



September 30, 2004

**RRD OPERATIONAL MEMORANDUM NO. 5**

**SUBJECT: GROUNDWATER SURFACE WATER INTERFACE CRITERIA**

**Key definitions for terms used in this document:**

<b>NREPA:</b>	<b>The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended</b>
<b>Part 31:</b>	<b>Part 31, Water Resources Protection, of NREPA</b>
<b>Part 201:</b>	<b>Part 201, Environmental Remediation, of NREPA</b>
<b>Part 213:</b>	<b>Part 213, Leaking Underground Storage Tanks, of NREPA</b>
<b>MDEQ:</b>	<b>Michigan Department of Environmental Quality</b>
<b>RRD:</b>	<b>Remediation and Redevelopment Division</b>
<b>Criteria or criterion:</b>	<b>Includes the cleanup criteria for Part 201 of NREPA and the Risk Based Screening Levels as defined in Part 213 of NREPA and R 299.5706a(4)</b>
<b>GSI:</b>	<b>Groundwater Surface Water Interface that is the location at which groundwater vents to a surface water body</b>
<b>Facility:</b>	<b>Includes "facility" as defined by Part 201 of NREPA and "site" as defined by Part 213 of NREPA</b>
<b>Mixing zone:</b>	<b>A mixing zone is the portion of a surface water body in which venting groundwater is mixed with the receiving water</b>

**PURPOSE**

This Operational Memorandum provides guidance on the application and implementation of the GSI criteria for the GSI pathway for site investigation and other response activities under Part 201, and Part 213 of NREPA. The MDEQ has determined the requirements of R 299.5716 are applicable requirements for corrective action under Part 213 of NREPA.

**INTRODUCTION**

Generic cleanup criteria for the GSI pathway have been developed pursuant to Sections 20120a(1) and 21304a of NREPA, R 299.5706a(4), and R 299.5716(6). Generic cleanup criteria are available in RRD Operational Memorandum No. 1.

Section 20120a(15) of NREPA requires that if a remedial action proposes to allow groundwater to vent to a surface water from a facility then the discharge must comply with the requirements of Part 31 of NREPA and the rules promulgated under that Part.

Section 3109a of NREPA allows for mixing zones for discharges of venting groundwater in the same manner as for point source discharges, and a permit for the discharge is not required if the discharge is provided for in a MDEQ-approved Part 201 remedial action plan or a Part 213 corrective action plan.

The MDEQ has identified water quality standards for hazardous substances developed under Part 31 of NREPA that constitute generic GSI criteria consistent with R 299.5716(6). Water quality standards include chronic chemical-specific values that represent the most restrictive of

the water quality values protective for aquatic life, human health, or wildlife; acute chemical-specific values protective of aquatic life; acute and chronic toxic units protective of aquatic life from groundwater toxicity testing; and standards for water quality characteristics (including physical characteristics, taste and odor, etc.). The chronic chemical-specific GSI criteria are listed in the criteria table of R 299.5744 and the associated footnotes of R 299.5750 (RRD Operational Memorandum No. 1). Acute chemical-specific GSI criteria protective of aquatic life are included in the Part 31, Rule 57 Water Quality Values spreadsheet available on the MDEQ web page (<http://www.michigan.gov/deq>, select Water, Water Quality Monitoring, Assessment of Michigan Waters, Rule 57 Water Quality Values). In addition to the chemical-specific water quality standards, consistent with provisions of R 323.1057(6) and R 323.1219, venting groundwater may not exceed 1.0 acute toxic units and venting groundwater may not cause or contribute to an exceedance of 1.0 chronic toxic units in the surface waters outside of any MDEQ approved mixing zone.

Response activities are required for exceedances of GSI criteria in groundwater, and for unacceptable water quality characteristics (e.g., R 323.1050 physical characteristics such as color, foam or sheens, or R 323.1055 taste and odor) in surface waters. (R 299.5716(3)). Response activities are required for any hazardous substance determined to have been released at the facility; for breakdown products of the released hazardous substances; for hazardous substances that have resulted from a reaction with the hazardous substances released (e.g., mobilization of soil constituents), or for water quality characteristics that have been adversely affected by the release.

Compliance with Part 31 of NREPA is demonstrated if generic GSI criteria are not exceeded in the groundwater at appropriate GSI monitoring points and no water quality characteristics exist in the surface water that require response activity. If compliance with generic criteria cannot be achieved, a person may request that the MDEQ approve a response activity that authorizes a mixing zone pursuant to R 299.5716(7) and (8), or includes site-specific criteria pursuant to R 299.5716(11).

### **RELEVANT PATHWAY**

The GSI pathway is relevant when a remedial investigation or application of best professional judgment leads to the conclusion that a hazardous substance in groundwater is reasonably expected to vent to surface water in concentrations that exceed the generic GSI criteria. (R 299.5716(1)). The GSI pathway may be relevant if there is a hydraulic connection from the groundwater to the surface waters of the state. Surface waters of the state are defined as the Great Lakes and their connecting waters (the connecting waters include the St. Mary's river, the Keweenaw waterway, the Detroit river, the St. Clair river, and Lake St. Clair), inland lakes, rivers, streams, impoundments, open drains, wetlands, and other surface bodies of water within the confines of the state. (R 323.1044(v) & (s)). This includes intermittent streams, creeks, brooks, ditches, drains or wetlands. The designation of groundwater not in an aquifer does not mean the GSI pathway is not relevant.

Factors that must be considered to determine if a hazardous substance in groundwater is reasonably expected to vent to surface waters in concentrations that exceed GSI criteria include the proximity of the surface waters, the direction of groundwater movement, preferential pathways, the mass of hazardous substances present at the facility that may affect the groundwater, and documented facility-specific evidence of natural attenuation. Fate and

transport modeling may be appropriately used to support a professional judgment about whether there is a reasonable likelihood of exceeding GSI criteria, but must be confirmed by field measurements.

### APPLICABLE CRITERIA

If the GSI pathway is determined to be relevant, the GSI criteria are applicable. Applicable criteria must include all appropriate hazardous substances released or otherwise affected by the release (reactions, breakdown products, etc.) and appropriate water quality characteristics. (R 299.5716(3)). If the target detection limit (RRD Operational Memorandum No. 2, Attachment 1) for a hazardous substance is greater than the risk-based GSI criterion the target detection limit is substituted for the risk-based value as the cleanup criterion. If the background groundwater concentration for a hazardous substance is greater than the risk-based GSI criterion, background is substituted for the risk-based value as the cleanup criterion. Background in groundwater means the concentration or level of a hazardous substance which exists in the groundwater at or regionally proximate to a site that is not attributable to any release at or regionally proximate to the site. Background in groundwater must be determined on a facility-specific basis if proposed to be substituted for a cleanup criterion. RRD Operational Memorandum No. 4 provides guidance on establishing groundwater background values.

GSI cleanup criteria include generic GSI criteria, site-specific GSI criteria developed under R 299.5716(11) and (12), and mixing zone-based GSI criteria developed under R 299.5617(7) and (8). Development of mixing zone-based GSI criteria may be proposed if there is, or there is expected to be, an exceedance of generic criteria. The requirements for development of mixing zone-based GSI criteria are discussed in detail under the heading Request for Mixing Zone-Based GSI Criteria.

Some generic chemical-specific GSI criteria are based upon the hardness or pH of the receiving waters. (R 299.5750(1)(G)). For these chemicals, representative site-specific surface water samples must be collected for hardness or pH measurements and the values used as input to the spreadsheet available on the MDEQ webpage (<http://www.michigan.gov/deqrrd>) select "Operational Memoranda for Part 201 and Part 213 Programs," "ERD-18: Footnote {G} - GSI/GSIPC Calculation") to calculate GSI and GSI protection criteria. To establish a value that can be used for evaluating the potential need for remedial activities, estimated hardness values of 50 milligrams per liter (mg/l) for the Upper Peninsula surface waters, 100 mg/l for northern Lower Peninsula surface waters, and 150 mg/l for southern Lower Peninsula surface waters may be used as input to the spreadsheet. To estimate a GSI criterion for pentachlorophenol 7.0 standard units may be used to represent the pH of the receiving water. Final determination of compliance with criteria must be based on criteria calculated with site-specific hardness or pH values.

Compliance with the generic GSI criteria for ammonia is determined by multiplying the total ammonia-nitrogen concentration in the groundwater by a default value to represent unionized ammonia. The default value for unionized ammonia is based upon pH and temperature of the receiving waters. (R 299.5750(1)(CC)). For the generic GSI criterion the default for temperature depends upon the designation of coldwater surface waters. To determine compliance with the criteria, the designation of the receiving surface water must be identified. The Michigan Department of Natural Resources designates coldwater lakes and trout streams. Copies of the designations are available from the RRD District Offices or on the MDEQ webpage ([www.michigan.gov/deqrrd](http://www.michigan.gov/deqrrd)). If the surface water is not designated as coldwater it is



protected as warmwater. Representative site-specific surface water measurements may be collected for temperature or pH and the maximum values used rather than the default pH of 8 standard units and default surface water temperatures of 68°F for coldwater and 85°F for warmwater to estimate an alternative default value pursuant to R 299.5750(1)(CC).

Some generic chemical-specific GSI criteria depend upon whether the surface water is protected as a drinking water source (R 299.5750(1)(X)). The Great Lakes and their connecting waters are protected as a drinking water source. (R 323.1100) A listing of public water supply intakes on inland lakes and rivers is available from the RRD District Offices or is available on the MDEQ webpage (<http://www.michigan.gov/deqrrd>).

Generic chemical-specific GSI criteria may be based upon Tier I or Tier II water quality values depending on the amount of toxicity data available at the time the water quality standards were developed. Tier I values represent a complete toxicity data set, and Tier II values an incomplete set. The Tier I or II designation is indicated in the Part 31, Rule 57 Water Quality Values spreadsheet. Additional information on the toxicity data used to calculate a Tier II water quality value for a hazardous substance may be obtained through the RRD District Office. A person may submit a proposal, for MDEQ review and approval, to develop additional mammalian or aquatic toxicity data to reduce the uncertainty factor used in the development of the Tier II values or to allow for calculation of Tier I values. Following submittal and review of the additional data developed pursuant to the MDEQ approved proposal the value may be modified in accordance with applicable provisions of Part 31.

Development of site-specific criterion may be proposed under the provisions of R 299.5716(11) and the Part 31 rules that specify what site-specific modifications are allowed. Aquatic life values may be modified on a site-specific basis to be more or less stringent to reflect local environmental conditions. Modifications may be derived using the recalculation procedure, water effect ratio procedure, or resident species procedure described in section 3.7 entitled "Site-Specific Aquatic Life Criteria" in chapter 3 of the United States EPA Water Quality Standards Handbook, second edition - revised (1994). (R 323.1057(2)(r)). Wildlife values may be modified on a site-specific basis to be more or less stringent to reflect local environmental conditions. (R 323.1057(3)(n)). Human health values may be modified on a site-specific basis to be more or less stringent to reflect local environmental conditions or local human exposure. Less stringent human health values must be protective of designated uses of the surface waters of the state and must be based on sound scientific rationale. (R 323.1057(4)(h)). Site-specific criteria must be numerical criteria expressed as hazardous substance concentrations in groundwater. (R 299.5716(11)).

If the water quality standard has not been developed under Part 31 for a hazardous substance of concern then the necessary data for the MDEQ to establish a criterion under Part 31 must be provided to the MDEQ and a water quality standard developed prior to any authorization of the discharge, unless the MDEQ can establish criterion based upon comparison to a hazardous substance criterion with similar fate and toxicity or can determine that a numerical criterion is not required to assure the remedial action will be protective. (R 299.5703(3)).



GSI samples must be representative of the groundwater within the contaminant plume venting to the surface water. Contaminant concentrations must be measured in the groundwater contaminant plume or in the path of the contaminant plume at points located as close to the surface water body as feasible, where and when groundwater gradients show that the groundwater is moving toward the surface water body. GSI compliance monitoring points must be selected after taking into consideration changes in groundwater flow direction, so that samples from the GSI wells are representative of groundwater flowing to the surface water. This requirement does not preclude location of monitoring points in a floodplain. GSI monitoring points must be downgradient of the release and should, wherever possible, be in locations where groundwater is not normally recharged by the surface water (i.e., where periodic flooding and associated bank storage is not a factor). Water surface elevations in the surface water and groundwater must be determined before and during each sampling event in order to demonstrate that groundwater is and has been moving toward the surface water body for a period of time adequate to preclude dilution of groundwater with surface water.

Groundwater sampling guidance applicable to the GSI is available in RRD Operational Memorandum No. 2, Attachment 5 regarding collection of samples, and RRD Operational Memorandum No. 4, Attachment 2 regarding groundwater sampling strategies.

### **GSI MONITORING POINTS**

Generic GSI monitoring points are defined as vertical wells at locations in the saturated zone that are representative of groundwater entering surface water. (R 299.5716(10)). Monitoring well locations must be as close as practical to surface waters where groundwater flow direction is toward the surface water. Samples must be representative of groundwater, not surface water. The direction of groundwater flow and hydraulic gradient must be determined during each sampling event by measurement and evaluation of water surface elevation levels in each sampling location and the receiving surface water body. The GSI monitoring well network must be designed to monitor both the highest concentrations and full distribution of hazardous substances that exceed applicable criteria in the aquifer at the area of compliance. The monitoring points must include the interval or intervals that represent the highest concentrations of hazardous substances. Additional guidance relevant to GSI monitoring wells is included in RRD Operational Memorandum No. 4, Attachment 2, Groundwater.

If venting groundwater enters a storm drainage system owned by an entity that is subject to storm water regulation under the federal water pollution control act, 33 U.S.C. §§ 1251-1387, then the person who is conducting response activity to address that venting groundwater must comply with applicable storm water program requirements regarding elimination of illicit discharges in the storm drainage system owner's discharge permit or with local ordinances regarding illicit discharges, if such ordinances apply. A list of regulated communities and guidance on the storm water program is available on the MDEQ webpage (<http://www.michigan.gov/deq> select Water, Surface Water, Storm Water, Municipal Program/MS4 Guidance). In all other cases, when groundwater is venting indirectly to surface waters of the state through storm sewers, monitoring points must be established in locations that are as close as practical to the storm sewer or must be at alternative monitoring locations approved by the MDEQ to allow representative monitoring before the groundwater mixes with any flow in the sewer. The GSI criteria applicable at the monitoring point may be mixing zone-based criteria that are based on the characteristics of the receiving water to which the sewer discharges, if a proposal for mixing zone-based criteria is approved by the MDEQ.



### REPRESENTATIVE SAMPLING

The use of GSI monitoring points other than the generic GSI monitoring wells is acceptable only if approved by the MDEQ in accordance with the provisions of R 299.5716(13). If a person proposes to rely on alternative monitoring points, a proposal must be submitted for MDEQ approval. The proposal must contain a precise definition of where and how the plume is venting to surface waters, and must identify and document the chemical, physical, or biological processes that would result in reduction of the hazardous substances between the location of generic GSI monitoring wells and the location of any proposed alternative monitoring points consistent with the provisions of R 299.5716(13). A proposal for alternative GSI monitoring points for venting groundwater that is acutely toxic will require compliance with applicable provisions of R 299.5526(4) and R 299.5716(14).

### NECESSARY INTERIM RESPONSE ACTIVITIES

If there is an exceedance of a GSI criterion based upon acute toxicity at a generic GSI monitoring well or MDEQ approved alternative GSI monitoring point then immediate action must be taken. An exceedance of GSI criterion may be based upon an exceedance of a chemical-specific acute toxicity value or the groundwater may be determined to be acutely toxic from whole effluent toxicity testing. If a person has Section 20114 of NREPA obligations, R 299.5526(4)(d) requires interim response activities to be initiated immediately upon obtaining information that there is groundwater venting to the surface water that is acutely toxic, and requires that response activities continue as necessary to mitigate or eliminate the discharge. If a person does not have Section 20114 of NREPA obligations, the provisions of R 299.5716(14) require notice of the conditions to the MDEQ within seven days of obtaining knowledge that the exceedance is occurring if the person is liable under Section 21026 of NREPA, or if the person intends to seek approval of an alternative monitoring point. Within 60 days of the initial notice to the MDEQ of the acute exceedance the person must submit to the MDEQ one or more of the following:

- A schedule for completion of response activity to prevent the discharge that exceeds applicable criteria.
- Notice of intent to propose alternative GSI monitoring points and a schedule for submission of the documentation as required by R 299.5716(13).
- Notice of intent to propose site-specific criterion and a schedule for submission of the information as required by R 299.5716(11).

The documentation must provide a reasonable basis to determine that the proposal for an alternative monitoring point or site-specific criterion will result in compliance in an acceptable timeframe. Upon review of the submittal the MDEQ may direct necessary response actions be undertaken or modifications to proposed schedules.

### REQUEST FOR MIXING ZONE-BASED GSI CRITERIA

If generic GSI criteria are exceeded or reasonably expected to be exceeded at generic GSI monitoring wells a person may request the MDEQ approve a response activity that authorizes a mixing zone pursuant to Section 3109a of NREPA. (R 299.5716(7) and (8)). A form to provide the information necessary for the MDEQ to process the request is included as Attachment 1.

Pursuant to R 299.5716(7) a request for the MDEQ to develop mixing zone-based criteria must provide the following information:

1. The name of the receiving surface water and the location where groundwater is venting.

- a. This information must include a map that illustrates the location of the facility, the location of the contaminant plume, and the receiving surface waters.
- b. The GSI pathway exposure assumptions include unrestricted residential or recreational use of the receiving surface water. Information regarding the location where the groundwater vents must include any information that would make these assumptions not applicable to site conditions.
2. The location, nature, and chemical characteristics of past and current sources of groundwater contamination.
  - a. The information must provide the basis for any conclusions that source concentrations for all contaminants do not and will not exceed generic GSI criteria at the generic GSI monitoring wells, or the request for mixing zone-based GSI criteria must include source concentrations and all source contaminants.
  - b. The information must include any evidence of the presence of any dense or light non-aqueous phase liquids.
3. The name, chemical abstract service (CAS) number, and concentration of the hazardous substances in the groundwater at the generic GSI monitoring points and upgradient of the interface to the source area of hazardous substances that have a potential in the future to reach the GSI monitoring wells, and water quality characteristics.
  - a. To assure that mixing zone-based criteria are developed for all contaminants likely to exceed generic GSI criteria maximum concentrations upgradient of the GSI monitoring points to the source area must be provided.
  - b. Any hazardous substance without established generic GSI criteria must be included.
  - c. Any existing unacceptable water quality characteristic must be included.
  - d. CAS numbers can be obtained from chemical dictionaries and the National Institute of Occupational Safety and Health Pocket Guide to Chemical Hazards.
  - e. Cross sectional mapping of the contaminant plume, the location of monitoring wells and borings, elevation of each groundwater sampling location, contours for individual or groups of contaminants, and other relevant information should be included to assist in demonstrating the worst case maximum concentrations predicted to reach the GSI monitoring wells.
4. The discharge rate, in cubic feet per second, of that portion of the venting groundwater plume that exceeds, or is likely in the future to exceed, a generic GSI criterion.
  - a. The mixing zone-based criteria are calculated based upon the maximum discharge rate of venting groundwater. (R 323.1209).
  - b. The plume discharge rate is calculated using Darcy's Law ( $Q_p = k \cdot i \cdot A$ ) where:
 

$Q_p$	= Discharge rate, in cubic feet per second, of groundwater plume for the area contaminated above generic GSI criteria.
$k$	= A representative hydraulic conductivity within the area of plume discharge.
$i$	= A representative hydraulic gradient within the area of plume discharge.
$A$	= The cross-sectional area of the plume perpendicular to groundwater flow that encompasses the entire plume that exceeds the generic GSI.
  - c. The hydraulic conductivity value ( $k$ ) should be obtained from properly designed and representative aquifer pumping tests (pumping tests).

Additional guidance on representative pumping tests is available in RRD Operational Memorandum No. 4, Attachment 2, Groundwater. If rising and falling head tests (i.e., slug tests) are proposed in lieu of pumping tests as the means of determining hydraulic conductivity at a facility, documentation must be provided that demonstrates the results are representative for site conditions. Documentation must include an analyses of the test results that includes, as a minimum, information that addresses the following:

- Details of the procedures followed in the design, performance, and analysis phases of the test program and details of the design, construction, and development of the monitoring wells tested. Well placement and effective well development are very important elements of a slug test program.
  - An evaluation to determine if the test results are reliable and within a range of values that are appropriate for the aquifer material types known to exist at the site.
  - The number of tests and test locations appropriate for effectively characterizing a site is dependent upon site conditions and size. Representative testing must be located within the most conductive formation material. Three or more rising and falling head tests of varying displacement values should be performed at each well location included in the slug testing program.
  - If the hydraulic conductivity values obtained from a slug testing program are not consistent with the values associated with the aquifer materials known to exist at the site, or if there is uncertainty regarding the quality of the slug test program, then an appropriately conservative multiplier (e.g., 3 to 10 times) must be used to obtain a representative value. Documentation and justification must be provided to support the multiplier.
- d. The hydraulic gradient (i) used must not underestimate the gradient. The maximum hydraulic gradient observed at a site from several representative hydraulic gradient determinations should be used to calculate the discharge rate. In the event that seasonal variations occur the highest hydraulic gradient must be used.
- e. The limits of the cross-sectional area (A) extend to the nearest adjacent wells along the GSI in which groundwater concentrations are consistently below generic GSI criteria. The vertical extent must also be based upon wells with consistent concentrations below generic GSI criteria or on demonstrated geological constraints such as the top of the water table to a basal or confining clay layer. The assumption is that groundwater concentrations exceed generic GSI criteria within the defined areas.
5. The location of other venting groundwater plumes in the vicinity of the facility in question, together with information about the names and concentrations of hazardous substances in those plumes, if available.
- a. Available information from the MDEQ webpage, or general knowledge should be used to identify locations of venting groundwater or point source discharges that may affect the mixing zone allocation. For a lake discharge, information regarding other discharges in the watershed vicinity should be included, for a stream discharge

- information regarding other discharges in the vicinity of the receiving stream segment should be included.
6. If the venting groundwater is a new or increased discharge to the surface waters of the state, then information to support an antidegradation demonstration or exemption, if one is required or allowed under R 323.1098.
    - a. R 323.1098 requires that waters of the state which are currently better water quality than the water quality standards not be allowed to be degraded by a “new or increased loading” unless there is an “antidegradation demonstration.” The effective date of this provision is July 1997. The antidegradation demonstration required by these rules applies to venting groundwater as a “new” loading. If the contaminant plume vented to surface waters prior to July 1997 and continues to vent it is considered an existing loading. A contaminant plume that began to vent after July 1997 is considered a new loading. If a contaminant plume has been intercepted through response activities and it is proposed to stop those response activities and allow the plume to vent, the discharge is considered a new loading. An increased loading is a contaminant plume in which the groundwater contaminant concentrations have or will substantially increase due to the migration of source area contamination, leaching of soil contaminants, or further migration of contaminated groundwater.
    - b. The demonstration must show the discharge is in the public interest based upon identified social or economic benefits to the area in which the new or increased loading will occur. Venting groundwater contamination frequently from Part 201 or Part 213 facilities is from historical practices and there is no current operating presence to balance employment, production, or efficiencies with quantifiable additional costs of remediation. The demonstrations for these facilities has balanced the additional remediation costs to an increased use of the facility (e.g., redevelopment or other industrial, commercial or residential growth), and other economic or social benefits to the community. Simply removing any perceived social stigma associated with the contaminated site to allow redevelopment has not been considered a social or economic benefit to justify allowing the increased loading.

The submittal must contain sufficient information for the MDEQ to process the request. Site characterization must be sufficient to provide the necessary information. Pursuant to R 299.5716(8), upon receipt of sufficient information, the MDEQ will calculate mixing zone-based GSI criteria according to Section 3109a of NREPA and the related rules promulgated under Part 31 of NREPA.

Chronic mixing zone-based criteria are calculated based on dilution of the maximum discharge flow of venting groundwater and the allocated low flow value of the receiving surface waters. Low flow values for surface waters are available from the MDEQ webpage (<http://www.michigan.gov/deg> Select Water, Water Management, Hydrologic Data Collection & Analysis, Flood and Low flow Discharge Reporting System, Low flow discharge database). Other contaminant loadings in the surface water body may limit the available dilution.

Acute mixing zone-based criteria are calculated as maximum concentrations not to be exceeded at the GSI monitoring points in order to prevent harm to aquatic life. Dilution is not a factor in the calculation of acute criteria.

For certain chemicals and for stream segments with waste load allocations, the dilution afforded by the surface water body may not be the limiting factor in determining mixing zone-based GSI criteria because the assimilative capacity of the stream segment has been reached for specific contaminants. A list of stream segments with waste load allocations and the specific contaminants affected is available on the MDEQ webpage (<http://www.michigan.gov/deqrrd>). Ambient concentrations in most Michigan surface waters exceed the applicable water quality standards for polychlorinated biphenyls (PCBs) and mercury and mixing zone-based calculations for these bioaccumulative chemicals of concern (BCCs) will not include dilution. Existing discharges of venting groundwater that includes other BCCs may, on a case-by-case basis, be allowed dilution. No mixing zone is available for new discharges of BCCs.

In some circumstances, chemical-specific criteria may not be protective of aquatic life due to the number or nature of toxic substances and/or unidentified substances found in the venting contaminant plume. Whole Effluent Toxicity testing of the groundwater contaminant plume may be necessary to assess the toxicity of the groundwater. The MDEQ may specify requirements, including test methods, for such testing with the development of mixing zone-based criteria.

The calculation of mixing zone-based GSI criteria alone does not constitute an MDEQ mixing zone determination and is not authorization for the discharge of venting groundwater.

#### **ALTERNATIVE MIXING ZONE DEMONSTRATION**

Mixing zone-based criteria calculations can provide no greater than a ten fold dilution factor to groundwater venting to the Great Lakes or inland lakes (R 323.1082(5)) and can not allocate more than 25 percent of the receiving surface water low flows in river systems (R 323.1082(2) and R 323.1090) unless it can be demonstrated to the MDEQ that use of a larger volume is acceptable consistent with the provisions of R 323.1082(7). An alternative mixing zone demonstration consistent with R 323.1082(7) must provide information that assures exposure in a mixing zone will not result in deleterious effects to populations of aquatic life or wildlife, and provides precise definition of where and how the groundwater plume vents. If venting groundwater is acutely toxic the MDEQ has determined that an alternative mixing zone determination to allow dilution is not protective.

#### **AUTHORIZATION OF VENTING GROUNDWATER**

When it has been demonstrated that there is no exceedance of generic GSI criteria in the GSI monitoring wells and there is no unacceptable water quality characteristic in the surface waters that requires response activities, the MDEQ authorizes the discharge of the venting groundwater by operation of R 299.5716(6) and no request for authorization of the discharge is required. Statistical analysis is not allowed for comparison to generic GSI criteria for this demonstration.

The MDEQ will not authorize a venting groundwater discharge unless sufficient information is provided to determine that the discharge is protective of the public health, safety, welfare, and the environment.

The MDEQ will establish conditions for authorization of venting groundwater when a mixing zone determination is part of approved response activities through the legal agreement for an approved Part 201 remedial action plan; or audit of a Part 213 corrective action plan and the publication of the mixing zone determination in the MDEQ calendar.



The MDEQ may authorize the venting groundwater with approval of an interim response if information is provided that supports the conclusion that the discharge is protective of the public health, safety, welfare, and the environment and the person receiving the authorization accepts any conditions the MDEQ may impose regarding the authorization pursuant to R 299.5526(9).

The MDEQ authorization of venting groundwater above generic GSI criteria cannot be for a period longer than five years, consistent with the provisions of R 323.2150. The document providing the MDEQ authorization of the venting groundwater will establish the conditions for reauthorization.

### **COMPLIANCE WITH MIXING ZONE-BASED GSI CRITERIA**

Compliance with mixing zone-based GSI criteria is demonstrated if there are no mixing zone-based GSI criteria exceedances in the generic GSI monitoring wells, and no water quality characteristics exist in surface water that require response activity. (R 299.5716(9)).

Compliance with mixing zone-based GSI criteria that are based on chronic toxicity endpoints may be demonstrated by a statistical evaluation of the data, if that evaluation is part of an MDEQ-approved monitoring plan. The statistical evaluation may be based, if sufficient data are available, on a properly calculated and documented 95 percent upper confidence limit on the mean, or other statistical technique approved by the MDEQ. (R 299.5716(9)(b)). Compliance with mixing zone-based GSI criteria that are based on acute toxicity must be demonstrated on a point-by-point basis. (R 299.5716(9)(b)). Additional guidance on the applicability of statistics is available in the [MDEQ Sampling Strategies and Statistics Training Materials](#).

### **LONG TERM MONITORING REQUIREMENTS**

A method must be established to ensure that contaminants in groundwater are not venting, and will not vent, to surface waters above applicable GSI criteria. Extended monitoring at GSI monitoring points and sentinel monitoring points identified in the aquifer monitoring plan as required by Sections 20118(10), 21309a(2) of NREPA and the applicable provisions of R 299.5716 will be necessary unless the facility is adequately characterized to determine that any exceedance of applicable GSI criteria is unlikely. In that situation, if the remediation relies upon mixing zone-based criteria, adequate long term monitoring to establish that generic GSI criteria are met will be necessary or the authorization for that venting groundwater will require on-going evaluation for periodic reauthorization.

Sentinel monitoring wells will be necessary when prior warning of a potential exceedance at the GSI monitoring wells is required to allow sufficient time for additional response activities to be implemented to prevent unacceptable discharges to the surface water.

The portion of the contaminant plume to be monitored for compliance will generally consist of the portion of the groundwater plume where contaminants exceed or are expected to exceed generic GSI criteria. The monitoring area(s) will be defined in the remediation plan. Compliance monitoring areas will need to be specifically identified for each contaminant in the venting groundwater plume. This may result in multiple compliance monitoring areas. Depending upon site-specific circumstances, it may be necessary to adjust the compliance monitoring points during implementation of the remediation plans.



A contingency plan is required when it is necessary to identify additional response activities that may be required to address a future exceedance of generic GSI criteria. If venting in excess of generic GSI criteria has not yet occurred, the contingency plan may include a request for a mixing zone determination and a further contingency if the mixing zone-based criteria do not resolve the anticipated exceedances of generic GSI criteria.

A contingency plan is required in conjunction with an authorization to rely on mixing zone-based GSI criteria when it is necessary to identify additional response activity that may be required to address a future exceedance of the mixing zone-based GSI criteria and to assure protection of the public health, safety, welfare, and the environment pursuant to R 299.5716(9)(c) and remedial action plan or corrective action plan requirements. The contingency plan may allow for evaluation of the significance of any exceedance before implementation of additional response activity to control a future discharge that exceeds the mixing zone-based GSI criteria. An exceedance of a GSI criterion based on acute toxicity is predetermined to be a significant exceedance by provisions of R 299.5526(4) and R 299.5716(14). Evaluations of the significance of exceedances of chronic criteria must consider, at a minimum, the magnitude and expected duration of the exceedance in relation to the speed with which additional response activities can be implemented, and the feasibility of implementing additional response activity during the anticipated duration of the exceedance. The details of the contingent actions must reflect the known conditions of the facility and the associated risks.

Corrective action plans, remedial action plans, or plans for interim response activities designed to meet criteria must provide sufficient information to demonstrate that the monitoring program and contingency actions are adequate to protect public health, safety, welfare, and the environment, and comply with provisions of Part 31 and Part 201 or Part 213 of NREPA. Additional requirements for Part 201 plans that address venting groundwater are included in R 299.5526, R 299.5530, and R 299.5532.

  
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Andrew W. Hogarth, Chief  
Remediation and Redevelopment Division

Dated: 9/30/04

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This memorandum and its attachments are intended to provide direction and guidance to foster consistent application of Part 201 and Part 213 of NREPA and the associated administrative rules. This document is not intended to convey any rights to any parties or create any duties or responsibilities under the law. This document and matters addressed herein are subject to revision.



The following documents are rescinded with the issuance of this operational memorandum:

- Environmental Response Division Operational Memorandum 17, Instructions for Obtaining Determinations on Mixing Zone-Based Groundwater Surface Water Interface Criteria for Inclusion in Remedial Action Plans and Monitoring Compliance with Criteria for Discharges of Groundwater Contaminants to Surface Water dated September 8, 1998.
- Storage Tank Division Operational Memorandum 8, Requests for Venting Groundwater Mixing Zone Determinations, dated November 5, 1998.

[\(Click here for attachment\)](#)