.

(Formula I)

$$C_{gw} = C_{sl} \times \rho_s \div [(\theta_{ws} + K_d \times \rho_s + H' \times \theta_{as}) \times (1 + \{K \times i \times \delta \div I \div W\})]$$

Where:

C_{gw} = Estimated contaminant concentration in groundwater (mg/L).

C_{sl} = Highest measured contaminant concentration in soil (mg/kg).

θ_{ws} = Water filled soil porosity (unitless). Default value = 0.1

K_d = Soil-water partition coefficient (L/kg) for inorganic chemicals or $K_{oc} \times f_{oc}$ for organic chemicals. Chemical-specific value.

K_{oc} = Soil organic carbon/water partitioning coefficient (L/kg). Chemical-specific value.

f_{oc} = Fraction organic carbon in soil (unitless). Default value = 0.01
 H' = Henry's law constant at 55° F (dimensionless). Chemical-specific value.
 θ_{as} = Air filled soil porosity (unitless). Default value = 0.2
 K = Aquifer hydraulic conductivity (cm/year). Default value = 16,060 cm/year
 i = Groundwater head gradient (unitless). Default value = 0.01
 δ = Groundwater mixing zone thickness (cm). Default value = 200 cm
 I = Infiltration rate of water through soil (cm/year). Default value = 7 cm/year
 W = Width of soil source parallel to groundwater flow direction (cm). Default value = 1500 cm
 ρ_s = Soil bulk density (g/cm³). Default value = 1.86 g/cm³

133.4(9) *Potential impact of soil contaminant on a water line.* A VOC in soil found within 50 feet of an actual or planned drinking-water line at a concentration that would exceed the soil to groundwater criterion using Formula I in subrule 133.4(8) is an indeterminate condition.

133.4(10) *Direct contact with a contaminant in soil.* The detection of a contaminant in soil in excess of the larger of its statewide standard or a concentration that causes a combined oral plus dermal hazard quotient greater than 0.4 or a combined oral plus dermal cancer risk greater than 4×10^{-5} is an indeterminate condition. Contaminant-specific hazard quotients and cancer risks may be calculated for each applicable potentially exposed individual per paragraph 133.11(4)“a” and each applicable soil depth category per subparagraph 133.11(4)“b”(2). Calculation of hazard quotients and cancer risks are based on exposure point concentrations at a locations of exposure as prescribed in paragraph 133.11(5)“b” and formulae prescribed in subrule 133.11(2).

133.4(11) *Contaminants in air in an enclosed space.* The detection of a VOC in air from an enclosed space that causes a hazard quotient greater than 0.4 or a cancer risk greater than 4×10^{-5} , determined in accordance with subrule 133.11(2) for each potentially exposed individual per paragraph 133.11(4)“a”, is an indeterminate condition action. Calculation of hazard quotients and cancer risks shall be based on exposure point concentrations at a locations of exposure as prescribed in paragraph 133.11(5)“c” and formulae prescribed in subrule 133.11(2).

If an air sample has not been collected from a location of exposure per subparagraph 133.11(5)“c”(1) and analyzed for a VOC, but the VOC has been detected in a sample of soil vapor, groundwater, or soil within 100 feet of the location of exposure, an indeterminate may exist as determined by the following paragraphs. The formulae specified in the following paragraphs are from subparagraph 133.11(5)“c”(2).

a. *Soil vapor.* The detection of a VOC in a soil vapor sample that yields an indoor air concentration (calculated using Formula VIII) that causes a hazard quotient greater than 0.4 (calculated using Formula IV) or a cancer risk greater than 4×10^{-5} (calculated using Formula VII) is an indeterminate condition.

b. *Groundwater derived contaminants.* The detection of a VOC in a groundwater sample that yields an indoor air concentration (calculated using Formula IX) that causes a hazard quotient greater than 0.4 (calculated using Formula IV) or a cancer risk greater than 4×10^{-5} (calculated using Formula VII) is an indeterminate condition.

c. *Soil derived contaminants.* The detection of a VOC in a soil sample that yields an indoor air concentration (calculated using Formula X) that causes a hazard quotient greater than 0.4 (calculated using Formula IV) or a cancer risk greater than 4×10^{-5} (calculated using Formula VII) is an indeterminate condition.

133.4(12) *Screening cumulative risk assessment.* In lieu of basing an indeterminate condition on medium-specific criteria for exposure to contaminants in soil and vapors as prescribed in subrules 567—133.4(10) & (11), an indeterminate condition may be based on a screening risk assessment per rule 567—133.11 (455B,455E) that includes all contaminants of concern and applicable routes of exposure to contaminants from the site in question.

133.4(13) *Surface water impacts.* Evidence of a contaminant in a surface water that may cause a violation of its applicable water quality criteria per subrule 567—61.3(3) is an indeterminate condition. Such evidence includes a physical observation (e.g., a surface sheen, discoloration) or the detection of an SOC contaminant at a concentration greater than the larger the surface water's background concentration plus 25 percent or 25 percent of its applicable water quality standard.

133.4(14) *Ecological impacts.* An indeterminate condition exists where there are obvious signs of adverse ecological impact, such as substantial areas where vegetation or wildlife is absent or stressed, when likely attributed to a release.

133.4(15) *Non-aqueous phase liquids.* The existence of a measureable amount of a non-aqueous phase liquid in a groundwater well or on water in an open excavation is an indeterminate condition. A measureable amount of non-aqueous phase liquid will generally considered to be more than 0.02 ft.

133.4(16) *Other.* Any situation where there is a high likelihood of a current or future condition warranting remedial action is an indeterminate condition. Factors that may be considered for such a determination include, but are not limited to:

- a. physical evidence of a release;
- b. a credible report of a release;
- c. current and likely future land use;
- d. the types, amounts, toxicity, and mobility of contaminants involved;
- e. the likelihood of exposure to contaminants;
- f. the existence of direct conduits for migration of contaminants;
- g. high groundwater table with potential for contaminated groundwater directly entering a buildings, such as by a sump pump;
- h. the number of people who are potentially exposed;
- i. the likely rates and frequency of exposure; and
- j. the characteristics (e.g., age) of people who are potentially exposed.

567—133.5(455B,455E) Liability and responsibility for response actions.

133.5(1) *Liability of a responsible party.* A responsible party is liable for all necessary response actions in accordance with rules 133.8 and 133.9 (455B,455E), including

reimbursement of costs incurred by the department per Iowa Code 455B.392 and 455B.423(6). If more than one responsible party exists, liability shall be apportioned among parties in proportion to each party's contribution. The department will make this apportionment if the parties are unable to do so in a timely manner. The department will not require response action of a responsible party that can reasonably prove contribution of less than 10 percent of the total contaminant load unless doing so would prevent elimination of a condition warranting remedial action that would otherwise be reasonably possible under this chapter.

133.5(2) *Liability of a property owner.* A current or past owner of property, where a condition warranting remedial action exists, is a responsible party if they significantly contributed to the condition or exacerbated a pre-existing condition during their period of ownership.

If the current property owner is not a responsible party, a viable party does not exist or cannot be reasonably determined by the department, and evidence of significant off-site contamination exists; the current property owner may be responsible for conducting response actions prescribed in rule 133.8 (455B, 455E) and subrules 133.9(2) – (6) that are limited to their property.

133.5(3) *Responsibilities of the department.*

a. If the department determines that contamination at a site likely originates from an off-site source, the department shall make reasonable efforts to identify the off-site source.

b. If the source of contamination has been found but a responsible party has not been identified, or if there is credible evidence of multiple responsible parties but not all such parties have been identified, the department shall attempt to identify all responsible parties.

c. The department may use the hazardous substance remedial fund to conduct response actions prescribed in rules 133.8 and 133.9 (455B, 455E) when no party has been identified as being liable for such actions under subrules 133.5(1) and (2), or when every identified responsible party is not a viable party who is willing to conduct the prescribed response actions. Due to its limited resources, the hazardous substance remedial fund will generally only be used, at the department's discretion, for situations that pose an immediate and substantial threat to human health or the environment as determined by the department. The department may seek reimbursement for such use of the hazardous substance remedial fund from any viable party who is unwilling to conduct the prescribed response actions or who is subsequently identified.

567—133.6(455B, 455E) Notification of a condition warranting remedial action.

133.6(1) *Notification timing and responsibility.* Any condition warranting remedial action that may pose an immediate and substantial threat to human health or the environment shall be reported to the department in accordance with chapter 567—Chapter 131. Such notification shall be within 6 hours of discovery. Otherwise, the department shall be notified of a condition warranting remedial action in writing within 30 days of its discovery (e.g., receipt of analytical report). The party responsible for making the notification shall be any known responsible party or owner of the property on which the condition warranting remedial action has been found.

Any party who discovers an indeterminate condition may report such finding to the department. However, only reporting of a condition warranting remedial action is required.

133.6(2) *Substance of notification.* Notification of a condition warranting remedial action shall include the information shown in the following subrules.

a. *Required information.*

- 1) Specific information on the site location (e.g., county, city, street address, section-township-range, latitude-longitude, GPS coordinates).
- 2) Property owner contact information.
- 3) Contact information and role of the party submitting the notification.
- 4) Description of the condition warranting remedial action.

b. *Information to be provided if available without additional effort.*

- 1) Contact information for the owner of any neighboring property where contamination is known or suspected to extend.
- 2) Laboratory results from samples of environmental media.
- 3) Information on the location, depth, construction details, and ownership of drinking-water wells within 1,000 feet of the property in question.
- 4) Site maps and aerial photographs that show pertinent features (e.g., sample locations, property boundaries, buildings, waterlines, storm and sanitary sewers, past and present chemical handling areas, surface waters, topography, and proposed development).
- 5) Site-specific information on geology, e.g., boring logs.
- 6) Information on the current and historical use of each property in question with particular attention to chemical use, including known or likely dates of contaminant releases (e.g., a phase 1 environmental site assessment report).
- 7) Zoning designation of the site and adjacent property.
- 8) Current land use and any planned change in land use of the site and adjacent property.
- 9) Information that suggests a responsible party or parties, other than the current property owner, with an explanation of their responsibility and their contact information.
- 10) Rationale for why an indeterminate condition is or is not likely to be a condition warranting remedial action.
- 11) Any other pertinent information.

133.6(3) *Notification not required.* With the exception of a situation that constitutes an immediate and substantial threat to human health or the environment, notification to the department of a condition warranting remedial action is not required if actions are taken that eliminate the condition warranting remedial action within 30 days of its discovery.

567—133.7(455B, 455E) Department response to evidence of contamination. Upon receipt of notification per rule 133.6 (455, 455E) or receipt of evidence of contamination by other means, the department will conduct an assessment of the situation and determine if it should be addressed as a condition warranting remedial action, an indeterminate condition, or a no further action condition. This assessment will be based on the information provided by the party making the notification plus other information that is readily available to the department. The department will provide a narrative rationale for determinations under this rule.

133.7(1) *Finding of a condition warranting remedial action.* A situation that meets the criteria of any subrule in rule 133.3 (455B,455E) will be determined by the department to be a condition warranting remedial action that shall be addressed in accordance with rule 133.9(455B,455E).

133.7(2) *Finding of an indeterminate condition.* The department may conclude that a situation meeting a criterion specified in rule 133.4(455B,455E) is an indeterminate condition that will be addressed in accordance with rule 133.8(455B, 455E). Despite qualifying as an indeterminate condition, the department may conclude instead that the potential threat posed by the situation is low enough to warrant a no further action condition determination.

133.7(3) *Finding of a no further action condition.* The department will determine a no further action condition exists when there is insufficient evidence to classify the situation as a condition warranting further action or an indeterminate condition or when a situation qualifies as an indeterminate condition, but the department concludes that the potential threat posed by the situation is low enough to warrant a no further action condition determination. With a determination that a no further action condition exists, the department will inform the property owner, the party making notification, and any other party who is known or suspected to be a responsible party that no additional action is being required based on available information and the reasons for the determination. Such a decision will provide no assurance that further action to address the situation for which the determination was made will not be required in the future based on new information, a change in conditions, or a change in regulations. When eligible, the Iowa Land Recycling Program per chapter 567—137 will be offered as a voluntary alternative to achieve liability protections and assurances that additional actions will not be required in the future to address the same situation.

567—133.8(455B,455E) Response to an indeterminate condition.

When the department concludes that an indeterminate condition exists under subrule 133.7(2), the department will fulfill any obligation to identify responsible parties under subrule 133.5(3) and notify the appropriate parties of the resultant findings. The department will then determine the minimum response actions deemed necessary to verify the existence of a condition warranting remedial action. Response actions may include collection of information listed in paragraph 133.6(2) and collection and analyses of additional environmental samples.

A viable party will be required to conduct the response actions prescribed by the department, unless the department finds no evidence that off-site contamination exists or is likely to exist in the foreseeable future and the viable party is an on-site property owner, in which case response actions are optional. If a viable party has not been found and evidence of significant off-site contamination exists, the department may require the current on-site property owner to conduct the prescribed on-site response actions. Otherwise, the prescribed response actions may be voluntarily conducted by the owner or owners of the property comprising the impacted area or, at the discretion of the department, response actions may be conducted by the department.

Within 14 days of receipt of notice from the department of required response actions, the viable party or parties shall submit an acknowledgement of the requirement for response action or seek a meeting to discuss the matter with the department. The department will provide a minimum of 45 days to submit records and 90 days to submit results of environmental samples.

Additional provisions for responding to indeterminate conditions per subrule 133.4(14) are provided in the subrule 133.8(1) below. Subrules 133.8(2) and (3) prescribe the department's response to additional information that is received.

133.8(1) *Ecological risk.* When the department concludes that an indeterminate condition exists under subrule 133.4(14), the department will conduct a site visit prior to making a judgment regarding the potential for ecosystem damage. Based on the findings of such a site visit, the department may recommend that a responsible party or parties conduct an ecological risk assessment or the department may elect to conduct an ecological risk assessment. Procedures for ecological assessments are not prescribed herein. However, current guidance for conducting ecological risk assessments by the department or EPA may be utilized. It is *not* the intent of this subrule to only compare contaminant levels from individual environmental samples to ecological standards. Rather, it is intended that the magnitude and extent of contamination relative to the potential environmental risk be a primary consideration.

133.8(2) *Department response to additional information.* The department will make a determination as to the existence of a condition warranting remedial action after the receipt of the additional information prescribed above in this rule and will notify all appropriate parties of the determination along with an explanation. The determination will be that a condition warranting remedial action exists per paragraph 133.7(1), a no further action condition exists per subrule 133.7(3), or an indeterminate condition remains. Subrule 133.8(3) prescribes subsequent action when an indeterminate condition remains.

133.8(3) *Continued uncertainty.* Through the actions prescribed above in this rule, the department will attempt to minimize the continued finding of an indeterminate condition in subrule 133.8(2), but when it is made, the minimum amount of additional response actions deemed necessary to make a final determination will again be determined by the department. In the near term, this may involve collection and analyses of environmental samples or fate and transport modeling of environmental conditions. In the longer term, it may involve continued monitoring of environmental conditions.

When uncertainty involves potential migration of contaminants, criteria specified in subrule 133.9(6) may be used to demonstrate stable or improving conditions based on monitoring data. If evidence of a condition warranting remedial action remains inconclusive after 8 quarters of monitoring, the department will normally allow continued monitoring of potentially mobile contaminants at a frequency not to exceed quarterly for up to 3 additional years before making a final determination. Lack of conclusive evidence of a condition warranting remedial action at the end of the maximum 5-year monitoring period will normally result in a determination that a condition warranting remedial action is unlikely to exist with no additional action required per subrule 133.7(3). The department may require additional monitoring in situations where significant uncertainty remains and potential adverse consequences of an improper determination are large, e.g., a public drinking water supply may be significantly impacted.

567—133.9 (455B,455E) Response to a condition warranting remedial action.

133.9(1) *Notification of required response actions.*

a. Following the department's receipt of notification of a condition warranting remedial action per rule 133.6 (455B, 455E), determination per subrule 133.7(1), or determination the a condition warranting remedial action exists per 133.8(2), the department will provide notification of the existence of the condition warranting remedial action, the required response action (including the routes of exposure that must be assessed), and the party or parties responsible for conducting the response action per rule—133.5 (455B, 455E). This notification will be given to the owner of each property where the condition warranting remedial action has been determined to exist and any other party that is known to be a responsible party. The department will notify the owner of any off-site property known to be in an impacted area of findings related to their property, the identities of the responsible parties, the actions to be taken, and how their property may be affected. If a condition warranting remedial action involves groundwater contamination, the local water permitting authority will be notified by the department. If the condition warranting remedial action involves groundwater contamination within a source water protection zone of a public water supply, the department will notify the public water supply of the determination.

b. The department's notification to the party or parties responsible for conducting the response action may stipulate the need for a work plan for supplying any pertinent information, which has not previously been provided, to conduct applicable response actions prescribed in subrules 133.9(2) – (6). Due dates for submittals and completion of actions may be prescribed by the department. Unless otherwise specified per subrule 133.9(2), when the department requires a work plan, a minimum of 45 days will be given to submit the work plan and, when the department requires other actions, a minimum of 90 days will be provided for completion of the other actions. A responsible party is required to conduct response actions in accordance with the following subrules, as applicable.

133.9(2) Immediate response required. When a condition warranting remedial action exists that is an immediate and substantial threat to human health or the environment, the department may require action to mitigate the risk in a timeframe appropriate to the risk. If a responsible party cannot be readily identified or is unwilling or unable to conduct the necessary response action, the department may conduct the necessary action using money from the hazardous substance remedial fund and subsequently seek reimbursement from a responsible party. Immediate actions to mitigate a condition warranting remedial action may include, but are not limited to:

- a. Providing an alternative drinking water supply or treatment of a drinking water supply impacted by any contaminant of concern at a concentration greater than a statewide standard for a protected groundwater source.
- b. Removing contaminated material and properly disposing of it.
- c. Repairing or emptying a tank or pipe that is leaking or is subject to imminent failure.
- d. Repairing a containment structure that is subject to imminent failure.
- e. Taking action to restrain or mitigate the spread of contaminants.
- f. Restricting access to an area of contamination.
- g. Venting an area with an explosive condition.

133.9(3) Determine the source of contamination or the nature of a condition warranting remedial action. If not already known, the source of contamination or other cause of a condition warranting remedial action shall be determined to the extent reasonable and practical to do so.

This may include additional research of historical information and in most cases will involve collection of environmental samples. If new evidence is found that suggests the existence of an off-site source of contamination, the department shall be notified of this finding and provided with all supporting information. If the department concurs with this finding, it will fulfill its responsibilities to determine if an off-site source exists and identify the associated responsible party or parties in accordance with subrule 133.5(3).

133.9(4) *Eliminate the source of contamination or circumstance causing the condition warranting remedial action.* To the extent reasonable and practical to do so, any source of contamination or circumstance causing a condition warranting remedial action shall be eliminated within a timeframe appropriate to the situation, as approved by the department.

133.9(5) *Determine the extent of contamination.* The extent of soil and groundwater contamination shall be determined horizontally and vertically to the larger of background standards or applicable statewide standards. Alternatively, if it can be demonstrated that no off-site contamination exists in excess of the larger of background standards or applicable statewide standards, the extent of soil and groundwater contamination may be determined to concentrations that would not cause an indeterminate condition per rule 133.4(455B,455E). When contaminants in soil are known or suspected, particular attention shall be paid to determining the extent of contamination in surficial soil in areas where human contact with soil is most likely. The extent of vapor contamination shall be determined to vapor concentrations that constitute an indeterminate condition per subrule 133.4(11) or to vapor concentrations that pass an human health risk assessment per rule 133.11(455B,455E). Alternatively, determining vapor concentrations at all locations of exposure per subparagraph 133.11(5)“c”(1) is acceptable. In addition to environmental samples analyzed by a certified laboratory per 567—Chapter 83, other information may be used to supplement the determination of the extent of contamination. Such information may include, but is not limited to: field-screening analyses, visual evidence, historical information (e.g., known fill areas), and known or predicted contaminant migration pathways.

133.9(6) *Assess the stability of groundwater-related contamination.* The potential for groundwater-related contamination to increase or migrate shall be assessed. Factors to be considered in assessing the stability of contamination include:

- a. knowledge about the source of contamination (e.g., location, type, amount, date),
- b. trends in contaminant concentrations from historic sample results,
- c. whether the contaminant source has been removed,
- d. the relative magnitude of contaminants compared to health-based standards,
- e. the adsorptive properties of the contaminants,
- f. the degradation potential of the contaminants,
- g. the physical properties of soils and aquifers (e.g., hydraulic conductivity, thickness, organic matter content),
- h. the estimated groundwater flow rates and flow paths,
- i. the likely fate of groundwater (e.g., discharge to surface water), and
- j. the distance of contamination from property boundaries.

Stability of groundwater-related contamination may be assessed by a qualitative approach, a quantitative approach, or a combination of approaches. With the approval of the department,

groundwater stability may be demonstrated individually at selected monitoring points or collectively using mass discharge information.

If stable or improving conditions cannot be demonstrated to the satisfaction of the department using the above-listed factors, stable or improving conditions may be quantitatively demonstrated based on eight consecutive quarters of monitoring results. This may be accomplished by use of statistical methods such as linear regression or the Mann-Kendall trend test, as approved by the department. The department may reduce monitoring requirements necessary to achieve compliance under this provision when sufficient qualitative information, such as listed above, is available. The department will reject a determination that conditions are stable or improving in situations where significant uncertainty remains (e.g., a large recent increase in contaminant concentration), despite demonstration of a statistical stable-or-improving condition, and potential adverse consequences of an improper determination are large, e.g., a public drinking water supply may be impacted.

When stable or improving conditions have not been demonstrated with 8 quarters of monitoring data and the need for remedial action other than monitoring has not been established, the department will allow continued monitoring until such time that steady or improving conditions can be demonstrated or the need for other remedial action becomes apparent.

Groundwater fate and transport modeling may be also used to predict stable-or-improving conditions when the department agrees that there is sufficient information to accurately conduct such modeling.

133.9(7) *Develop remedial action plan.* Upon completion of actions required in subrules 133.9(2) – (6), unless the condition warranting remedial action has been eliminated by those actions to the satisfaction of the department, a remedial action plan shall be developed and submitted to the department for approval. The plan shall include a schedule for completing remedial action within a timeframe appropriate for the situation.

133.9(8) *Conduct remedial action.* Remedial action shall be implemented in accordance with a remedial action plan per subrule 133.9(7) that has been approved by the department.

133.9(9) *Demonstrate compliance.* Upon completion of the remedial action, the responsible party or parties shall demonstrate to the satisfaction of the department that a condition warranting remedial action no longer exists. Stable or improving conditions, as determined per subrule 133.9(6), will generally be required for groundwater-related contamination before compliance can be demonstrated. Paragraphs 133.9(9) “a” – “f” describe additional requirements for demonstrating compliance, as applicable. If the department determines that a condition warranting remedial action still exists, the department will inform the responsible party or parties of this determination and require continued response actions until compliance is achieved.

a. Residual contaminants in groundwater, soil, or air. To demonstrate compliance a compliance human health risk assessment in accordance with rule 133.11(455B,455E) must not reveal an unacceptable cumulative risk from exposure to residual contaminants in soil, groundwater, and air that is not precluded by an institutional or technological control. A compliance risk assessment is not necessary if either no residual exposure point concentration of any contaminant of concern exists in excess of its statewide standard no route of exposure to any contaminant of concern remains due to placement of technological or institutional controls. A

compliance risk assessment is also not necessary when the only route of exposure is oral ingestion of drinking water in which case only compliance with subrule 133.3(1) is required.

b. Surface water stream. Upstream and downstream surface water samples collected during normal or below normal streamflow must demonstrate for three consecutive quarters that the site does not cause a condition warranting remedial action per subrule 567—133.3(2) due to contamination of the surface stream.

c. Surface water that is not a stream. Sampling of the surface water at the location of anticipated discharge from the site must demonstrate for three consecutive quarters that the site does not significantly contribute to a condition warranting remedial action per subrule 567—133.3(2) due to contamination of the surface water.

d. Permeation into a water line. Upgradient and downgradient sampling of the water line in close proximity to the contamination of soil or groundwater during periods of minimal flow in the water line must demonstrate for three consecutive sampling events separated by at least one month that the site does not significantly contribute to a condition warranting remedial action per subrule 567—133.3(1) due to permeation of contaminants into the water line .

e. Ecological condition. The condition has been resolved to the satisfaction of the department.

f. NAPLs. The condition has been resolved to the satisfaction of the department by one of the following means as appropriate.

1. Compliance with subrule 567—135.7(5) will constitute compliance with this paragraph for contaminants that are non-aqueous phase liquids (i.e., free product) that are lighter than water (LNAPLs).

2. Demonstration that a NAPL that is lighter than water is not mobile in accordance with ASTM E2856, “Standard Guide for Estimating LNAPL Transmissivity,” ASTM International, West Conshohocken, PA, 2011, DOI: 10.1520/E2856-11E01, www.astm.org.

3. The department may also make a site-specific determination of free-product removal requirements based on estimated volume of free product, mobility of free product, recoverability of free product, potential rate and cost of free product removal, and potential reduction in exposure risks from free product recovery. Risks from contamination resulting from free product (e.g., groundwater used for drinking water and vapor intrusion) may be addressed independent of direct risks from free product.

133.9(10). *Compliance achieved.* When compliance has been achieved, the department will determine the situation to be a no further action condition in accordance with subrule 133.7(3).

567—133.10 (455B,455E) Institutional and technological controls.

133.10(1) *Institutional controls.* The determination of the existence of a condition warranting remedial action or an indeterminate condition may include the consideration of existing institutional controls. Elimination of a condition warranting remedial action or an

indeterminate condition may include the implementation of new institutional controls. Possible institutional controls include the following:

- a.* Local ordinances that prohibit the installation of wells in areas serviced by public water supplies may be used to eliminate groundwater ingestion as a possible route of exposure to contaminants.
- b.* Use of a nonresidential exposure scenario may be based on existing zoning when consistent with current land use and any formally planned changes in land use.
- c.* Specific land-use and water-use restrictions may be imposed by an environmental covenant pursuant to 567—Chapter 14.
- d.* Water-use restrictions in a designated protected water source pursuant to 567—Chapter 53 may be used to eliminate ingestion of water from a surface water source or a groundwater source as a possible route of exposure to contaminants.
- e.* Notification to and acknowledgement by property owners of the existence of contamination on their property that does not currently create a condition warranting remedial action, but could cause a condition warranting remedial action in the future with an unforeseen change in land use, may be used as a land-use control. This form of institutional control must be coupled with inclusion of site records in a publically accessible database maintained by the department. The notification shall include a reminder of the requirement to include information about the contamination in the groundwater hazard statement per Iowa Code Section 558.69 when the property is transferred, along with suggested language.
- f.* Other forms of institutional controls may be used if approved by the department.

133.10(2) *Technological controls.* The determination of the existence of a condition warranting remedial action or indeterminate condition may include the consideration of existing technological controls. Elimination of a condition warranting remedial action or indeterminate condition may include the implementation of new technological controls. The department may require use of an institutional control in conjunction with use of a technological control when deemed appropriate for informing future property owners of the existence of residual contaminants that could cause a condition warranting remedial action if the technological control is not maintained. Possible technological controls include the following:

- a.* Passive physical impediments to human exposure to media containing contaminants including, but not limited to:
 - 1) fencing,
 - 2) pavement,
 - 3) building footprint,
 - 4) soil cover/cap,
 - 5) impermeable barriers that limit groundwater or vapor movement,
 - 6) use of permeation-resistant materials for drinking-water lines,
 - 7) a location on the floodplain, and
 - 8) a remote location that is difficult to access.

9) On-site contaminants in groundwater that meets the definition of a protected groundwater source will normally not be considered to pose a threat to human health from potential groundwater ingestion unless the groundwater source is already used for an on-site drinking water supply or such use is planned. This provision does not discount the potential for contaminants in a nonprotected groundwater source to adversely impact an underlying geologic formation this is used for water supply.

b. Active physical measures to prevent the migration of or exposure to contaminants including, but not limited to:

- 1) groundwater pumping for hydraulic containment of contaminants,
- 2) air sparging of groundwater to prevent contaminant mobility,
- 3) permeable groundwater treatment walls to prevent contaminant migration,
- 4) physical or chemical treatment of groundwater to prevent contaminant mobility,
- 5) physically solidifying or chemically stabilizing material containing contaminants to prevent potential exposure or reduce contaminant mobility,
- 6) groundwater treatment before use, and
- 7) radon-type ventilation systems to prevent vapor intrusion.

c. Other forms of technological controls may be used if approved by the department.

567—133.11 (455B,455E) Human health risk assessment.

133.11(1) *Overview of human health risk assessments.* A human health risk assessment involves a quantitative estimation of risk in excess of background risk from the cumulative exposure of an individual to all contaminants of concern in all impacted environmental media. Separate human health risk assessments may be necessary due to differences in exposed individuals or differences in contaminant characteristics associated with the different areas of an impacted area. For example, soil and air contamination may exist on-site only, but on-site and off-site groundwater contamination exists. In this example, an on-site child resident may be exposed to contaminants in groundwater from an on-site well, vapor from on-site sources, and soil; whereas an off-site adult worker may only be exposed to lesser concentrations of vapor contaminants from off-site groundwater.

Risk calculations involve each contaminant of concern associated with each potential route of exposure to each impacted environmental medium. The formulae for assessing human risk are specified in subrule 133.11(2). These formulae estimate risk as a function of the amount of exposure to a contaminant and the toxicity of the contaminant. Subrule 133.11(3) prescribes how contaminant toxicity is determined. Determination of the amount of exposure to a contaminant is described below.

Subrule 133.11(4) prescribes how to: establish the exposure scenario which characterizes an individual who is or is likely to be exposed, identify the environmental media that the individual is or is likely to be exposed to, determine how much of each environmental medium an individual is likely to be exposed to, and determine the frequency and period of time over which the exposure is likely to occur.

Subparagraphs 133.11(5)“a”(1), 133.11(5)“b”(1), and 133.11(5)“c”(1) prescribe how to determine the location of exposure. Subparagraphs 133.11(5)“a”(2), 133.11(5)“b”(2), and

133.11(5)“c”(2) prescribe how to determine the exposure point concentration of each contaminant of concern in each environmental medium at each location of exposure.

Calculated risks for each category of exposed individual based on the exposure point concentration of each contaminant of concern at the location of exposure in each applicable route of exposure are added to determine cumulative risks to that individual. Acceptable human health risk levels are specified in subrules 133.11(6), (7), and (8).

The human health risk assessment procedures prescribed herein are largely objective and quantitative. However, discretionary and qualitative aspects of risk assessments may also be considered with the concurrence of the department. Human health risk assessments may be done in a screening mode, based on limited information and worst-case assumptions, or a compliance mode, based on a fully characterized site.

133.11(2) Human health risk assessment formulae. Quantitative human health risk assessments based on exposure to contaminants in water, soil and air shall utilize Formulas II through VII below.

(Formula II) Non-cancer risk from oral exposure to a contaminant in water or soil.

$$HQ = EPC \times CF \times ER \times EF \times ED \div BW \div (AT \times 365 \text{ days/yr.}) \div RfD_o$$

(Formula III) Non-cancer risk from dermal exposure to a contaminant in soil.

$$HQ = EPC \times CF \times (AS \times SA \times Abs \times EF \times ED) \div BW \div (AT \times 365 \text{ days/yr.}) \div RfD_d$$

(Formula IV) Non-cancer risk from inhalation exposure to a contaminant in air.

$$HQ = EPC \div SAC \div AF$$

(Formula V) Cancer risk from oral exposure to a contaminant in water or soil.

$$\text{Cancer Risk} = X \div (X/SF_o)^n \times [(EPC \times CF \times (ER_c \times EF_c \times ED_c \div BW_c + ER_a \times EF_a \times ED_a \div BW_a) \div (AT \times 365 \text{ days/yr.})]^n$$

(Formula VI) Cancer risk from dermal exposure to a contaminant in soil.

$$\text{Cancer Risk} = X \div (X/SF_d)^n \times [EPC \times CF \times (AS_c \times SA_c \times Abs \times EF_c \times ED_c \div BW_c + AS_a \times FA_a \times Abs \times EF_a \times ED_a \div BW_a) \div (AT \times 365 \text{ days/yr.})]^n$$

(Formula VII) Cancer risk from inhalation exposure to a contaminant in air.

$$\text{Cancer Risk} = X \div (X \div UR)^n \times (EPC \div AF)^n$$

Where:

Abs = Absorption factor (unitless); portion of contaminant absorbed by the body from dermal exposure.

AF = Adjustment factor for inhalation exposure to account for other than continuous exposure.

AS = Daily area of skin with dermal exposure (cm^2/day).
AT = Averaging time (years); time over which exposure is averaged and potential adverse effects may occur.
BW = Body weight of the exposed individual (kg)
EPC = Exposure point concentration of the contaminant (soil: mg/kg , water: mg/L , air: mg/m^3)
CF = Conversion factor: 10^{-6} kg/mg for soil, 1 for water.
ED = Exposure duration by the exposed individual (years).
EF = Exposure frequency by the exposed individual (days/year).
ER = Oral exposure rate by the exposed individual (mg/day).
HQ = hazard quotient assigned to a target organ or organs.
n = Exponent (unitless) of low-dose cancer-risk function. Default = 1
SAC = Safe air concentration (mg/m^3); non-cancer toxicity factor for inhalation exposure. Equals acceptable concentration of contaminant in air based on continuous inhalation of only the associated chemical. The SAC value for a chemical is the larger of the reference concentration (RfC) prescribed in accordance with 567—paragraph 137.5(3)“c” or 0.1% of the chemical’s federal Occupational Safety and Health Administration (OSHA) limit for air contaminants or 8-hour time-weighted average, if such a standard exists.
RfD = Reference dose ($\text{mg}/\text{kg}/\text{day}$); non-cancer toxicity factor based on oral or dermal exposure. Equals acceptable oral or dermal dose from exposure only to the associated chemical.
SA = Amount of soil adhered to skin (mg/cm^2).
SF = Cancer slope factor ($\text{mg}/\text{kg}/\text{day}$)⁻¹, cancer toxicity factor for oral or dermal exposure.
UR = Inhalation unit risk (mg/m^3)⁻¹; cancer toxicity factor for inhalation exposure.
X = Cancer risk (unitless) that is the basis for the cancer slope factor. Default = 0.1

Notes:

(1) Subscript “a” refers to an exposed individual who is an adult and subscript “c” refers to an exposed individual who is a child. Subscript “o” refers to a toxicity factor based on oral exposure, subscript “d” refers to a toxicity factor based on dermal exposure, and subscript “i” refers to a toxicity factor based on inhalation exposure.

(2) In situations where the risk associated with exposure to a contaminant at a concentration equal to the MCL is greater than the acceptable cumulative risk, the cumulative risk may be calculated assuming the risk associated with exposure to the contaminant at a concentration equal to the MCL is equal to the acceptable cumulative risk criterion.

133.11(3) Source of contaminant toxicity values. The toxicity values used in Formulae II, III and IV to estimate non-cancer risks are oral reference dose (RfD_o) and dermal reference dose (RfD_d) and safe air concentration (SAC), respectively. The toxicity values used in Formulae V, VI and VII to estimate cancer risk are oral slope factor (SF_o) and dermal slope factor (SF_d) and inhalation unit risk (UR), respectively. The source of contaminant toxicity values, except SACs based on OSHA air standards, shall be consistent with 567—paragraph 137.5(3)“c”. The federal 29 CFR Part 1910 Subpart Z shall be the source of SACs based on OSHA air standards.

The department, in consultation with the Iowa department of public health, may modify the human health risk assessment process when doing so results in lower estimated risk while assuring a high level of protection is still provided. Such modifications may include the following.

- a. Prescribing more appropriate values for n or X in formulae V, VI and VII than the prescribed default values.
- b. Prescribing use of Formulae II, III, and IV for estimating low-dose cancer response along with an appropriate values of RfD_o , RfD_d and SAC for chemicals that have been reasonably demonstrated to have a threshold cancer response.
- c. Prescribing values for SAC, RfD_o , RfD_d , SF_o , SF_d or UR that are deemed to be more reasonable and appropriate than the values determined in accordance with 567—paragraph 137.5(3)“c”.

The department will maintain a readily accessible database containing all chemical-specific toxicity values used to estimate risk, the source of each value, and the rationale for any determination made in accordance with the paragraphs “a” – “c” above.

133.11(4) *Exposure scenarios*

a. *Exposed individual.* A human health risk assessment will normally be based on one of three categories of exposed or potentially exposed individuals: a resident, a non-resident worker, and a construction worker.

(1) *Resident.* The resident category is based on an individual who lives at the same location from childhood into adulthood. A resident may be exposed to contaminants in surficial soil, shallow soil, indoor air, drinking water. Drinking water may come from a well located on the occupied property or from another source (e.g., public water supply). The resident category is the most protective and should be used as the default category unless use of another category can be justified, such as by use of institutional controls. The resident category of exposed individual shall be utilized for locations that meet the definition of a residential area.

(2) *Nonresident.* The nonresident category of exposed individual is based on an adult who works at a workplace setting for 25 years. A nonresident may be exposed to contaminants in surficial soil, shallow soil, indoor air, and drinking water. Drinking water may come from a well located on the workplace property or from another source (e.g., public water supply). The nonresident category of exposed individual may be used for locations that meet the definition of a nonresidential area.

(3) *Construction worker.* The construction worker category of exposed individual assumes an adult who has short-term exposure as a construction worker. A construction worker may be exposed to contaminants in air in an excavation greater than 5 feet deep and contaminants in soil. The construction worker category of exposed individual shall be used for all locations, residential or nonresidential, where construction involving excavation of soils is reasonably possible.

(4) *Other.* Other categories of exposed individuals may be established on a case-by-case basis with the approval of the department.

b. Routes of exposure. An exposure scenario shall include all routes of exposure that exist or are reasonably possible in the foreseeable future. The following routes of exposure shall be included in a human health risk assessment as applicable.

(1) *Groundwater/drinking water.* Groundwater or other drinking-water exposure shall be included in a human health risk assessment only when there is an existing or anticipated impact to drinking water coupled with at least one other route of exposure to contaminants from the site being assessed. Drinking water may come from a well that draws in contaminants from the site or a drinking-water line impacted by permeation of contaminants from the site. If drinking water is the only potential route of exposure, a human health risk assessment is not necessary since compliance with subrule—133.3(1) will take precedence. Technological or institutional controls that are approved by the department may also be used to prevent an otherwise potential exposure to contaminants in groundwater/drinking water.

(2) *Soil.* Soil exposure shall be included in a human health risk assessment if a contaminant of concern has been identified in soil in an area where exposure to soil is reasonably possible. Surficial, shallow, and deep soil shall be assessed in separate risk assessments (i.e., not added together in the estimation of cumulative risk) as described below.

1. *Surficial soil.* Surficial soil is soil less than three inches deep. Surficial soil applies only to the resident and nonresident categories of exposed individual. Exposure to surficial soil is not considered to be reasonably possible for a resident or nonresident category of exposed individual in areas covered by a building or pavement, unless the building or pavement is expected to be removed leaving the area uncovered in the foreseeable future. Other forms of technological or institutional controls that are approved by the department may also be used to prevent an exposure to surficial soil.

2. *Shallow soil.* Shallow soil is soil greater than three inches deep but less than two feet deep in a residential area or greater than three inches but less than one foot deep in a nonresidential area. Exposure to shallow soil applies to the resident and nonresident categories of exposed individual. Exposure to shallow soil is not considered to be reasonably possible for a resident or nonresident category of exposed individual in areas covered by a building or pavement, unless the building or pavement is expected to be removed leaving the area uncovered in the foreseeable future. Other forms of technological and institutional controls that are approved by the department may also be used to prevent exposure to shallow soil. Less stringent technological controls to prevent exposure to shallow may be allowed compared to surficial soils.

3. *Deep soil.* Deep soil is all soil above the normal groundwater table. The deep soil category applies only to the construction worker category of exposed individual. Excavation resulting in exposure to contaminants in deep soil by a construction worker will be assumed to be reasonably possible unless a technological or institutional control approved by the department precludes excavation in an area or provides sufficient warning to prevent unsafe exposure.

(3) *Air in the resident and nonresident exposure scenarios.* Human health risk assessments shall include exposure by inhalation only as a result of vapor intrusion to enclosed spaces. Inhalation shall be included in a screening or compliance risk assessment for a residential or non-residential exposure whenever a contaminant of concern that is a VOC is detected in soil, groundwater, or soil vapor within 100 feet of an enclosed space that currently exists or is likely to exist in the foreseeable future; unless vapor intrusion can otherwise be dismissed by sampling or a technological or institutional control approved by the department.

(4) *Air in the construction-worker exposure scenario.* Inhalation shall be assessed in a screening or compliance risk assessment for a construction worker exposure whenever a contaminant of concern that is a VOC is detected in soil, groundwater, or soil vapor; unless vapor intrusion can otherwise be dismissed by sampling or a technological or institutional control approved by the department.

(5) *Other.* The department may require other routes of exposure to be addressed that are necessary to ensure protection of human health based on site-specific conditions.

c. Amount of exposure. Tables I – III specify the assumed amount of exposure for each category of exposed individual and route of exposure. The amount of exposure for other exposed individuals and routes of exposure will be determined on a case-by-case basis with the approval of the department. (Note: the formulae shown in Tables I – III are prescribed in subrule 133.11(2) and the parameters listed in Table I – III are also described in subrule 133.11(2).

Table I
RESIDENTIAL EXPOSURE ASSUMPTIONS

Route of Exposure	Water Oral	Surficial Soil Oral & Dermal	Shallow Soil Oral & Dermal	Inhalation
EXPOSURE PARAMETERS NON-CANCER BASED RISKS				
Formula:	II	II(oral)/III(dermal)	II(oral)/III(dermal)	IV
Parameter				
AT	6 years	6 years	6 years	--
Abs	--	Chemical-Specific	Chemical-Specific	--
AF	--	--	--	1
AS	--	2,200 cm ²	2,200 cm ²	--
BW	15 kg	15 kg	15 kg	--
CF	1	10 ⁻⁶ kg/mg	10 ⁻⁶ kg/mg	--
ED	6 years	6 years	6 years	--
EF	365 days/year	240 days/year	180 days/year	--
ER	1 L/day	200 mg/day	200 mg/day	--
SA	--	0.2 mg/cm ²	0.2 mg/cm ²	--
EXPOSURE PARAMETERS CANCER BASED RISKS				
Formula:	V	V(oral)/VI(dermal)	V(oral)/VI(dermal)	VII
Parameter				
AT	70 years	70 years	70 years	--
Abs	--	Chemical-Specific	Chemical-Specific	--
AF	--	--	--	2.3
AS_a	--	2,500 cm ²	2,500 cm ²	--
AS_c	--	2,200 cm ²	2,200 cm ²	--
BW_a	70 kg	70 kg	70 kg	--
BW_c	15 kg	15 kg	15 kg	--
CF	1	10 ⁻⁶ kg/mg	10 ⁻⁶ kg/mg	--
ED_a	30 years	24 years	24 years	--
ED_c	--	6 years	6 years	--
EF_a	365 days/year	240 days/year	180 days/year	--
EF_c	365 days/year	240 days/year	180 days/year	--
ER_a	2 L/day	100 mg/day	100 mg/day	--
ER_c	--	200 mg/day	200 mg/day	--
SA_a	--	0.07 mg/cm ²	0.07 mg/cm ²	--
SA_c	--	0.2 mg/cm ²	0.2 mg/cm ²	--

Table II
NON-RESIDENTIAL EXPOSURE ASSUMPTIONS

Route of Exposure	Water Oral	Surficial Soil Oral & Dermal	Shallow Soil Oral & Dermal	Inhalation
EXPOSURE PARAMETERS NON-CANCER BASED RISKS				
Formula:	II	II(oral)/III(dermal)	II(oral)/III(dermal)	IV
Parameter				
AT	25 years	25 years	25 years	--
Abs	--	Chemical-Specific	Chemical-Specific	--
AF	--	--	--	4.9
AS	--	2,500 cm ²	2,500 cm ²	--
BW	70 kg	70 kg	70 kg	--
CF	1	10 ⁻⁶ kg/mg	10 ⁻⁶ kg/mg	--
ED	25 years	25 years	25 years	--
EF	225 days/year	150 days/year	100 days/year	--
ER	1 L/day	100 mg/day	100 mg/day	--
SA	--	0.1 mg/cm ²	0.1 mg/cm ²	--
EXPOSURE PARAMETERS CANCER BASED RISKS				
Formula:	V	V(oral)/VI(dermal)	V(oral)/VI(dermal)	VII
Parameter				
AT	70 years	70 years	70 years	--
Abs	--	Chemical-Specific	Chemical-Specific	--
AF	--	--	--	14
AS _a	--	2,500 cm ²	2,500 cm ²	--
AS _c	--	0	0	--
BW _a	70 kg	70 kg	70 kg	--
BW _c	15 kg	15 kg	15 kg	--
CF	1	10 ⁻⁶ kg/mg	10 ⁻⁶ kg/mg	--
ED _a	25 years	25 years	25 years	--
ED _c	0	0	0	--
EF _a	225 days/year	150 days/year	100 days/year	--
EF _c	0	0	0	--
ER _a	1 L/day	100 mg/day	100 mg/day	--
ER _c	0	0	0	--
SA _a	--	0.1 mg/cm ²	0.1 mg/cm ²	--
SA _c	--	0	0	--

Table III
CONSTRUCTION-WORKER EXPOSURE ASSUMPTIONS

Route of Exposure	Deep Soil Oral	Deep Soil Dermal	Inhalation
EXPOSURE PARAMETERS NON-CANCER BASED RISKS			
Formula:	II	III	IV
Parameter			
AT	1 year	1 year	--
Abs	--	Chemical-Specific	--
AF	--	--	5.5
AS	--	2,500 cm ²	--
BW	70 kg	70 kg	--
CF	10 ⁻⁶ kg/mg	10 ⁻⁶ kg/mg	--
ED	1 year	1 year	--
EF	25 days/year	25 days/year	--
ER	330 mg/day	--	--
SA	--	0.1 mg/cm ²	--
EXPOSURE PARAMETERS CANCER BASED RISKS			
Formula:	V	VI	Not Applicable
Parameter			
AT	70 years	70 years	--
Abs	--	Chemical-Specific	--
AF	--	--	--
AS _a	--	2,500 cm ²	--
AS _c	--	0	--
BW _a	70 kg	70 kg	--
BW _c	15 kg	15 kg	--
CF	10 ⁻⁶ kg/mg	10 ⁻⁶ kg/mg	--
ED _a	1 year	1 year	--
ED _c	0	0	--
EF _a	25 days/year	25 days/year	--
EF _c	0	0	--
ER _a	330 mg/day	--	--
ER _c	0	--	--
SA _a	--	0.1 mg/cm ²	--
SA _c	--	0	--

133.11(5) Location of exposure and exposure point concentration. The following paragraphs prescribe how the location of exposure and exposure point concentration are determined for human health risk assessment calculations.

a. Groundwater/drinking water. The location of exposure and exposure point concentration for groundwater/drinking water are prescribed in the following subparagraphs. When an exposure point concentration is based on contaminants found in groundwater samples (not drinking-water samples), dissolved (i.e., filtered) sample analyses may be used.

(1) *Location of exposure.* The location of drinking-water exposure shall be the routine finished drinking water for the assessed individual. This may be from an existing or planned well located on the property occupied by the exposed individual or from another source (e.g., a public water supply). Finished water may be impacted by contaminants entering a well used for water supply or by permeation of contaminants into a water line located in the impacted area. If exposure is based on a possible, but unplanned, future drinking-water well, the location of such well will be assumed to be the location on the property occupied by the potentially exposed individual that would yield water causing the highest risk from ingestion.

(2) *Exposure point concentration.* The exposure point concentration for a screening human health risk assessment shall be the highest measured concentration or estimated concentration per subrule 133.4(8) if a measured concentration is not available, at the location of exposure.

The exposure point concentration for a compliance human health risk assessment shall be based on steady or improving conditions determined per subrule 133.9(6) at the location of exposure. The exposure point concentration for a compliance risk assessment shall be determined by one of the following methods as applicable.

1. When the location of exposure is an existing finished drinking water in which stable or improving conditions have been demonstrated by monitoring of the finished drinking water, the exposure point concentration shall be the arithmetic average measured concentration at the location of exposure over the last year.

2. When the location of exposure is an existing finished drinking water in which stable or improving conditions cannot be reasonably demonstrated by monitoring of the finished drinking water, the exposure point concentration shall be determined by a method approved by the department, such as use of groundwater monitoring data to make mass discharge calculations or groundwater fate and transport modeling.

3. When the location of exposure is a planned or possible finished drinking water, the exposure point concentration shall be determined by use of groundwater monitoring data to make mass discharge calculations approved by the department or groundwater fate and transport modeling approved by the department.

b. Soil. The location of exposure and exposure point concentration for soil are prescribed in the following subparagraphs.

(1) *Location of exposure.* The location of exposure to a contaminant of concern in soil for a screening human health risk assessment is the sample location within each impacted soil-depth zone with the highest detected contaminant concentration.

For a compliance human health risk assessment, the impacted area shall be divided into sub-areas (“averaging areas”) as specified in Table IV. Impacted areas shall generally be subdivided into averaging areas in which the length does not exceed twice the width and contaminants are concentrated in the fewest areas possible. Each impacted soil-depth zone in each averaging area shall be a location of exposure for a human health risk assessment.

Table IV also specifies the maximum area that an individual sample may represent for a compliance human health risk assessment that is used to determine if a condition warranting remedial action has been eliminated. The area represented by each soil sample shall generally be defined by perpendicular lines through the midpoints of lines connecting adjacent sample locations. Maximum sample area can, but does not necessarily, apply to a compliance risk human health assessment used for the initial determination of whether a condition warranting remedial action exists.

Table IV
Soil Exposure Areas

<u>Land-Use</u>	<u>Impacted Area (IA) (acres)</u>	<u>Maximum Averaging Area (acres)</u>	<u>Maximum Sample Area (Sq. Ft.)</u>
Residential	<0.25	0.25*	625
	≥0.25	0.25	625
Nonresidential	<1	1*	2,500
	1 - 10	1	2,500
	10 - 100	IA ÷ 10	(15,000 x IA) ÷ (50 + IA)
	>100	10	10,000

* If the impacted area is less than the maximum averaging area, the averaging area will be limited to the size of the property or properties on which the contamination exists.

(2) *Exposure point concentration.* For a screening risk assessment, the maximum concentration of each contaminant of concern found in each sampled soil-depth zone shall be the exposure point concentration.

For a compliance risk assessment, the exposure point concentration for soil in each soil-depth zone in each averaging area shall be the area-weighted arithmetic average contaminant concentration. A separate risk assessment shall be conducted for each applicable soil-depth zone in each averaging area. When analytical data are available at multiple depths at the same horizontal location within the same soil-depth zone, the highest concentration for each contaminant shall be used in the determination of the soil exposure point concentration or, with the department’s approval, a depth-weighted average concentration for that location may be used.

Up to ten soil-sample aliquots, each having an identical sample area, from the same soil averaging area from the same soil-depth zone may be composited into one sample for analysis.

Composite-sample results may be used for exposure point concentrations for compliance risk assessment when the composited sample represents the entire averaging area. When more than one composite sample is collected from an averaging area or a combination of composite and individual sample results is used for determining the exposure point concentration for an averaging area, the area-weighted arithmetic average concentration of each contaminant of concern from each composite sample or individual sample shall be used as the exposure point concentration for compliance risk assessment. Aliquots of a composite sample shall be retained for possible individual analysis per subrule 133.11(7).

c. Air. The location of exposure and exposure point concentration for air are prescribed in the following subparagraphs.

(1) *Location of exposure.* The location of exposure to contaminants in air by a resident or nonresident in a screening or compliance human health risk assessment shall be the interior of a residential or commercial building respectively, that is most susceptible to vapor intrusion and currently exists or is likely to exist in the foreseeable future. When an occupied building does not currently exist nor is planned, the location of exposure will be assumed to be the possible building location yielding the largest risk from exposure to vapors using methods listed in subparagraph 133.11(5)“c”(2) for which sufficient information exists. The location of exposure for a construction worker is the most susceptible location where an excavation greater than 5 feet deep could occur and be occupied by a construction worker (e.g., a utility trench).

(2) *Exposure point concentration methods.* Determination of the exposure point concentration for a contaminant in air may involve use of one of the six methods listed below.

1. The measured concentrations in an enclosed space. (This method may be subject to interferences from internal and external sources of contaminants.)
2. The measured concentrations of contaminants in a vapor sample from immediately below the floor slab of an existing enclosed space multiplied by the ratio of radon concentration in the sub-slab vapor sample to the radon concentration in the enclosed space.
3. The estimated indoor air concentrations based on Formula VIII and measured contaminant concentrations in a vapor sample from immediately below the floor slab of an enclosed space.
4. The estimated indoor air based on use of a vapor transport model approved by the department, such as a department-approved version of EPA’s Johnson & Ettinger Model.
5. The estimated indoor air concentration based on Formula VIII and measured contaminant concentrations in a soil-gas sample at the closest location to the location of exposure.
6. The estimated indoor air concentration based on Formula IX or Formula X and measured contaminant concentrations in a groundwater or soil sample, respectively at the closest location to the location of exposure.

(Formula VIII) $C_{\text{air-sg}} = C_{\text{sg}} \times AF_{\text{sg}}$

(Formula IX) $C_{\text{air-gw}} = H' \times 1,000 \times C_{\text{gw}} \times AF_{\text{sg}}$

(Formula X) $C_{\text{air-sl}} = (H' \times 1,000 \times C_{\text{sl}} \times \rho_b) \div (\theta_{\text{ws}} + K_{\text{oc}} \times f_{\text{oc}} \times \rho_b + H' \times \theta_{\text{as}}) \times AF_{\text{sg}}$

Where:

AF_{sg} = Attenuation Factor for soil gas to indoor air at the point of exposure (unitless) = 0.003 for residential and nonresidential exposures and 1 for a construction-worker exposure.

$C_{\text{air-sg}}$ = Concentration of a contaminant in air at the point of exposure estimated to result from the contaminant in soil gas. (Units = mg/m³)

$C_{\text{air-gw}}$ = Concentration of a contaminant in air at the point of exposure estimated to result from the contaminant in groundwater. (Units = mg/m³)

$C_{\text{air-sl}}$ = Concentration of a contaminant in air at the point of exposure estimated to result from the contaminant in soil. (Units = mg/m³)

C_{sg} = Concentration of a contaminant in soil gas. (Units = mg/m³)

C_{gw} = Concentration of a contaminant in groundwater. (Units = mg/l)

C_{sl} = Concentration of a contaminant in soil. (Units = mg/kg)

H' = Henry's Law coefficient at 55° F (chemical specific). (Dimensionless)

f_{oc} = Soil organic carbon weigh fraction (soil specific). (Dimensionless)

Default Value = 0.01.

K_{oc} = Soil organic carbon partition coefficient (chemical specific).

(Units = cm³/g)

ρ_b = Soil dry bulk density. (Units = g/cm³) Default Value = 1.86 g/cm³.

θ_{as} = Air-filled soil porosity. (Units = cm³/cm³) Default Value = 0.2.

θ_{ws} = Water-filled soil porosity. (Units = cm³/cm³) Default Value = 0.1.

(3) *Exposure point concentration in air for a resident or nonresident exposure scenario.*

The exposure point concentration for a screening or compliance risk assessment shall be determined by the first method listed in subparagraph 133.11(5)“c”(2) for which sufficient information is available. When the location of exposure is an existing building, method 1, 2, or 3 will generally be required for a compliance risk assessment. The exposure point concentration for a compliance risk assessment shall be the arithmetic average of at least three samples, separated by at least 3 months, of indoor air or air immediately below a floor slab using, if such samples can be reasonable attained. Otherwise, the exposure point concentration for a compliance risk assessment may be based on the arithmetic average of one-time soil-gas samples that adequately represent the location of exposure, as approved by the department. A compliance risk assessment for a situation with vapors originating from contaminants in groundwater shall be based on stable or improving groundwater conditions determined per subrule 133.9(6). In such a situation where stable or improving groundwater conditions do not currently exist, the exposure point concentration for a compliance risk assessment will be the exposure point concentration based on current conditions multiplied by the predicted stable groundwater concentration divided by the current groundwater concentration.

(4) *Exposure point concentration in air for a construction worker exposure scenario.* The exposure point concentrations for contaminants in air for a screening risk assessment shall be

determined using Formulae VIII, IX, and X and the highest measured contaminant concentrations in soil-gas, groundwater, and soil samples respectively, located in areas where excavation is reasonably possible. Contaminant concentrations found in a soil-vapor sample from a location above and in close proximity to a groundwater or soil sample and at a depth likely associated with an excavation in the area (absent overriding information, a default value of 6 feet below the ground surface may be used) will take precedence over the estimated vapor concentration using Formulae IX and X from the underlying groundwater or soil sample.

The exposure point concentrations for contaminants in air for a compliance risk assessment shall be the measured concentrations in soil-vapor samples collected from the most susceptible location as approved by the department. Alternatively, the measured concentrations of contaminants in a vapor sample from 4 feet above the bottom of a test pit excavated to a depth representative of likely construction needs (absent overriding information, a default test-pit depth is 8 feet) may be used to determine the exposure point concentrations. Stable or improving conditions must be demonstrated per subrule 133.9(6) for vapors originating from groundwater. If stable or improving groundwater conditions do not currently exist, adjustments to the exposure point concentration may be made as described in subparagraph (3) above.

133.11(6) *Chronic acceptable human health risk levels for resident, nonresident, and construction-worker soil exposure scenarios.* For each applicable exposure scenario, the summation of hazard quotients that affect the same target organ associated with each contaminant of concern and applicable route of exposure shall not exceed one, and the summation of cancer risks associated with each contaminant of concern and applicable route of exposure shall not exceed one in ten thousand.

133.11(7) *Acute acceptable human health levels for resident, nonresident, and construction-worker soil exposure scenarios.* The summation of hazard quotients that affect the same target organ associated with each contaminant in an individual environmental sample of soil shall not exceed ten. If the summation of hazard quotients associated with the same target organ from a composite soil sample times the number of aliquots which comprise the composite sample exceeds ten, the individual aliquot samples comprising the composite sample shall be analyzed and the results used to determine if an acute condition warranting remedial action exists.

133.11(8) *Acceptable air contaminant levels for a construction worker scenario.* A measured or estimated concentration of a contaminant in air for a construction worker per paragraph 133.11(5)“c” that is equal to or less than 10% of its federal Occupation Safety and Health Standards (OSHA) limit for air contaminants, or OSHA 8-hour time-weighted average, per 29 CFR Part 1910 Subpart Z is acceptable. If an OSHA limit has not been established for a contaminant, ten times the contaminant’s reference concentration per subrule 133.11(2) shall be used in lieu of 10% of the OSHA limit.

567—133.12(455B) Requirements for conduct of work.

133.12(1) *Persons conducting work.* All required activities under this chapter shall be conducted by or under the direct supervision of a qualified individual. Soil sampling for lead

analysis in pre-1978 residential settings, settings with child-occupied facilities, and those settings where structures are being converted to residential or child-occupied uses must be conducted by individuals qualified to conduct such work in accordance with 641—Chapter 70. Otherwise, qualified individuals include persons listed in 567—rule 134.2(455B, 455E). The department may approve other persons with appropriate backgrounds to be qualified individuals.

133.12(2) *Sampling protocols.* Sampling required by the department under this chapter shall be conducted using generally accepted protocols, including applicable procedures specified in EPA guidance documents, guidance documents prepared by the department, and 567—Chapters 110, 135, and 137. Other sampling protocols may be utilized if approved by the department.

133.12(3) *Laboratory analyses.* Laboratories that analyze samples required by the department shall be certified for the type of analyses being conducted per 567—Chapter 83.

567—133.13(455B) Compensation for damages to natural resources.

133.13(1) *Applicability.* This rule applies to persons who, by release of a hazardous substance to the environment, cause injury to, destruction of, or loss of natural resources held in trust by the state for the public. In most cases this would involve the destruction of aquatic life or other wildlife under the ownership of the state, as provided in Iowa Code section 481A.2. This rule relates to the compensation to the state and public for the natural resource damages and is in addition to any other legal recourse for the event or action that caused the destruction or damage.

133.13(2) *Liability to the state.* Persons who cause injury to, destruction of, or loss of natural resources of the state are liable to the state as provided by Iowa Code section 455B.392(1)“a”(3). This rule establishes the methodologies and criteria for evaluating the extent and value of the damage and establishes the methods of compensation. If the person and the department cannot agree to the proper resolution of a particular case, the issues of liability, damage and compensation will be established through contested case proceedings, as provided by 567—Chapter 7.

133.13(3) *Assessment.* When natural resources are destroyed or damaged by an identifiable source, the degree and value of the losses shall be assessed by collecting, compiling, and analyzing relevant information, statistics, or data through prescribed methodologies to determine damages, as set forth in this rule.

a. General. Except as specified otherwise in this rule, the definitions, methodologies, and criteria in 43 CFR 11 may be used to assess natural resource damages.

b. Fish loss. Assessment of damages for fish kills shall be in accordance with the following:

(1) Normally investigators will follow the methods prescribed by AFS to determine numbers of fish killed, by species and size.

(2) During periods of ice cover, where local conditions prevent using these methods, or in other appropriate circumstances, for example when the resources are known to have been

diminished by prior incidents, investigators will utilize the best information available to determine numbers of fish killed by species and size. Information may include existing or prior data on population levels in the affected water body or nearby water bodies with similar characteristics, including any historical fish kill data.

(3) The monetary valuation of fish shall be the replacement values as published in AFS for all fish lost except the following: channel catfish, flathead catfish, blue catfish, northern pike, muskellunge, northern pike/muskellunge hybrid, rainbow trout, brown trout, brook trout, white bass, yellow bass, white bass/striped bass hybrid, largemouth bass, smallmouth bass, spotted bass, crappie, rock bass, bluegill, redear sunfish, warmouth, pumpkinseed, freshwater drum, yellow perch, walleye, sauger, and walleye/sauger hybrid. The value of these fish shall be \$15 each, unless AFS establishes a higher value. Notwithstanding the above, the value of each fish classified by the department as an endangered or threatened species shall be \$1,000.

(4) The value of lost services to the public shall be the number of fishing trips lost over the period of the resource loss, as determined through local creel survey information or through interpolation from the most recent statewide creel survey. Each trip shall be valued at \$30.

(5) The cost of the investigation shall include salaries plus overhead for the time of staff, including support staff, involved in investigating the fish kill and performing the assessment; meals and lodging for staff while they are in the field conducting the assessment; mileage, valued at the current rate established pursuant to Iowa Code section 18.117; costs borne by the department associated with containment or cleanup operations; and any other costs directly associated with the investigation and assessment.

133.13(4) Compensation. The department will extend to the responsible person the opportunity to reach voluntary agreement as to the amount of damages and the compensation method. If the person disputes liability or the damage amount, the department will make a demand for payment and the person may appeal and demand contested case procedures under 567—Chapter 7. The method of compensation shall be solely in the discretion of the department.

a. Direct monetary payment. Compensation will normally be by direct monetary payment to the department. The money received will be used to replace, restore or rehabilitate the lost or damaged resources. Resource enhancement projects, support of educational programs relating to resource protection or enhancement, or resource acquisition of equal or greater value also may be funded. If practical, such alternatives should provide similar services to the public and should be in the vicinity of the loss.

b. Indirect monetary payment. In appropriate cases, an equal or greater amount of compensation may be made by monetary payment to another government agency or private nonprofit group in the natural resource field for the same purposes as provided in paragraph “a.”

c. Direct funding of projects. With the approval and oversight of the department, the person may be allowed to contract directly for the same purposes as provided in paragraph “a.”