BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the Matter of the Petition of Saline County)
)
Landfill, Inc., for an Adjusted Standard)

No. AS-2016-1

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STATE OF ILLINOIS
Pollution Control Board

NOTICE OF FILING

Please take notice that today I have filed with the Office of the Clerk of the Pollution Control Board, and with the Office of the Hearing Officer assigned, responses to the questions directed to Petitioner in the Hearing Officer's Order of October 8, 2015. A copy of that motion and a proposed form of Order is hereby served upon you.

ORIGINAL

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DATE: December 7, 2015

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Pollution Control Board

December 7, 2015

D ORIGINAL

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James R. Thompson Center
Suite 11-500
100 W. Randolph St.
Chicago, IL 60601

RE: Petition of Saline County Landfill for Adjusted Standards AS-2016-1

Dear Sir or Ma'am,

Enclosed please find Saline County Landfill, Inc.'s responses to the thirty-three group questions in the Hearing Officer's Order dated October 8, 2015. The enclosed filing is submitted on recycled paper. An original and three (3) copies are included, per 35 IL Admin. Code 101.302(h)(1)(B).

The responses to the thirty-three questions are structured in question – response format, pages 794 through 834. Attachments A through F support the responses to specific questions in the October 8, 2015 Order. Requested adjusted standard language modifications are in Attachment G. The location and content of these attachments are summarized below:

Attachment	Content	In Response to Question No.
A	Proposed Assessment Monitoring Parameters & Groundwater Protection Standards, pages 835-841	No. 17
B	Board Adjusted Standard Regulatory Justification, pages 842-846	Nos. 14, 21 and 22(b)
C	Proposed Detection Monitoring Constituent GPS Values, pages 847-850	Nos. 25 and 28

D	Graphical Analysis, pages 851-853	No. 26
E	Proposed Permit List G2 Constituent PQL (Unit 1 v. Unit 2) Comparison, pages 854-856	No. 29
F	Chromium Leaching Technical Article, pages 857-873	No. 14
G-1	Proposed Adjusted Standard Regulatory Wording, with redline changes, pages 874-909	Compilation of Regulatory wording changes
G-2	Proposed Adjusted Standard Regulatory Wording, without redline of changes, pages 910-941	Compilation of Regulatory wording changes - clean copy

Yours very truly,

Brian Konzen

BEK:kh
Encl.
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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the Matter of the Petition of Saline County)
) No. AS-2016-1
Landfill, Inc., for an Adjusted Standard)

CERTIFICATE OF SERVICE

The undersigned hereby certifies that true and correct copies of the foregoing responses to questions were deposited in the United States Post Office at Edwardsville, Illinois, on the 7th day of December, 2015, before 5:00 p.m. properly enclosed in an envelope with postage prepaid and addressed to:

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QUESTIONS FOR SALINE COUNTY LANDFILL,INC. (AS 16-1)

The Board asks that Saline County Landfill, Inc. (SCL) respond to the following questions relating to its petition for an adjusted standard. SCL sequentially numbered its July 17, 2015 petition in the upper right corner of each page and the Board cites to the petition using these page numbers as "Pet. at _."

Detection Monitoring

1. *SCL's proposed adjusted standard to 35 Ill. Adm. Code 811.319(a)(2)(A)(ii) deletes cadmium, magnesium, sulfate, total dissolved solids (TDS) and zinc from detection monitoring. Pet. at 297 (App. B). However, in the Adjusted Standard Technical Demonstration (ASTD), SCL states that constituents indicative of acid mine drainage are proposed to be retained as part of the monitoring program and identifies dissolved sulfate, TDS, specific conductance, dissolved magnesium, iron and manganese. Pet. at 142; see also Pet. at 48, 95 (Table 4). The Illinois Environmental Protection Agency (IEPA) recommends that ammonia, barium, magnesium, sulfate, TDS, and zinc be retained in the detection monitoring list. IEPA Recommendation (Rec.) at 14-16. Comment on whether the following language reflects SCL's request for an adjusted standard as to Section 811.319(a)(2)(A)(ii).*

> *In lieu of 35 Ill. Adm. Code 811.319(a)(2)(A)(ii), SCL must monitor for the following list of constituents:*
>
> *Ammonia- Nitrogen (dissolved)*
> *Arsenic (dissolved)*
> *Barium (total)*
> *Bicarbonate Alkalinity (dissolved)*
> *Boron (dissolved)*
> *Chloride (dissolved)*
> *Chromium (dissolved)*
> *Cyanide (total)*
> *Lead (dissolved)*
> *Magnesium (dissolved)*
> *Mercury (dissolved)*
> *Nitrate (dissolved)*
> *Potassium (total)*
> *Sodium (total)*
> *Sulfate (dissolved)*
> *Total Dissolved Solids*
> *(TDS)*
> *Zinc (dissolved)*

Response to Comment

During the IEPA review of the initial draft of the Adjusted Standard, the Agency pointed out the value of continuing to monitor some constituents such as total dissolved solids (TDS), dissolved sulfate dissolved magnesium etc. as an indication of changes in groundwater quality due to acid mine drainage. As such, the revised petition that was submitted to the Board suggested that these constituents that provide an indication of acid mine drainage impacts continue to be monitored in addition to the landfill leachate indicator constituents so that the source of major influences on the geochemistry could be readily identified. However, pursuant to the IEPA recommendations, the petition requested that they be exempted from the statistical analysis requirements of 35 IAC 811.319(a)(4)(A)(ii) and (iv) but not the trend analysis requirement specified at 35 IAC 811.319(a)(4)(A)(i). As such, the list proposed by the Board has been amended below to reflect this understanding:

ii. In lieu of 35 Ill. Adm. Code 811.319(a)(2)(A)(ii-vi), SCL must monitor for the following list of constituents:

Ammonia- Nitrogen (dissolved)^#
Arsenic (dissolved)
Barium (total)
Bicarbonate Alkalinity (dissolved)
Boron (dissolved)
Chloride (dissolved)^#
Chromium (dissolved)#
Cyanide (total)
Lead (dissolved)
Magnesium (dissolved)*
Mercury (dissolved)
Nitrate (dissolved)
Potassium (total)
Sodium (total)
Sulfate (dissolved)*
Total Dissolved Solids (TDS)*
Zinc (dissolved)*
pH*

iii) This is the minimum list for MSWLFs.

iv) Any facility accepting more than 50% by volume non-municipal waste must determine additional indicator parameters based upon leachate characteristic and waste content.

v) The monitoring of the constituents designated in 35 IAC 811.319(a)(1)(A)(ii) by "*" shall be conducted in order to characterize potential acid mine drainage effects on the groundwater quality. The "*" designated constituents) shall be subject to 35 IAC 811.319(a)(4)(A)(i) -the 8 consecutive monitoring event trend analyses but exempt from 35 IAC 811.319(a)(4)(A)(ii) and (iv)- the statistically based comparisons to maximum allowable predicted concentrations (MAPCs) within the zone of attenuation and the Applicable Groundwater Quality Standard (AGQS) beyond the zone of attenuation.

vi) The constituents designated in 35 IAC 811.319(a)(1)(A)(ii) by "^" shall be subject to 35 IAC 811.319(a)(4)(A)(i) 8 consecutive monitoring event trend analyses but exempt from 35 IAC 811.319(a)(4)(A)(ii) - the statistically based comparisons to maximum allowable predicted concentrations (MAPCs) at wells located within the zone of attenuation.

vii) Constituents designated in 35 IAC 811.319(a)(1)(A)(ii) by "#" have Board adjusted groundwater quality standards. The applicable groundwater quality standard for dissolved ammonia (15 mg/L), dissolved chloride (200 mg/L) and dissolved chromium (100 ug/L) are the effective applicable groundwater quality standard at or beyond the landfill's zone of attenuation.

2. SCL proposes that pH and specific conductance will be monitored as field parameters. Pet. at 48. SCL, in a September 21, 2015 filing with the Board, states that it is not pursuing an adjusted standard as to specific conductance at this time. Confirm that SCL intends that these field monitoring parameters will be addressed with IEPA, such as through permit conditions, and not as an adjusted standard ordered by the Board.

Response to Comment

pH and specific conductance are parameters that are measured in the field to provide an indication of when the groundwater pre-sample purge has equilibrated in a manner which is likely to provide a groundwater sample that is representative of the formation groundwater quality. Both of these constituents' measure ion concentrations in groundwater that are likely to be strongly affected by acid mine drainage (i.e., pH is a direct measure of the acidity of the groundwater and specific conductance is a measure of the dissolved ions in solution). Because specific conductance is not specifically listed by 35 IAC 811.319(a)(2)(A), it is believed that Board relief is not required to exempt this constituent from statistical analysis (i.e., that the issue could be resolved with IEPA concurrence through permit changes alone). As such, pursuant to the IEPA comments on the petition, the applicant has agreed to withdraw the specific conductance adjusted standard petition relief request. The request to exempt specific conductance from statistical analysis requirements of permit conditions VIII.13(b) and (d) will be made to IEPA as a significant permit modification once a decision has been rendered on the proposed adjusted standard relief.

The petitioner has requested that the Board exempt pH from the detection and assessment monitoring data analysis requirements of 35 IAC 811.319(a)(4)(A)(ii) and (iv) since the constituent might be subject to such requirements pursuant to assessment monitoring requirements of 35 IAC 811.319(b)(5)(A) and 35 IAC 811.319(b)(5)(F).

3. *SCL's proposed adjusted standard includes a change to Section 811.319(a)(2)(A)(i) requiring a constituent to be monitored if it "appears in, or is expected to be in, the leachate at concentrations which are greater than the groundwater." Pet. at 297 (App. B). According to the ASTD, some constituents, including magnesium, sulfate and zinc, are present in leachate at lower concentrations than in groundwater. Pet. at 135-137. Comment on whether SCL's proposed adjusted standard to Section 811.319(a)(2)(A)(i) creates a conflict between that regulation and the proposed detection monitoring list.*

Response to Comment

The Board is correct. The proposed changes implemented to accommodate the IEPA request that acid mine drainage related constituents be monitored in addition to leachate indicator parameters creates a potential conflict between the proposed rewording of 35 IAC 811.319(a)(2)(A)(i) and the proposed detection parameters presented in 811.319(a)(2)(A)(ii). This inconsistency could be corrected by modifying 35 IAC 811.319(a)(2)(A) as follows:

> A) "The operator shall monitor each well for constituents that will provide a means for detecting groundwater contamination as well as parameters capable of characterizing the acid mine drainage impacts. Detection monitoring constituents utilized for statistical analysis shall be chosen for monitoring if they meet the following requirements…:"

4. *SCL states that based upon discussions with IEPA, several constituents are proposed to be retained for detection monitoring for trend analyses but exempted from the statistical analysis requirements. Pet. at 142. IEPA recommends that ammonia, chloride, magnesium, sulfate, TDS, and zinc be retained in the detection monitoring list at Section 811.319(a)(2)(A)(ii), and chloride, iron, manganese and zinc be retained for assessment monitoring under Section 811.319(b) only for purposes of trend analysis required in Permit Condition VIII.13(a), but be exempted from statistical analysis required by Permit Condition VIII.13 (b, d and e). Rec. at 14-16.*

   a. *Clarify whether permit conditions VIII.13(a, b, and d) implement Sections 811.319 (a)(4)(A)(i), (a)(4)(A)(ii), and (a)(4)(A)(iv), respectively.*

Response to Comment

Yes, it is the applicant's belief that the referenced permit sections do implement the referenced regulatory sections. A comparison the permit language to the corresponding regulatory citation is provided below:

From Permit

13. *Pursuant to 35 Ill. Adm. Code 811.319(a)(4)(A), any of the following events shall constitute an observed increase only if the concentrations of the constituents monitored can be measures at or above the practical quantitation limit (PQL):*

a. The concentration of any constituent in List G1 of Condition VIII.12 shows a progressive increase over eight (8) consecutive quarters.

From 35IAC 811.319(a)(4)(A)(i)

i) The concentration of any inorganic constituent monitored in accordance with subsections (a)(1) and (a)(2) shows a progressive increase over eight consecutive monitoring events;

<u>Response to Comment</u>

Given that the currently permitted monitoring schedule occurs on a quarterly basis, permit condition VIII,13(a) is deemed equivalent to 35 IAC811.319(a)(4)(A)(i).

From Permit

b. The concentration of any constituent monitored in accordance with List G1 or List G2 of Condition VIII.12 exceeds the MAPC at an established monitoring point within the zone of attenuation. MAPC values are not applicable to parameters in the zone of attenuation wells having an established intrawell value.

From 35IAC 811.319(a)(4)(A)(ii)

ii) The concentration of any constituent exceeds the maximum allowable predicted concentration at an established monitoring point within the zone of attenuation;

Response to Comment

The permit condition is deemed implement the cited regulatory standard, However, the last sentence of the permit condition VIII.13(b) indicating that MAPCs are not applicable to parameters in the ZOA having an interwell value conflicts with the tabulated Permit Attachment 2 intrawell values that list both AGQS and MAPC values (refer to Petition Attachment G for Permit). The last sentence of permit condition VIII.13(b) may have been inadvertently copied from the language utilized at another landfill and included into the SCL permit in a manner that did not recognize the intrawell MAPC values listed in permit Attachment 2. Since the Permit Attachment 2 MAPC values are consistent with the intent of 35 IAC 811.319(a)(4)(A)(ii) to implement MAPCs within the zone of attenuation, these tabulated numerical standards are believed to take precedence over the last sentence of permit condition VIII.13(b). Therefore, the applicant will file a significant permit modification application to request the deletion of the last sentence of permit condition VIII.13(b). This will restore the consistency with 35 IAC 811.319(a)(4)(A)(i).

From Permit

> d. The concentration of any constituent monitored at or beyond the edge of the zone of attenuation (compliance boundary) exceeds its AGQS, or pursuant to 811.320(d) any constituent monitored at an upgradient well, exceeds its AGQS.

From 35IAC 811.319(a)(4)(A)(iv)

> *iv) The concentration of any constituent monitored at or beyond the zone of attenuation exceeds the applicable groundwater quality standards of Section 811.320.*

Response to Comment

The permit and regulatory citations are deemed consistent. The clarification that AGQS value are the relevant standard at upgradient wells is deemed to provide an intuitive clarification since MAPCs developed based on contaminant transport modeling would not be effective at monitoring locations upgradient of the landfill.

b. *Identify the rule language in Appendix B of the petition that exempts the above listed constituents from Sections 811.319(a)(4)(A)(ii) and (a)(4)(A)(iv), and subjects them to only trend analysis under (a)(4)(A)(i).*

Response to Comment

As stated in the response to Comment 1, the trend analysis of mine spoil indicator constituents was added at the request of the IEPA. The Board is correct that proposed regulatory changes have not been requested in the Petition Appendix B to exempt these constituents from statistical analyses. The response to Board comment No. 1 provides the proposed changes to 35 IAC 811.319(a)(2)(A)(ii-vi) that address this deficiency. This list has been updated to include footnotes as to which constituents would be subject to trend analyses only.

5. *Comment on whether the following language reflects SCL's request for an adjusted standard as to constituents subject only to trend analysis.*

> *In lieu of 35 Ill. Adm. Code 811.319(a)(4)(A)(ii) and (a)(4)(A)(iv), SCL must institute confirmation procedures for observed increases only as to the following constituents:*
>
> *Ammonia*
> *(dissolved) Arsenic*
> *(dissolved*
> *Chloride (dissolved and total)*
> *Chromium (dissolved)*
> *Iron (dissolved and total)*
> *Magnesium (dissolved)*
> *Manganese (dissolved and total)*
> *Sulfate (dissolved)*
> *Total Dissolved Solids (TDS)*

Response to Comment

The preceding list is confusing. It includes many of the constituents which are proposed to be exempted from permit condition VIII.13(b) and (d) statistical analyses (i.e., dissolved sulfate, TDS, dissolved magnesium etc.). However, other constituents are included which are exempt from detection monitoring. For instance, dissolved iron and manganese are not listed in 35 IAC 811.319(a) as detection monitoring parameters and therefore would not be subject to the analysis requirements of 35 IAC 811.319(a)(4)(A). The IEPA comment indicates that these constituents would continue to be "not be included in the facility's detection monitoring list..." The petitioner, believes that it was IEPA's intent that iron and manganese could be monitored during assessment monitoring to help define whether an observed increase for another parameter was related to acid mine drainage. As such, during assessment monitoring, the constituents iron (dissolved and total) and manganese (dissolved and total) would be exempt from the requirements of 35 Ill. Adm. Code 811.319(a)(4)(A)(ii) and (a)(4)(A)(iv), but would be subject to the trend analysis requirements of 35 Ill. Adm. Code 811.319(a)(4)(A)(i).

Constituents such as dissolved arsenic, dissolved boron, dissolved lead, etc. would continue to be subject to both trend and statistical analysis requirements. As such the petitioner believes that the proposed wording provided in response to Board comment No. 1 (including the footnotes at the end of the parameter list) is the most definitive way to designate which constituents are subject to the full detection monitoring requirements of 35 IAC 811.319(a)(4)(A) and which constituents are exempted from the statistical analyses (i.e., subparagraphs ii and iv). Finally, after consideration to Board comments No. 7, it is proposed that the constituents dissolved ammonia and dissolved chloride be exempt from the statistical analysis requirements of 35 IAC 811.319(a)(4)(A)(ii) but assuming approval of the Board Adjusted Groundwater Quality Standards for dissolved ammonia and dissolved and total chloride, it is proposed that these constituents not be exempted from 35 IAC 811.319(a)(4)(A)(iv). Similarly, as discussed in the response to IPCB comment No. 14, it is proposed that a Board Adjusted Applicable Groundwater Quality Standard of 100 ug/L also be established for total and dissolved chromium based on the Class I Groundwater Quality Standard of 35 IAC 620.410.

Pursuant to the requirements of 35 IAC 811.319(a)(4)(A)(iv), the Board Adjusted Groundwater Quality Standards for dissolved ammonia, total and dissolved chloride, and total and dissolved chromium would be effective at and beyond the zone of attenuation. In order to maintain consistency with the proposed changes to 35 IAC 811.319(a)(2)(A)(ii), the petitioner suggests that 35 IAC 811.319(a)(4)(A)(ii) and (iv) be modified as follows:

> ii) *The concentration of any non-exempted 35 IAC 811.319(a)(2)(A)(ii) constituent or any 35 IAC 811.319(a)(3) organic constituent exceeds the greater of the maximum allowable predicted concentration and the groundwater protection standard Section 811.320(a)(3)(C) at an established monitoring point within the zone of attenuation;*
>
> iv) *The concentration of any constituent monitored at or beyond the zone of attenuation exceeds the applicable groundwater quality standards or Board adjusted groundwater standard of Section 811.320.*

6. Permit condition VIII.13(e) addresses exceedance of the intrawell applicable groundwater quality standard at an established monitoring point. Pet. at 511.

a. Identify the specific provision in Part 811 implemented by this permit condition.

Response to Comment

35 IAC 811.319 (a)(4)(A)(iv) does not differentiate between applicable groundwater quality standards developed using interwell vs. intrawell statistical methods to calculate background concentrations. Regardless of which statistical approach is utilized the statistical comparisons

are treated in the same way. 35 IAC 811.320(e)(1) encompasses background developed by both interwell (multiple well comparisons) and intrawell (single well) statistical approaches. Therefore, the petitioner believes that no specific relief is required to accommodate the use of intrawell applicable groundwater quality standards.

b. Does SCL's proposed adjusted standard in Appendix B of the petition include specific language that exempts constituents from the regulatory provision implemented by Permit Condition VIII.13(e)?

Response to Comment

No, see response to Comment 6(a).

c. Propose adjusted standard language that reflects SCL's requested relief. Note that the Board may grant relief from a Board regulation but is not authorized to grant an adjusted standard from existing permit conditions.

Response to Comment

As stated in the response to comment 6(a), the existing regulations are believed to sufficiently encompass the current permit use of intrawell groundwater background standards and AGQSs. The proposed Adjusted Standard modifications including the changes in the detection and assessment monitoring lists, the request for Board adjusted groundwater standards, or the use of risk based triggers for corrective action would not require changes to the portions of the regulations that address the use of intrawell applicable groundwater quality standards. That said, the introduction of Board adjusted groundwater standards as applicable groundwater quality standards (i.e., total and dissolved chloride, total and dissolved chromium, and dissolved ammonia, etc.) will require permit modifications that would include the deletion of the intrawell AGQS and MAPCs for these constituents. These changes to the permit would be proposed to IEPA as a significant permit modification application if the requested relief is granted.

7. IEPA recommends that ammonia, chloride, iron, magnesium, manganese, sulfate, TDS, and zinc be retained for detection and assessment monitoring for purposes of trend analysis only. Comment on whether the confirmation procedures under Section 811.319(a)(4)(B), including alternate source demonstration and assessment monitoring, apply when monitored constituents show progressive increase over eight consecutive monitoring events in accordance with Section 811.319(a)(4)(A)(i). Also clarify whether these constituents would be subject to applicable groundwater quality standards at the edge of the zone of attenuation.

Response to Comment

The applicant believes that the IEPA has advocated that iron and manganese be retained for assessment monitoring but that they would be exempted from the detection monitoring program (Refer to pages 22 and 23 of IEPA Recommendation to Petition for Adjusted Standard.

It is the applicants belief that exceedances of the 35 IAC 811.319(a)(4)(A)(i) detection monitoring trend analysis requirements would be subject to the confirmation procedures under Section 811.319(a)(4)(B), including alternate source demonstration and assessment monitoring, when the concentrations of the monitored constituents show progressive increase over eight consecutive monitoring events. If the exceedance of the trend analysis was confirmed by a verification resample, it is anticipated that the Alternate Source Demonstration would be utilized to document the cause of the increasing concentration trend. If the increases in concentrations are associated with an increased episode of acid mine drainage, then documenting these changes is deemed important since it is likely that other constituents might be affected by the increased acidity. On the other hand, if the increases in a constituent such as TDS are associated with increased concentrations of landfill leachate indicator constituents (i.e., sodium, barium, potassium, bicarbonate alkalinity etc.), then the assessment monitoring requirements would be appropriate.

Unfortunately, the edge of the zone of attenuation extends only 100 ft. from the landfill and does not correspond to a geologic boundary such as the strip mine high wall where the influences of acid mine drainage might be anticipated to diminish (refer to Figure 1 of the petition at page 108 for air photo depicting extent of the strip mined area relative to the landfill boundary). As such, it is believed that the AGQS values for the trend analysis constituents (refer to"*" designated constituents in the list in the response to Board comment 1) should not be applicable at or beyond the ZOA extending the facility property boundary. Pursuant to geographical limitations inherent in 35 IAC 811.320(a)(1), the proposed Board Adjusted Groundwater Standard for dissolved ammonia, total and dissolved chloride and total and dissolved chromium ($^{\#}$ designated constituents) are anticipated to be effective at and beyond the zone of attenuation. All other detection and assessment monitoring constituents not designated as trend analysis constituents (* denoted) or constituents with Board Approved Groundwater Quality Standards (i.e., dissolved ammonia, total and dissolved chloride and total and dissolved chromium would have applicable groundwater quality standards based on background concentrations or analysis method practical quantitation limits (PQLs) that would be effective at or beyond the zone of attenuation.

Assessment Monitoring

8. *The proposed adjusted standard to the assessment monitoring requirement at Section 811.319(b)(5)(E) allows the petitioner to request that IEPA delete any constituent listed in 40 CFR 258.Appendix II or 35 Il. Adm. Code 620.410 by demonstrating that the deleted constituent is not contained in the leachate at concentrations that are*

discernable from background groundwater quality. Pet. at 304 (App. B). According to the ASTD, SCL proposes to remove constituents from assessment monitoring. Pet. at 131, 139-140 see also Pet. at 49. Confirm that SCL proposes that the following constituents not be monitored under Section 811.319(b)(5)(E):

Antimony (total)
Cadmium (total)
Cobalt (total)
Copper (total)
Nickel (total)
Silver (total)
Selenium (total)
Thallium (total)

Response to Comment

Yes, the above listed constituents are proposed to be deleted from the assessment monitoring list since site groundwater monitoring data and the results of minespoil leach tests show that these constituents are more likely to be derived at high concentrations due to leaching of the minerals contained in the minespoil and/or shale bedrock than from the landfill leachate. If these constituents are not removed from the assessment parameter list, they could trigger unnecessary and costly installation of additional monitoring wells (35 IAC 811.319(b)(1)), filing of assessment monitoring plans (35 IAC 811.319(b)(2)), and evaluation of the nature and extent (35 IAC 811.319(b)(3) of these constituents in the groundwater. Thus, it is believed prudent to request the deletion of these parameters which can be shown to provide little or no utility in identifying potential releases from the landfill.

9. *Instead of SCL's proposed adjusted standard from Sections 811.319(b)(5)(D) and (E), comment on whether the following language reflects SCLs request for an adjusted standard to allow the deletion of constituents from assessment monitoring. In lieu of 35 Ill. Adm. Code 811.319(b)(5)(D), SCL will comply with the following:*

> *Within 90 days after the initial monitoring in accordance with subsection (b)(5)(A) of this Section, the owner or operator must monitor for the detected constituents listed in appendix II to 40 CFR 258, incorporated by reference in 35Ill. Adm. Code 810.104, and 35Ill. Adm. Code 620.410 on a semiannual basis during the assessment monitoring. The operator must monitor all the constituents listed in appendix II to 40 CFR 258 and 35 Ill. Adm. Code 620.410 on an annual basis during assessment monitoring, except for the following constituents:*
>
> *Antimony (total)*
> *Cadmium (total)*
> *Cobalt (total)*

> *Copper (total)*
> *Nickel (total)*
> *Silver (total)*
> *Selenium (total)*
> *Thallium (total)*

Response to Comment

This wording is consistent with the requested relief.

10. *As to the assessment monitoring requirement at 35 Ill. Adm. Code 811.319(b)(5)(G), comment on whether the following language reflects SCL's request for an adjusted standard.*

> *In lieu of 35 Ill. Adm. Code 811.319(b)(5)(G), SCL must comply with the following:*
>
> *If the concentrations of all constituents in appendix II to 40 CFR 258, incorporated by reference in 35 Ill. Adm. Code 810.104, and 35 IL Adm. Code 620.410, as modified in this adjusted standard are shown to be at or below background values, using the statistical procedures in Section 811.320(e), for two consecutive sampling events, the owner or operator must notify the Agency of this finding and may stop monitoring the constituents.*

Response to Comment

Yes, the preceding language is consistent with the petitioner's intent.

11. *Clarify whether the constituents SCL proposes to remove from assessment monitoring are currently required to be monitored either on a semiannual or annual basis in accordance with Section 811.319(b)(5)(D) because they are listed in either 40 C.F.R. §258.Appendix II or 35 Ill. Adm. Code 620.410. Clarify whether SCL intends that these constituents not be monitored either annually or semi-annually under the adjusted standard.*

Response to Comment

Pursuant to the requirements of permit condition IX.3 the complete 40 CFR 258 Appendix II lists are monitored on a semiannual basis. Based on nearly 10 years of assessment monitoring, it is the petitioners belief that the assessment monitoring parameter list has provided little or no insights (beyond the permit required routine List G1 and G2 constituents) in discerning landfill related changes in groundwater quality from the pre-existing anthropogenic influences caused by previous mining activity. Similarly, due to the heavily degraded background groundwater quality, the assessment monitoring results have done little to characterize potential health risks that might result from releases from the landfill. For this reason, the addition of constituents which are representative of the landfill leachate (i.e., sodium, barium, potassium, bicarbonate alkalinity, etc.) are believed to provide the best means for characterizing the nature and extent of the landfill related influences on groundwater quality.

> As such, it is anticipated that a permit modification request to monitor the detected constituents semiannually and the entire assessment list annually will be filed with IEPA in the future. The IEPA has curtailed the review of any groundwater related permit applications, pending the IPCB decision on this adjusted standard petition. Thus, no such changes can be requested until after a determination on the requested adjusted standard relief is decided.

12. As to arsenic (dissolved), the ASTD states, "leachate concentrations tend to be substantially elevated relative to the groundwater concentrations, making the constituent an appropriate indicator constituent for detection and/or assessment monitoring." Pet. At 130. IEPA recommends that dissolved arsenic be included in detection monitoring but does not address assessment monitoring. Rec. at 9. Clarify whether dissolved arsenic currently is included in assessment monitoring. Comment on whether it is SCL's intent to include dissolved arsenic in the assessment monitoring list.

Response to Comment

The 40 CFR 258 Appendix II and the 35 IAC 620.410(a) assessment monitoring constituents analyses are generally conducted on unfiltered or total samples so that the results can be assessed relative to risk based potable water standards (Federal Safe Drinking Water Act 40 CFR 141 or State Class I Groundwater Standards) which are also conducted on unfiltered samples. Therefore, it is anticipated that only total arsenic would be monitored as an assessment monitoring parameter. As discussed in the response to Board comment No. 1, dissolved arsenic will continue to be monitored as a detection monitoring constituent. Both the detection and the assessment monitoring lists are subject to the same comparisons to AGQS beyond the zone of attenuation and the MAPCS within the zone of attenuation. Thus, from a practical standpoint it makes little difference whether dissolved arsenic is monitored as part of the detection or the assessment monitoring lists.

13. As to chloride (total), SCL notes that chloride concentrations may act as a good indicator of potential leachate impacts and includes dissolved chloride in the proposed detection monitoring list. Pet at 131-132. IEPA recommends that both dissolved and total chloride be included in the detection monitoring list and total chloride be retained as apart of assessment monitoring. Rec. at 13. Comment on whether total chloride should be included on the assessment monitoring list.

Response to Comment

The petitioner believes that total chloride has value as an assessment monitoring constituent. It is one of the major anionic constituents present in leachate and is quite mobile. For these reasons, it is believed that total chloride should be monitored as part of an assessment program. Unfortunately, the regional data presented in Appendix E-2 of the Adjusted Standard Petition documents that the area is characterized by the presence of a pronounced salinity gradient that varies with depth and groundwater recharge/discharge conditions. This salinity gradient results in elevated chloride concentrations (total and dissolved) that sometimes occur at relatively shallow depths. The proposed Board adjusted chloride groundwater quality standard of 200 mg/L alleviates the majority of the variations associated with this regional shallow salinity gradient condition while still providing the utility as a potential indicator constituent. The Illinois EPA approach that chloride be exempted from statistical analysis but utilized for trend analysis also seeks to maintain the utility of this parameter while providing relief from the naturally occurring salinity conditions. From the petitioners standpoint, the groundwater chloride concentrations are highly dependent on the dilution of the upwelling brine with the recharge from precipitation therefore, it is relatively uncommon for concentrations to increase linearly without seasonal concentration/fluctuation decreases that could result in failure to trigger the 35 IAC 811.319(a)(4)(A)(i) despite an increasing concentration trend. As such, the inclusion of total chloride in the assessment parameter list in combination the Board Adjusted Groundwater Standard of 200 mg/L, is believed to provide a more sensitive indicator than the trend analysis criterion alone, while still minimizing the false positive rate that currently occurs due to the non-representative nature of the inter and intrawell permitted background concentrations. Additionally, total chloride is not typically monitored as part of the detection monitoring program, as such, a minimum of 2 years of assessment monitoring would be required at some wells before sufficient data would be available to conduct the 35 IAC 811.319(a)(4)(A)(i) or the proposed 35 IAC 811.319(b)(6) trend analysis (refer to response to comment No.9).

As discussed in the response to Board comment No. 1, it is proposed that dissolved chloride be subject to trend analysis within the zone of attenuation but exempt from 35 IAC 811.319(a)(4)(A)(ii) comparisons to MAPCs. Similarly, it is proposed that the total chloride monitoring data be exempted from 35 IAC 811.319(b)(4) the assessment monitoring comparisons to MAPCS. However, similar to the detection monitoring program, it is proposed that total chloride not be exempted from 811.319(b)(3). As such, it is proposed that the total chloride assessment monitoring data from wells located at or outside of the zone of attenuation would be compared to the proposed Board Adjusted Groundwater Quality Standard of 200 mg/L. Should potential exceedances of the Board Adjusted Groundwater Quality Standard be observed, the exceedance will need to be resolved by careful geochemical analysis of the groundwater composition and analysis of changes in the vertical geochemical gradients (i.e., Alternate Source Demonstrations). If these demonstrations are not deemed conclusive by IEPA, the operator would complete the nature and extent evaluation as required by 35 IAC 811.319(b)(3).

14. *As to chromium (total), SCL states that dissolved chromium is proposed to be retained in the detection monitoring list because leachate concentrations are several hundred percent greater on average than the groundwater concentrations. Pet. at 133. IEPA recommends that total chromium be retained for both detection and assessment monitoring. Comment on whether total chromium should be included on the assessment monitoring list.*

Response to Comment

Total and dissolved chromium are influenced by several factors that affect its utility as a detection and/or assessment monitoring parameters. First, the majority of the site monitoring wells are constructed of #304 stainless steel well screen and riser pipe. This stainless steel alloy is predominantly composed of nickel and chromium. Thus, acidic conditions in the groundwater may result in corrosion and/or pitting of the stainless steel resulting in the release of chromium. Second, the chromium concentrations have appeared greater at wells located within the lacustrine deposits or screened in the shallow shale deposits below the lacustrine unit along the west side of the landfill. This may suggest stratigraphic link for the geochemical occurrence of chromium. The lacustrine deposits do not exist along the southeast (upgradient) side of the landfill. Thus, it is not possible to propose representative background concentrations for these wells based on interwell statistical methods (i.e., using pooled upgradient background monitoring data). Finally, as discussed in the petition, the upgradient minespoil well G22S is located in close proximity to the mine highwall and thus the groundwater flow reaching well G22S has flowed a very short distance through the minespoil. As such, the geochemistry at well G22S is unlikely to be representative of groundwater that has been in contact with the minespoil over a longer flow path.

The proposed Groundwater Protection Standard (GPS) of 100 ug/L was believed to provide relief that would help overcome these limitations while being responsive to IEPA's request to maintain detection and assessment monitoring for dissolved and total chromium. However, the limitations in developing representative background concentrations (i.e., fact that lacustrine unit is discontinuous and does not occur upgradient of the landfill, and the fact that G22S the only upgradient minespoil well is located in close proximity to the upgradient mine highwall) greatly restricts the usefulness of this parameter. Additionally, the minespoil chemical analyses presented in Table 1 of Petition Appendix I indicate a total chromium concentration of 14.2 mg/Kg, indicating that it is one of the more abundant heavy metals present in the mine spoil. The leach tests indicate that slight concentrations of chromium can be leached from the minespoil under either distilled water or under TCLP acidic conditions. However, as shown by Table 1 of Appendix I, these leached chromium concentrations were not as elevated as might be anticipated based on the spoil total chromium concentrations (i.e., the leached concentrations ranged from <0.001 mg/L to 0.002 mg/L). Weng and Others (1993) indicate that chromium present in soil in the form of the mineral chromite is readily leachable with approximately 1% of the total chromium being mobilized under acidic conditions (Refer to Attachment F).

Pursuant to the Illinois EPA request, dissolved and total chromium would continue to be monitored as part of the detection and assessment monitoring programs, respectively. Under this scenario, the data from wells within the zone of attenuation would be compared to the Class I Groundwater Standard of 100 ug/L (i.e., the proposed GPS). Wells located at or beyond the zone of attenuation would be evaluated relative to the existing permitted applicable groundwater quality standards (i.e., Refer to Appendix G of Adjusted Standard Petition for tabulated chromium background concentrations). As shown in Permit Attachment 1, the shale unit interwell dissolved chromium AGQS/MAPC is 1 ug/L (refer to Pet. Page 527). Similarly the minespoil background concentration AGQS/MAPC is also 1 ug/L for dissolved chromium (refer to Pet page 528). These interwell dissolved chromium AGQS/MAPC standards are significantly lower than the total chromium intrawell AGQS/MAPC values established for each monitoring well. The most likely explanation for the significant differences between the total and dissolved chromium background concentrations is that the unfiltered (total metal samples) contain suspended solids that were dissolved when the sample was acidified for preservation purposes. This suggests that chromium is likely to be leached if acidic conditions are aggressive enough or are persistent enough to dissolve the chromite or mafic minerals present in the minespoil.

As such, pursuant to Board Comment No. 26, it is proposed that a Board Adjusted Applicable Groundwater Quality Standard of 100 ug/L (i.e., the Class 1 Groundwater Quality Standard) be approved pursuant to 35 IAC 811.320(a)(1)(B). This proposed Board adjusted total and dissolved chromium standard would be effective at and beyond the landfills zone of attenuation, extending to the facility's property boundary. This standard is requested because the site data (i.e., total chromium concentrations in the minespoil) and literature references suggest that elevated concentrations of chromium are likely to be leached from the minespoil and shale bedrock. The petitioner believes that the pronounced differences between the total and dissolved chromium background concentrations presented in the permit (refer to Appendix G of petition) are the result of acidic leaching of the minespoil and shale. Because the TCLP analysis results presented in Table 1 of petition Appendix I are based on an 18 hr leaching period, the results may not be as elevated as the more protracted leaching that occurs at the site over a longer time period. As such, after additional consideration, a Board adjusted groundwater quality standard is being requested for dissolved and total chromium (refer to response to comment No. 1).

As discussed in Attachment B, the groundwater at the site (both minespoil and shallow bedrock) has been heavily degraded by previous coal strip mining operations. As such, the potential use of the groundwater is severely limited by these anthropogenic degradation conditions. As discussed in Attachment B, the petitioner, believes that a Board adjusted groundwater quality standard for total and dissolved chromium is warranted pursuant to the requirements of 35 IAC 811.320(b)(4).

15. *As to potassium (total and dissolved), SCL states that total potassium should be included in the detection monitoring list, but it does not mention if that constituent should be also included for assessment monitoring. Pet. at 141. However, IEPA recommends that total potassium be retained for assessment monitoring. Rec. at 23. Comment on whether total potassium should be included on the assessment monitoring list.*

Response to Comment
The adjusted standard petition focused on changes and/or requests for relief that were deemed to require the Board approval. Pursuant to 35 IAC 811.319(b)(1) the adding of additional assessment monitoring constituents beyond the 40 CFR 258 Appendix II and 35 IAC 620.410 was not deemed to require IPCB approval. However, the petitioner agrees with the IEPA and the Board that total potassium is a good leachate indicator and should be included in the assessment monitoring parameter list.

16. *As to sodium (total), SCL proposes including total sodium in detection monitoring due to elevated leachate concentrations and relative insensitivity to the effects of acid mine drainage. However, SCL does not address whether total sodium should be included in assessment monitoring. Pet. at 141. IEPA recommends including sodium in assessment monitoring. Rec. 23-24. Comment on whether sodium should be included on the assessment monitoring list.*

<u>Response to Comment</u>
The adjusted standard petition focused on changes and/or requests for relief that were deemed to require the Board approval. Pursuant to 35 IAC 811.319(b)(1) the adding of additional assessment monitoring constituents beyond the 40 CFR 258 Appendix II and 35 IAC 620.410 was not deemed to require IPCB approval. However, the petitioner agrees with the IEPA and the Board that total sodium is a good leachate indicator and should be included in the assessment monitoring parameter list.

17. Provide the list of constituents SCL proposes to include in assessment monitoring.

<u>Response to Comment</u>
Table 6 (Pet at 97-105) has been updated to reflect the assessment monitoring discussions provided herein. This updated table is provided in Attachment A.

18. SCL states, based on comments from IEPA, that iron, manganese, and zinc will be retained in the assessment monitoring list but would be exempt from the statistical analysis requirements of permit conditions VIII.13(b, d, and e). Pet. at 49. Similar to Question 4, does SCL's proposed adjusted standard language in Appendix B of the petition include specific language that exempts constituents from statistical analysis? Propose adjusted standard language such as Question 5 above.

<u>Response to Comment</u>
The proposed changes discussed above were suggested by the Illinois EPA. The Board is correct that the proposed relief is not reflected by the initial Adjusted Standard Petition Appendix B proposed regulatory wording. As such the following regulatory changes are requested.

In lieu of 35 Ill. Adm. Code 811.319(b)(5)(A) the petitioner proposes the following language:

> 5) *In addition to the requirements of subsection (b)(1), to collect information to assess the nature and extent of groundwater contamination, the following requirements are applicable to MSWLF units:*
>
> A) *The monitoring of additional constituents pursuant to subsection (b)(l) must include, at a minimum (except as otherwise provided in subsection (b)(5)(E) of this Section), the constituents listed in 40 CFR 258.Appendix II, incorporated by reference at 35 Ill. Adm. Code 810.104, and constituents from 35 Ill. Adm. Code 620.410.*
>
> i) *Additionally, in order to aid in discerning leachate from acid mine drainage related concentration increases, the following constituents shall undergo assessment monitoring in accordance with the monitoring frequency described in subparagraph (D).*

*Iron (dissolved and total)**
*Manganese (dissolved and total)**
Bicarbonate Alkalinity (total)
Potassium (total)
Sodium (total)
*Zinc (total)**
*Chloride (total)^*
*Chromium (total)^*
*Sulfate (total)**
*TDS**
*pH**

ii) *The monitoring of the constituents designated above by "*" shall be conducted in order to characterize potential acid mine drainage effects on the groundwater quality. The acid mine drainage indicator constituents listed in (A)(i) above ("*" designated constituents) shall be exempt from the 35 IAC 811.319(b)(3) applicable groundwater quality comparisons at monitoring points located at or beyond the landfill's zone of attenuation;*

iii) *The acid mine drainage indicator constituents listed in (A)(i) and designated above with either "*" or "^" shall be exempt from the 35 IAC 811.319(b)(4) maximum allowable predicted concentration analyses at monitoring points located within the landfill's groundwater zone of attenuation.*

iv) *The acid mine drainage indicator constituents designated in (A)(i) above by either a "*" or "^" shall undergo the a temporal trend analyses in accordance with the requirements of 35 IAC 811.319(b)(6).*

Response

Since the assessment monitoring regulations currently provide no provision for analyzing the 8 consecutive monitoring round trend analyses, it is proposed that a new paragraph be added as 35 IAC 811.319(b)(6). The suggested wording of this paragraph is provided as follows:

6) *The concentration of any inorganic constituent monitored in accordance with subsections (b)(5)(A)(iv) shows a progressive increase over eight consecutive monitoring events. If such an increasing concentration*

trend is identified, the operator must complete the following confirmation procedures:

i) The operator shall verify any observed increase by taking additional samples within 90 days after the initial sampling event and ensure that the increasing concentration trend exists. The operator shall notify the Agency of any confirmed increase before the end of the next business day following the confirmation.

ii) The operator shall determine the source of any confirmed increase, which may include, but shall not be limited to, natural phenomena, sampling or analysis errors, or an offsite source.

iii) The operator shall notify the Agency in writing of any confirmed increase. The notification must demonstrate a source other than the facility and provide the rationale used in such a determination. The notification must be submitted to the Agency no later than 180 days after the original sampling event. The notification must be filed for review as a significant permit modification pursuant to 35 Ill. Adm. Code 813.Subpart B.

iv) If an alternative source demonstration described in subsections (a)(4)(B)(ii) and (iii) of this Section cannot be made, and is attributable to the solid waste disposal facility, then the operator shall determine the nature and extent of the groundwater contamination including an assessment of the potential impact on the groundwater at the facility and shall implement the remedial action in accordance with subsection (d).

Groundwater Quality Standards & Groundwater Protection Standards

19. SCL proposes adjusted groundwater quality standards of 15 mg/L for dissolved and total ammonia and 200 mg/L for dissolved and total chloride. Pet. at 49. In a filing on September 21, 2015, SCL confirmed that it is not pursuing an adjusted standard as to total ammonia. Clarify whether SCL's proposed adjusted groundwater quality standards as to ammonia and chloride are contained in the adjusted standard rule language in Appendix B to the petition.

<u>Response to Comment</u>

The technical discussion provided in Adjusted Standard pages 128 through 130 support the technical case for a Board Adjusted Background water Quality Standard for both total and dissolved ammonia. However, because total ammonia is not included in the proposed detection or assessment monitoring lists (i.e., is not included in either 40 CFR 258 Appendix II or in 35

IAC 620.410) there does not appear to be a scenario under which the monitoring of total ammonia would be required. As such, the petitioner has responded to IEPA and the Board to delete the request for Board Adjusted Standard for a total Ammonia Applicable Groundwater Quality Standard. The facility permit has required that the groundwater be monitored for dissolved ammonia on a quarterly basis. While dissolved and total ammonia are anticipated to behave in a similar manner, very little total ammonia groundwater quality data is available for discrete technical analyses to support the request for a Board Adjusted total ammonia groundwater standard. As such, it is deemed by the petitioner to be more expedient to drop the request for a Board Adjusted Standard for a Total Ammonia Groundwater Quality Standard than to collect data and provide additional analyses for a constituent that is unlikely to ever be monitored in the future.

Pursuant to 35 IAC 811.320(a)(1)(B) and to 35 IAC 811.320(b) regulatory procedures exist for the Board to approve an Applicable Groundwater Quality Standard via an adjusted standard. The applicant requested the proposed Board adjusted applicable groundwater quality standards for ammonia and total and dissolved chloride at several locations in the petition (refer to Petition pages 128-130). However, the request was not made in Appendix B since applicable groundwater quality standards are site specific and no regulatory changes are typically required to implement AGQS values into a facility's permits. Therefore, since regulatory provisions existed under 35 IAC 811.320(a)(1)(B) and 35 IAC 811.320(b), no changes in the regulations appeared necessary to implement the proposed standards, rather it was anticipated that the Board approved standards for these constituents would be incorporated into the facility's permit via a significant permit modification following an acknowledgement of the Boards acceptance of the proposed adjusted standard background values.

The formal request for the proposed Board adjusted applicable groundwater quality standards is provided in Comment No. 20.

20. Comment on whether the following language reflects SCL's request for an adjusted groundwater quality standard as to ammonia and chloride.

> *In lieu of 35 Ill. Adm. Code 811.320(a), SCL must meet the following groundwater quality standards at and beyond the zone of attenuation:*

Ammonia (dissolved)	*15 mg/L*
Chloride (dissolved and total)	*200 mg/L*

Response to Comment

The proposed adjusted standard language is acceptable. However, as discussed in the response to Board comment No. 14, the petitioner also requests that the Board approve the Class I Groundwater Standard of 100 ug/L for total and dissolved chromium, as a Board Established Standard. As such the proposed wording has been modified as follows:

Pursuant to 35 Ill. Adm. Code 811.320(a)(2)(B), SCL must meet the following groundwater quality standards at and beyond the zone of attenuation:

Ammonia (dissolved)	*15 mg/L*
Chloride (dissolved and total)	*200 mg/L*
Chromium (dissolved and total)	*100 ug/L*

21. *As required by 35 Ill. Adm. Code 811.320(a)(l)(B) and 811.320(b)(4), provide SCL's justification for the relief requested as to ammonia and chloride.*

Response to Comment
The technical justification for the Board adjusted groundwater quality standard for dissolved ammonia and total and dissolved chloride is the same as that provided for the proposed modifications to the detection and assessment monitoring parameter lists (refer to Petition pages 56-58). These discussions are provided Attachment B.

22. *SCL identifies proposed groundwater quality standards for "indicator constituents" which is also the list of proposed constituents for detection monitoring (see Question 1 above). Pet. at 52.*

    a. *Describe what SCL means by the phrase "indicator constituents."*

Response to Comment
"Indicator constituents" are the proposed detection monitoring constituents which based or the relative comparison of leachate to groundwater concentrations are deemed to provide potential indication of a release of leachate. The term indicator constituent is derived from portions of 35 IAC 811.319(a)(2) which reads as follows:

> 2) *Criteria for choosing constituents to be monitored*
>
> A) *The operator shall monitor each well for constituents that will provide a means for detecting groundwater contamination. Constituents shall be chosen for monitoring if they meet the following requirements:*
>
> i) *The constituent appears in, or is expected to be in, the leachate; and*
>
> iv) *Any facility accepting more than 50% by volume non-municipal waste must determine additional indicator parameters based upon leachate characteristic and waste content.*

b. *Clarify whether SCL proposes an adjusted groundwater quality standard for these indicator constituents as set forth on page 52 of the petition. Provide the* *basis for any such request as required by 35 Ill. Adm. Code 8ll.320(a)(l)(B) and 811.320(b)(4).*

Response to Comment
The constituents listed on page 52 of the petition are deemed to provide potential indication of a leachate release and therefore are proposed to be monitored as part of the facility's groundwater detection monitoring program. The majority of these constituents have currently permitted background levels, developed through either interwell or intrawell statistical procedures that are reflective of the range of background concentrations and are therefore deemed representative. In a few instances, such as bicarbonate alkalinity, no background concentrations are currently permitted. In these instances, the applicant will need to collect data and propose background concentrations to the IEPA as a significant permit modification application. The only Board Adjusted Groundwater Standards proposed by this petition are for total and dissolved chloride, total and dissolved chromium and dissolved ammonia. The technical justification for these Board adjusted background standards is provided in Attachment B.

Groundwater Protection Standards (GPS) have been proposed for other constituents. For instance a GPS value of 2000 ug/L has been proposed for total barium. This GPS value is separate and distinct from the applicable groundwater quality standards in that the GPS is effective only within the landfill's zone of attenuation (i.e., at wells where the GPS exceeds the existing permitted MAPC values) whereas the constituents applicable groundwater quality standard(s) would represent the compliance standard outside of the zone of attenuation. The proposed Board Adjusted Groundwater Quality Standards for total and dissolved chloride, total and dissolved chromium and dissolved ammonia would be effective at and beyond the zone of attenuation all the way to the facility's property boundary. As previously mentioned, these Board Adjusted Groundwater Standards are necessary in order to characterize the strip mined anthropogenic groundwater quality that extends outside of the ZOA and to characterize the regional salinity conditions that have been documented throughout the area (refer to Petition Appendix E-2).

c. *Propose adjusted standard language consistent with the format in Question 20 above.*

Response to Comment
At present it is believed that the requested Board Adjusted Standards are confined to total and dissolved chloride, total and dissolved chromium and dissolved ammonia as stated in the response to comment No. 20. However, as discussed in the response to Board Comment No. 25, the list of requested Board Adjusted Standard Applicable Groundwater Quality Standard concentrations might potentially expand to encompass the proposed GPS values, if the Board does not see fit to grant the proposed GPS relief.

23. *SCL appears to take the position that constituents exempt from statistical analysis are*

> *not subject to groundwater quality standards. Pet. at 52. Explain how constituents exempt from statistical analyses would be evaluated if they are not subject to groundwater quality standards. Comment on whether the confirmation procedures under Section 811.319(a)(4)(B), including alternate source demonstration and assessment monitoring, would apply if monitored constituents show progressive increase over eight consecutive monitoring events in accordance with Section 811.319(a)(4)(A)(i).*

Response to Comment

The idea that some constituents that are indicative of acid mine drainage (i.e., TDS, pH, sulfate, zinc, etc.) should continue to be monitored but be exempted from statistical analysis requirements was an idea that was first proposed by the IEPA. The petitioner agreed with the Agency's rationale that continuing to monitor constituents that provided indication of the development or worsening of acidic drainage conditions could provide information that might be important in evaluating the overall groundwater quality. The Agency has suggested that these constituents that are indicative of acid mine drainage be exempted from statistical analysis based on the following language:

> `" It is recommended that the constituent be exempted from the statistical analysis requirements of Permit Condition VIII.13(b, d and e) and instead be subjected only to the temporal trend analysis required in Permit Condition VIII.13(a)"`

As discussed in the response to Board Comment Nos. 1 and 3, the detection monitoring parameters listed by the adjusted standard at 35 IAC 811.319(a)(2)(A)(ii) should include a footnote to denote which parameters are subject to only trend analyses. Section 35 IAC 811.319(a)(2)(A) would be changed as shown below to exclude the designated parameters from statistical analyses.

> *A) "The operator shall monitor each well for constituents that will provide a means for detecting groundwater contamination and characterizing acid mine drainage impacts. Detection monitoring constituents utilized for statistical analysis must be chosen for monitoring if they meet the following requirements:"*

As discussed in the response to Board comment No. 7, it is the applicants belief that exceedances of the 35 IAC 811.319(a)(4)(A)(i) trend analysis requirements would be subject to the confirmation procedures under Section 811.319(a)(4)(B), including alternate source demonstration and assessment monitoring, when the concentrations of the monitored constituents show progressive increase over eight consecutive monitoring events. If the exceedance of the trend analysis was confirmed by a verification resample, it is anticipated that the Alternate Source Demonstration would be utilized to document the cause of the increasing concentration trend. If the increases in concentrations are associated with an increased episode of acid mine drainage, then documenting these changes is deemed important since it is likely that other constituents might be affected by the increased acidity. On the other hand, if the increases in a constituent such as TDS are associated with increased concentrations of landfill leachate indicator constituents (i.e., sodium barium, potassium, bicarbonate alkalinity, organic constituents, etc.), then the assessment monitoring requirements would be appropriate.

Likewise, as discussed in the response to Board comment No. 9, regulatory language is also proposed to enable the trend analyses to be conducted under the 35 IAC 811.319(b) assessment monitoring program.

24. Comment on whether the constituents proposed to be exempt from statistical analyses should be subject to adjusted groundwater quality standards based on Class I groundwater standards. Propose adjusted standard language consistent with the format in Question 20 above. Or, explain the rationale for not including groundwater quality standards for the constituents.

Response to Comment

The constituents that are proposed to be exempted from the statistical analysis requirements are listed in the response to Board comment No. 1 and include sulfate (dissolved), total dissolved solids (TDS), zinc (dissolved), pH, chloride (total and dissolved), and ammonia (dissolved). The majority of these constituents either have no promulgated Class I groundwater standard (i.e., dissolved ammonia, and dissolved magnesium) or have Class I groundwater standards that do not encompass the range of background concentration variability present in the groundwater (i.e., pH, TDS and dissolved sulfate). Thus, the petitioner believes that statistical analyses for these constituents cannot reasonably be based on groundwater quality standards based on Class I Groundwater.

Other constituents occur at concentrations that are typically lower than the Class I groundwater Standard. As discussed in the response to Board Comment No. 13, the vast majority of the historical total and dissolved chloride monitoring data has been less than the Class I Groundwater standard of 200 mg/L. Thus, while there is considerable variability in concentrations, much of which is believed to be attributed to the presence of a very steep vertical concentration gradient (i.e., chloride concentrations that increase with depth) which occur at relatively shallow depth below the landfill, the concentration variations rarely result in observed concentrations greater than 200 mg/L. The past chloride concentration episodes in excess of 200 mg/L (the Class I Standard), appear to correspond to periods of construction dewatering when the salinity gradients occurred at shallower than normal depths. Thus, given that recent chloride concentrations have moderated at concentrations below 200 mg/L, the applicant has proposed that total and dissolved chloride monitoring data collected from wells located at or outside the zone of attenuation be compared to a Board Adjusted Applicable Groundwater Quality Standard of 200 mg/L (Refer response to Board comment No. 7). Pursuant to 35 IAC 811.320(a)(1) this adjusted standard would be effective at and beyond the landfill's zone of attenuation and not within the zone of attenuation.

Given that the toxicity characteristic leaching procedure (TCLP) test results summarized on Adjusted Standard Petition Page 640 indicate that zinc may be leached from the minespoil under acidic conditions. Furthermore, the concentrations of zinc might be anticipated to vary as the levels of acidity increase. Therefore, no Board Adjusted Background Groundwater Quality standard is proposed for total or dissolved zinc. Rather it is proposed that the constituent be exempted from statistical analyses as suggested by IEPA. This approach of exempting the constituent recognizes the limitations due to acidity related leaching and also would provide relief within the zone of attenuation where a Board Adjusted Groundwater Quality Standard would not be effective.

Based on this discussion, it is believed that the language utilized in the response to Board comment No. 1 adequately summarizes the detection monitoring constituents that require exemptions from statistical analyses as well as the constituents that require Board Adjusted Applicable Groundwater Quality Standards. Based on this approach, the request for Board Adjusted Standards would be limited to dissolved ammonia, total and dissolved chloride and total and dissolved chromium. These standards would provide relief at and beyond the landfills zone of attenuation. All of the constituents listed in the Response to Comment No. 1 followed by a "*" or a "^"are proposed to be exempted from comparisons to the MAPCs within the zone of attenuation.

25. SCL proposes an adjusted standard to groundwater quality standards at Section 811.320 to allow the development of a new concept SCL entitles "groundwater protection standards (GPS)" which would be the trigger to determine when groundwater quality variations require corrective action. Pet. at 63, 307-314 (App. B). SCL explains that site specific conditions "confound the development of representative background groundwater quality standards." Pet. at 63. Clarify whether SCL's proposed GPS for detection monitoring constituents in Tables 5 and 6 (Pet. at 96-105) are the same as applicable groundwater quality standards based on currently permitted background levels. Identify all constituents for which the proposed GPS is not currently permitted background levels.

Response to Comment

The currently permitted maximum allowable predicted concentrations (MAPCs) have been developed pursuant to 35 IAC 811.317 and 318. The MAPCs are based on the assumption that in the case of a landfill leak that a uniform concentration gradient would develop between the potential source (i.e., the landfill) and the zone of attenuation. However, as discussed by the petition, several hydrogeologic conditions exist at the site (discontinuous formations, mine highwall proximity to upgradient wells, acid drainage, mineralized water upwelling, etc.) that greatly complicate the determination of background concentrations. As such, the development of Maximum Allowable Predicted Concentrations is also significantly influenced by these conditions.

SCL's use of Groundwater Protection Standards (GPS) is nearly identical to that presented in the federal regulations at 40 CFR 258.55(d)(4). They are proposed to be used in this case because 35 IAC811.325(e) and (f) (stated below) does not specifically quantify what concentrations "provide no significant reduction in risk to actual or potential receptors". Furthermore the GPS values are needed to define remedial target concentrations that are technically practicable and which reduce threats to human health or the environment.

35 IAC 811.325(e) States:

> *The Agency shall determine that remediation of a release of one or more constituents monitored in accordance with Section 811.319 from a MSWLF unit is not necessary if the owner or operator demonstrates to the Agency that:*
>
> *1) The groundwater is additionally contaminated by substances that have originated from a source other than the MSWLF unit and those substances are present in such concentrations that cleanup of the release from the MSWLF unit would provide no significant reduction in risk to actual or potential receptors; .....*

35 IAC 811.325(f) states:

> *A determination by the Agency pursuant to subsection (e) shall not affect the Agency's authority to require the owner or operator to undertake source control measures or other measures that may be necessary to eliminate or minimize further releases to the groundwater, to prevent exposure to the groundwater, or to remediate the groundwater to concentrations that are technically practicable and which reduce threats to human health or the environment.*

Pursuant to 40 CFR 258.55(h) groundwater protection standards are established in the following manner:

(1) For constituents for which a maximum contaminant level (MCL) has been promulgated under section 141.2 of the Safe Drinking Water Act (codified) under 40 CFR part 141, the MCL for that constituent;

(2) For constituents for which MCLs have not been promulgated, the background concentration for the constituent established from wells in accordance with §258.51(a)(1); or

(3) For constituents for which the background level is higher than the MCL identified under paragraph (h)(1) of this section or health based levels identified under §258.55(i)(1), the background concentration.

The applicant has substituted the 35 IAC 620.410 Class I Groundwater Standards for the MCLs since the Class I Groundwater Standards are in several instances lower or more conservative than the Safe Drinking Water Act MCLs.

As discussed above the GPS values are not the same as the currently permitted applicable groundwater quality standards or the proposed Board Established Standards for the following reasons: 1) The GPS values are first based on widely accepted health or risk based potable groundwater quality standards. The GPS values are not based on AGQS or background levels unless there is no promulgated standard or unless the site background level or AGQS was greater than the MCL or Class I Groundwater Standard. Finally, pursuant to 35 IAC 811.320(a)(1) applicable groundwater quality standards are not effective within the landfills zone of attenuation. The petitioner believes that the GPS values are necessary to define appropriate risk based standards that would define the trigger for remedial action within the landfill's zone of attenuation. The Proposed GPS values for the detection monitoring constituents are listed in Attachment C. These GPS values are based on the 35 IAC 620.410 Class I Groundwater Standards in instances where the Class I groundwater values are greater than the Maximum Allowable Predicted Standard (MAPC) calculated based on background. These Class I Groundwater Standards would form the effective health risk based trigger for corrective action for instances where the proposed GPS is greater than the Maximum allowable predicted concentration (MAPC). The proposed GPS values are based on the MAPC Standards in instances where no Class I Groundwater Standard exists or in instances where the Class I Standard is less than the MAPC.

The petitioner has prepared the tables in Attachment C which summarize the proposed GPS values for the permit List G1 and G2 parameters. The lists include the proposed parameter changes that are requested by the adjusted standard changes. These tables are provided in an attempted to comply with the Board's request to "identify all constituents for which the proposed GPS is not the currently permitted background levels". However, it should be noted that the List G1 inorganic constituent background concentrations are often calculated by intrawell statistical methods. Thus, different background concentrations exist for each constituent at each monitoring well. As such, it is not easy to tabulate clearly the monitoring points that would have GPS values based on background concentrations or MAPCs or the points where the GPS value would be based on the Class I standard. Therefore the Attachment C Table 1 references the current permit for the tabulated intrawell MAPC values for the inorganic constituents. It is anticipated that should the Board accept the proposed approach, the existing permit Attachments 1 and 2 (Pet. pp. 538 to 550) would be revised to change the listed MAPC values to the higher of the Class I Groundwater Standard or the currently permitted MAPC. Because the MAPC values for the List G2 constituents have been calculated based on interwell statistical analyses, it is much easier to clearly tabulate the GPS values for each hydrostratigraphic unit (i.e., minespoil and shale) and identify the basis for the proposed GPS.

26. Comment on whether adjusted groundwater quality standards can be used as triggers for groundwater evaluation. Address whether adjusted groundwater quality standards can be used for all detection monitoring constituents outside the zone of attenuation. Address whether adjusted groundwater quality standards can be used for constituents impacted by acid mine drainage within the zone of attenuation instead of maximum achievable predicted concentrations.

Response to Comment

The Petitioner believes that Board Adjusted Background Groundwater Quality Standards cannot be utilized as triggers for remedial action because 1) pursuant to 35 IAC 811.320(a)(1) they are not effective within the landfill's zone of attenuation; and 2) the Board adjusted applicable groundwater quality standard would have to be selected in a manner that is substantially similar to the Class I Groundwater approach in order to achieve the risk mitigation goals specified in 35 IAC 811.325(e) and (f). Thus unless a site specific risk assessment was conducted for each constituent, it is likely that the same potable drinking water standards would be selected. As discussed in the response to Board comments No.1 and 7, the petitioner believes that Board Adjusted Groundwater Quality Standards may form appropriate compliance concentrations at and beyond the landfill's zone of attenuation for some constituents which are impacted by acid mine drainage. For instance, the petitioner has suggested that the dissolved ammonia, total and dissolved chloride and total and dissolved chromium Board adjusted applicable groundwater quality standard be effective at and beyond the landfills zone of attenuation. However, because acidity varies as a function of pH which is a logarithmic function the concentrations of other parameters such as total and dissolved sulfate, TDS, dissolved and total iron, dissolved magnesium, etc. may increase rapidly as acid mine drainage acidity increases. In these cases, the petitioner does not believe that published potable water quality standards reflect appropriate Board adjusted groundwater quality standards.

Board approved adjusted standard groundwater quality standards are proposed for the constituents dissolved ammonia total and dissolved chloride and total and dissolved chromium. As discussed in the response to comment No. 13, the natural chloride concentration variations are generally subtle, reflecting an increasing chloride concentration gradient with depth. The historical data suggest that the concentration changes were most pronounced during times that large scale dewatering that was conducted during the landfill expansion cell construction. The landfill is now closed and the concentrations appear to have stabilized considerably. As such, it is believed that the proposed Board adjusted groundwater quality standard could be utilized to analyze groundwater data at and beyond the landfills zone of attenuation. Historical monitoring data suggest that few if any exceedances of this total and dissolved chloride standard i.e., 200 mg/L) would occur at or beyond the landfill's zone of attenuation. If an exceedance did occur, it is anticipated that geochemical temporal analysis of major anions and cations would be useful in discerning the source of a chloride exceedance. Additionally, analysis of the nested well data (i.e., well completed at greater depth and could be utilized to determine the source of the increase (upwelling from depth vs. a possible release from the landfill).

As discussed in petition pages 128 -130, dissolved ammonia concentrations positively correlated to increases in acidity (scatter plots indicate that the ammonia concentration increases are more closely associated with sulfate concentrations, an acid mine drainage indicator than chloride, a possible leachate indicator constituent). Iron metabolizing bacteria that give rise to the acidity secrete ammonia. As such the concentrations of this parameter are anticipated to be subject to concentration variations when pronounced episodes of acidic drainage occur. That said, the historical monitoring data suggest that very few instances of ammonia concentrations that would exceed the proposed Board adjusted background standard of 15 mg/L at or beyond the zone of attenuation. Thus, if such a Board adjusted standard is approved to implement a dissolved ammonia applicable groundwater quality standard of 15 mg/L at and beyond the zone of attenuation, the number of wells that would be required to undergo alternative source demonstration and/or assessment monitoring would currently be limited to one monitoring wells (Well T26S). Under these circumstances the data for a wide assemblage of leachate indicator constituents could be utilized to demonstrate that the ammonia concentrations varied as a function of acid drainage rather than a leachate release. Thus, the petitioner believes that the analysis of ammonia could be a useful parameter whether it is utilized solely for trend analyses as suggested by IEPA or whether it is used for trend and statistical analyses (at or beyond the ZOA) as outlined above.

The question of whether Board adjusted applicable groundwater quality standards might be applicable within the zone of attenuation is more complex. The petitioner has proposed that the GPS values for total and dissolved chloride be set equal to the proposed Board adjusted applicable groundwater quality standard of 200 mg/L. This would have resulted in the same numeric chloride standard being applicable within the zone of attenuation as well as outside of the zone of attenuation. Presently, no wells within the ZOA exceed the proposed chloride standard of 200 mg/L, although well G14S located on the west side of the Cell 1 North expansion has historically exhibited concentrations that periodically exceeded 200 mg/L. The closed areas of the landfill expansion (i.e., Cells 1North and 1 South which are completed along the west side of the previously existing landfill have landfill baseliner invert elevations that are more than 10 ft below the seasonal mean water table. Thus, despite the fact that these landfill cells are equipped with composite liners, the sump areas are dewatered in a manner that may promote the upward flow of mineralized groundwater. Some concern exists that this upward flow may result in elevated chloride concentrations due to upwelling of mineralized water from the bedrock.

As such, the petitioner believes that the IEPA proposal to exempt total and dissolved chloride from statistical analysis requirements should be made applicable within the zone of attenuation. Dissolved chloride would continue to be subject to trend analysis of 35 IAC 811.319(a)(4)(A)(i) and the proposed assessment monitoring trend analysis requirement of 35 IAC 811.319(b)(6), (refer to response to comment No. 9) would be applicable to total chloride. Assuming that total and dissolved chloride are exempted from statistical analysis (i.e., comparison to MAPCs), the request for a total and dissolved chloride groundwater protection standard of 200 mg/L would be withdrawn. This 200 mg/L standard would be effective at and beyond the landfill's zone of attenuation as a Board Adjusted Applicable Groundwater Quality Standard rather than a GPS.

As shown in Figure 1 in Attachment D, the ammonia concentration trend at each of the shallow site monitoring wells is similar whether the wells are located downgradient of the landfill or are located upgradient (i.e., well G22S). This indicates that a site wide influence exists which simultaneously affects the majority of the site monitoring wells (upgradient and downgradient) completed within the minespoil monitoring unit. This simultaneous influence likely reflects the existence of soil moisture conditions that similarly affected the iron metabolizing bacteria that exist in the mine spoil. As shown by Figure 2 in Attachment D, no equivalent increases in TDS concentrations are apparent that might suggest that the increased ammonia concentrations were the result of a leachate release. Thus the petitioner believes that the pronounced nature of the temporal ammonia concentration variations resulting from microbacterial processes would make it extremely difficult to implement the use of A Board adjusted dissolved ammonia groundwater quality standard within the landfills zone of attenuation. Similarly, the potential use of the proposed dissolved ammonia GPS value of 15 mg/L is likely to be limited by the same factors. Therefore, assuming that dissolved ammonia are exempted from statistical analysis requirements, the request for a total and dissolved ammonia groundwater protection standard of 15 mg/L would be withdrawn. In lieu of these requirements, the petitioner supports the IEPA recommendation that dissolved ammonia be subject to trend analysis requirements of 35 IAC 811.319(a)(4)(A)(i).

Other constituents that are highly influenced by acid mine drainage have widely varying concentrations that occur at a number of site monitoring wells. It is recommended that constituents such as TDS, total and dissolved sulfate, dissolved magnesium, total and dissolved zinc and pH not be utilized for statistical analyses since it would be extremely difficult to develop background standards (statistical, Board adjusted Standard or otherwise) that would be capable of characterizing the temporal and spatial variations in the concentrations of these parameters. In the case of dissolved and total sulfate and TDS, the observed groundwater concentrations may extend an order of magnitude or more, greater than the Class I groundwater standards. Similarly, pH levels have varied from near neutral to less than 3 S.U. making it difficult to account for acid drainage related temporal and spatial fluctuations in many pH sensitive metal parameters.

The petitioner believes that Class IV Groundwater at the site (refer to 35 IAC 620.240) should be exempted from statistical analyses (comparisons to AGQS and MAPCs) for constituents that can be shown to be profoundly influenced by the effects of acid mine drainage. Due to the pronounce temporal and spatial concentration variations and the factors discussed in Appendix A of the petition (i.e., non-representative nature of upgradient wells due to proximity to mine high wall, absence of lacustrine deposits upgradient of the landfill, etc.), it is not possible to propose representative background concentrations pursuant to 35 IAC 620.440 that could be utilized to evaluate the acid mine drainage influenced constituent monitoring data inside and outside of the zone of attenuation. Therefore, as recommended by the IEPA, the petitioner believes that these constituents (designated by "*" in comment No. 1 and comment No. 18 responses) should be exempted from statistical analysis.

Finally, as discussed in the response to Board Comment No. 25, the petitioner has proposed that that Groundwater Protection Standards be approved for a wide array of detection and assessment monitoring constituents. These GPS values would define the effective remedial trigger concentrations within the landfill's zone of attenuation. The majority of these constituent GPS values are proposed due to the difficulties implementing the requirements of 35 IAC 811.325(e) and (f) without having clearly tabulated list of constituent concentrations that define the potential risk to public health and the environment. Without these tabulated GPS concentrations the landfill operator is required to achieve either MAPC values developed based on background concentrations that are demonstrated to be non-representative of the spatial variations that occur due to natural geochemical processes, or non-degradation standards which are applicable for 35 IAC 814 Subpart C Landfills. As pointed out by petition (page 79) this results in the implementation of the corrective action programs in a manner that directly conflicts with 35 IAC 811.325 (e) and (f).

For instance the concentration of cis 1,2-dichloroethene observed in the groundwater at well G17S is currently approximately 4 ug/L (approximately 1/20th of the drinking water standard of 70 ug/L). Under the currently regulations the operator is required to perform corrective action (which may require actions much more extensive than source control requirements mandated by 35 IAC 811.325 (f) in order to achieve the permitted MAPC of 1.04 ug/L. These corrective actions could be required despite the fact that groundwater quality would still be deemed Class IV due to concentrations of sulfate, iron, magnesium and TDS that would still exceed the Class

1 Potable Groundwater Standards by an order of magnitude or more. Furthermore, under the existing regulations, the corrective action could still be required despite the fact that no evidence exists that the cis 1,2 DCE AGQS concentrations are being exceeded at or beyond the landfill's zone of attenuation. Thus, no environmental benefit would be achieved by increasing the corrective action efforts to address the cis 1,2 DCE concentrations. In fact, cross media impacts associated with pump and treat corrective action might actually result in a net environmental detriment rather than a benefit.

The response to Board comment No. 25 notes the Federal Subtitle D (40 CFR 258.55(h) process for establishing Groundwater Protection Standards. As identified by this discussion, the proposed GPS values are first determined by risk based considerations (presence of MCLs or in this Case Class I Groundwater Standards that are less than the MCLs). These are deemed by the federal standards to be distinctly different from background standards. Should the Board choose to approve adjusted standard values that are based on the Class I Groundwater standards of 35 IAC 620.410, it would essentially accomplish the same relief goal as the proposed GPS values. Although, the MAPC values for many constituents would have to be recalculated for wells located within the ZOA based on the Board established Groundwater Standards. Additionally, the approval of health based Board Adjusted Standard Background values for the numerous constituents listed in Comment 25 would likely result in the unintended effect of extending the these risk based standards to the facilities property boundary rather than to just the zone of attenuation (i.e., 100 ft from the landfill), as proposed by the petitioner. This would be the case since pursuant to 35 IAC 811.320(a)(1) the Applicable Groundwater Quality Standards are effective at and beyond the zone of attenuation.

27. *For pesticides and organic constituents listed in petition Tables 5 and 6, SCL proposes groundwater standards based on Class I groundwater quality standards (35 Ill.Adm.Code 620.410), background levels (Section 811.320), and practical quantitation levels (PQL). Pet. at 96-105. SCL argues that it proposes its new concept of groundwater protection standards (GPS) to resolve what SCL describes as a conflict between remedial objectives based on non-degradation (background) standards (Section 811.320) and risk- based objectives under Sections 811.325(e) and (f). Pet. at 79.*

    a. *Section 811.325(b) requires corrective action to be protective of human health and the environment, as well as attain background groundwater quality standards. To the extent SCL proposes background levels as GPS for certain constituents, explain why SCL proposes an alternate groundwater protection standards if the background groundwater quality standard is itself protective of human health and the environment.*

Response to Comment

The petitioner has proposed that the Groundwater Protection Standards be implemented in the manner proposed by 40 CFR 258.55(h) by first proposing MCLs (or Illinois Class I Groundwater

Standards if lower than the MCL) or background concentrations, if the background levels are greater than the Class I Groundwater Standard or if no Class I Groundwater (or MCL) Standard exists. This approach has been utilized to maintain consistency with the federal regulatory approach and to ensure that human health and environment based risk triggers be utilized to determine when additional corrective action is warranted. The use of risk based standards appears central to the regulatory relief provided by35 IAC 811.325(e) and (f). The risk based groundwater standards are deemed to be more appropriate than background standards in instances where anthropogenic impacts exist from prior coal mining operations since representative background concentrations are often impossible to develop and because acid mine drainage may result in analytical method interferences (i.e., elevated iron and aluminum) concentrations which reduce the ability to quantify other constituent concentrations. The risk based standards act as a tool to help insure that the remedial action costs are commensurate with the benefits of the corrective action. Furthermore, the use of risk based criteria help minimize the potential of cross media impacts that could occur if pump and treat type corrective actions were applied to the groundwater within the strip mined area.

The Board is correct that the proposed GPS values include many pesticides and other organic constituents that have not been detected at SCL. However, if such constituents were to be detected in the future at concentrations less than the Class I Groundwater Standard, the petitioner still believes that the same environmental risk, cross media concerns and economic considerations voiced in the response to comment No, 26 (refer to cis 1,2 DCE corrective action discussion) would also hold true for these constituents. As such, in instances where the Class I Groundwater Standard is greater than the MAPC, the petitioner has requested that the GPS be approved as the relevant standard within the landfills zone of attenuation. As discussed on page 79 of the petition, the continued treatment of groundwater in an attempt to further decrease cis 1,2 -dichloroethene concentrations that are approximately 1/20th of the drinking water standard results in no significant environmental benefit when the concentrations of sulfate, iron, TDS and many other constituents are often an order of magnitude greater than the Class I Groundwater Standard and thus render the water non-potable. Furthermore, all available evidence (i.e., VOC monitoring results at T series wells) indicates that the concentrations of this constituent are attenuated to levels below the laboratory practical quantitation limits at the landfills zone of attenuation. Therefore, no evidence exists that more extensive corrective action efforts would measurably reduce risks or otherwise benefit potential off-site receptors.

b. *If the background groundwater quality standard is less stringent than an alternate standard protective of human health and the environment, comment on whether the remediation standard would still be the background groundwater quality.*

Response to Comment

Pursuant to the procedures identified in 40 CFR 258.55(h), the background groundwater quality standard or in this case the MAPC developed using the background standard would be the relevant GPS (i.e., remediation standard) value if the background concentrations and MAPCs are greater than the Illinois Class I Groundwater Standards or if no Class I Groundwater/MCL standard exists. These procedures are proposed in order to maintain corrective action environmental cross media impacts and social and economic costs that are commensurate with the environmental benefits.

> c. *Section 811.320(e)(3) allows use of the practical quantitation limit (PQL) defined as the lowest concentration that is protective of human health and the environment that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Explain why SCL proposes groundwater protection standards for several constituents based on Class I groundwater quality standards instead of PQL.*

Response to Comment
Historical monitoring data has shown that the laboratory is often unable to meet the permitted practical quantitation limits for all samples during all monitoring rounds. For instance iron and aluminum are common metals that are leached from the minespoil into the groundwater which cause interferences that hinder the ability to quantify the concentrations of other metals (i.e., lead, magnesium, thallium etc.). Often several analytical methods exist to analyze the required constituents. 35 IAC 811.320(e)(3) seeks to advise the practitioner to where possible, choose analytical methods that offer precision, accuracy, reproducibility while still being protective of human health and the environment. Because different analytical methods may have varying practical quantitation limits for the same constituent, 35 IAC 811.320(e)(3) cannot be taken to represent a single quantifiable numerical standard in the same way the Class I Groundwater Quality Standard (35 IAC 620.410) represents a single numerical standard regardless of the specific analytical method.

> *35 IAC 825(e) reads as follows:*
> *The Agency shall determine that remediation of a release of one or more constituents monitored in accordance with Section 811.319 from a MSWLF unit is not necessary if the owner or operator* demonstrates to the Agency that:
>
> *The groundwater is additionally contaminated by substances that have originated from a source other than the MSWLF unit and those substances are present in such concentrations that cleanup of the release from the MSWLF unit would provide no significant reduction in risk to actual or potential receptors; .....*

Often many different analytical methods and procedures are available to complete groundwater analyses. Section 811.320(e)(3) appears to be seeking that the groundwater sampling and analysis plans specify methods which are capable of determining whether a risk based standard such as the Class I Groundwater Standard has been exceeded. In these instances the petitioner believes that the actual risk based standard the 35 IAC 620.410 Class I standard provides a more definitive numerical risk based standard than a PQL that might change based on analytical methods, volume of sample analyzed, matrix interference conditions, etc.

The limitation of using the PQL to establish the risk based standard is apparent from the previous cis 1,2 DCE example provided in response to Board comment No. 26. The original laboratory, that conducted the groundwater analyses used to develop the cis 1,2 DCE background at 1.0 ug/L utilized a much lower PQL than most laboratories utilizing SW846 Method 8260 which typically has a PQL of 5.0 ug/L. As such, the Unit 1 Landfill AGQS has been established in the facility's permit at a concentration that is 1/5 of the level utilized by most landfills operating within the state. While this AGQS certainly meets the intent of Section 811.320(e)(3), it has occasionally created difficulty consistently meeting the PQL during every monitoring round. As such, the applicant believes that the Class I Groundwater Standards provide a more definitive and accessible risk based standard that can be used to quantify the magnitude of reduce threats to human health or the environment than the PQL.

The Class I Groundwater Standard is also deemed more consistent with the intent of 35 IAC 811.325(e) and (f). PQL values generally reflect instrumentation, equipment and matrix limitation considerations rather than the risk based considerations listed by 35 IAC 811.325(e) and (f). Finally, the use of the PQL values developed in compliance Section 811.320(e)(3) may in some instances provide no practical difference from the non-degradation requirements of 35 IAC 811.320(a)(2). Under these conditions, the inclusion of 35 IAC 811.325 (e) and (f) into the regulations would accomplish little or none of the risk benefit evaluation that the regulations appear to be promoting in cases where the groundwater is additionally contaminated by substances that have originated from a source other than the MSWLF unit.

> d. *Clarify whether SCL's proposed groundwater protection standards for pesticides and organic constituents wouldbe considered as groundwater quality standards at or beyond the zone of attenuation. If so, propose adjusted groundwater quality standards for constituents for which the groundwater quality standard is not based on background or PQL consistent with 35 IL. Adm. Code 811.320(a)(l)(B) and 8ll.320(b)(4). Propose adjusted standard language consistent with the format in Question 20 above.*

Response to Comment

The groundwater protection standard for pesticides and organic constituents would only be effective within the landfill's zone of attenuation. The relevant standard at or beyond the landfills zone of attenuation would remain the permitted background levels (i.e., applicable groundwater quality standards) which are based on the analysis method practical quantitation limits. The permitted PQLs may be modified to better reflect the concentrations that can consistently be achieved. However, this modification can be achieved through the significant permit modification process and does not require a Board adjusted Standard. As such, since the relevant standard at or beyond the zone of attenuation would remain the AGQS (PQL in the case of pesticides and organic constituents), therefore no modified adjusted standard language consistent with 35 IL. Adm. Code 811.320(a)(l)(B) and 8ll.320(b)(4) is believed necessary, in this instance.

28. *Provide a table of the constituents SCL proposes to include on the detection monitoring list and each constituent's proposed numeric groundwater protection standard. Comment on whether an adjusted standard using this list resolves SCL's concerns as to setting an alternative trigger for corrective action for those constituents impacted by acid mine drainage and upwelling of brine.*

Response to Comment

The permit List G1 and G2 have been edited to summarize the proposed detection monitoring constituents (Refer to Attachment C). The lists summarize the regulatory analysis requirements as well as the Groundwater Protection Standards. As discussed in the response to Board Comment No. 25, the GPS values are based on the 35 IAC 620.410 Class I Groundwater Standards in instances where the Class I groundwater values are greater than the Maximum Allowable Predicted Standard calculated based on background. The proposed GPS values are based on the MAPC Standards in instances where no Class I Groundwater Standard exists or in instances where the Class I Standard is less than the MAPC.

As discussed in the Comment No. 25 response, it should be noted that the List G1 inorganic constituent background concentrations are often calculated by intrawell statistical methods. Thus different background concentrations exist for each constituent at each site detection monitoring well. As such, it is not easy to tabulate the monitoring points that would have GPS values based on background concentrations or MAPCs or the points where the GPS value would be based on the Class I Groundwater Standards. It is anticipated that this would be accomplished during permitting by revising the existing permit Attachments 1 and 2 (Pet. pp. 538 to 550) to change the listed MAPC values to the higher of the Class I Groundwater Standard or the currently permitted MAPC. Because the MAPC values for the List G2 constituents have been calculated based on interwell statistical analyses, it is much easier to clearly tabulate the GPS values for each hydrostratigraphic unit (i.e., minespoil and shale) and identify the basis for the proposed GPS (refer to Attachment C).

The proposed groundwater protection standards would result in the replacement of the existing maximum allowable predicted concentration (MAPC) for some constituents with the risk based Class I Groundwater Standard. This change would better allow the requirements of 35 IAC 811.325(e) and (f) to be implemented in a way that that protective of public health and the environment and in a way that would result in corrective action being implemented in a manner that achieves commensurate economic and environmental benefits. Furthermore, the proposed changes would still result in the non-degradation standards or Applicable Groundwater Quality Standards remaining effective at and beyond the facilities zone of attenuation boundary.

The majority of the relief for the acid mine drainage and brine related site specific conditions is obtained through the proposed changes to the detection and assessment monitoring lists (i.e., deletion of constituents affected by acid drainage), and by the proposed approval of Board Adjusted Groundwater Quality Standards for dissolved ammonia, total and dissolved chloride and total and dissolved chromium). The GPS values do in some instances (i.e., primarily chromium and boron) help overcome some of the limitations in developing representative background concentration for these constituents. As discussed in the Petition, the site conditions such as the proximity of the mine high wall to the upgradient side of the landfill and the absence of lacustrine deposits along the upgradient (southeast) side of the landfill, limit the ability to develop representative background groundwater quality. Furthermore, the process utilized to develop the numerical MAPC values assumes that a uniform concentration gradient exists from the landfill to the edge of the zone of attenuation. For many metal constituents, this concentration gradient can be disrupted when the groundwater pH routinely varies by more than 3 pH units (thousand fold increases in groundwater acidity) over short distances. These acidity conditions often result in dissolution of the mineral matter in minespoil and shale. As such, it is anticipated that the GPS values will provide some relief in these instances.

29. *In its petition, SCL states "GPS values may require periodic modification due to changes in regulations ... and/or changes in the analytical testing program or changes in permitted background concentrations." Pet. at 64. Identify each of the constituents on the list in the above question which may require periodic modification to the numerical trigger for corrective action and explain why SCL anticipates periodic modification to the groundwater protection standard for that constituent.*

Response to Comment
It is not possible to tabulate the GPS values in the manner requested. MCLs and Class I Groundwater Standards are generally developed by USEPA or the Agency for Toxic Substances and Disease Registry (ASTDR) based on exposure risk calculations based on what the rule makers have considered an acceptable risk (typically 1 cancer death out of a population of 1,000,000 persons). These numerical standards are subject to change as new toxicology data and studies come to light. As such, some flexibility to modify the GPS values in the future must be maintained in order to maintain consistency with Federal and State law.

It is also anticipated that GPS values are likely to change for some constituents due to proposed changes in method practical quantitation limits (PQLs). Prior facility permits actually contained two distinctly different sets of AGQSs for organic constituents that were both based on the analysis method practical quantitation limits that were reported for the Unit 1 Landfill and the Unit 2 landfill, respectively. The Unit 1 landfill generally contained PQLs that were significantly lower than the Unit 2 landfill based on the specific method analysis procedures (i.e., method purge volume etc.). Historical analyses have shown that the laboratory has not always been able to achieve the ultra- low PQLs on a consistent basis. As such, it is anticipated that at some point following the decision on the petition, that the operator will propose to IEPA as a significant permit modification application PQLs that are consistent with the published 40 CFR 258 Appendix II practical quantitation limits (and/or 35 IAC 724 Appendix I quantitation limits) for the specific method utilized by the laboratory. In this way, the permitted standards will be more consistent with other facilities located throughout Illinois.

IEPA has requested that the adjusted standard petition not include the proposed Unit 2 Landfill PQLs since the Agency has the authority to approve changes in the sampling and analysis plan PQL levels as a Significant Permit Modification Application and thus the change would not require Board approval. However, in the interest of being responsive to the Board comments, a comparison of the Unit 1 and Unit 2 PQL values are provided in Attachment E. This is provided for informational purposes only. No adjusted standard changes are requested of the Board at this time to implement the PQL changes.

30. *Explain why SCL proposes to develop groundwater protection standards as the trigger for corrective action rather than seeking adjusted groundwater quality standards as provided for in Section 811.320(a)(l)(B) and (b).*

Response to Comment

As discussed in the response to comment No. 26, the GPS values have been proposed in a manner consistent with 40 CFR 258.55(h). As such the GPS values are based sequentially on published risk based standards such as 35 IAC 620.410 and background standards in cases where background exceeds the Class I Groundwater Standard or in cases where no Class I Groundwater or MCL exists. The GPS values would be effective only within the zone of attenuation and therefore the geography of the applicable areas differ from the Board Adjusted Background Groundwater Quality Standards, which are effective at and beyond the landfill's zone of attenuation. Pursuant to 35 IAC 811.320(a)(1), the application of Board adjusted applicable groundwater quality standards would have the unintended effect of extending the relief to the property boundary, as opposed to GPS values or MAPCs that are effective only within the zone of attenuation. Secondly, the GPS values are believed necessary so that a clearly identified health and environment risk based groundwater standard is available to determine when the 35 IAC 811.325(e) requirement of "*significant reduction in risk to actual or potential receptors*" is achieved.

31. *IEPA explains that it uses background groundwater quality to determine pollutant concentrations triggering corrective action. Rec. at 27. IEPA acknowledges that 35 Ill. Adm. Code 811.325(e) allows IEPA to determine that remediation is not necessary in certain circumstances. Rec. at 27. For example, remediation is not necessary when groundwater is contaminated by another source and corrective action by the landfill would provide no significant reduction in risk to actual or potential receptors. 35 Ill. Adm. Code 811.325(e)(l). Comment on whether SCL believes the concerns raised in its petition could have been addressed under Section 811.325(e) and whether SCL views Section 811.325(e) as applicable to its situation.*

Response

As discussed in the response to Board comments No.26 and 27, the applicant believes that 35 IAC 811.325(e) and (f) are very applicable to the site since the previous history of coal strip mining has rendered the groundwater non-potable. However, 35 IAC 811.325(e) and (f) are currently rendered ineffective at balancing environmental and economic benefits of additional corrective action since these regulations do not specify what risk based standards should be considered in determining the potential environmental and human health benefits. Absent these standards, the IEPA applies non-degradation or background levels as the appropriate level for corrective action. Based on the Agency's application of a non-degradation standard as a remedial trigger, 35 IAC 811.325(e) and (f) do not provide the balanced consideration of risk to benefits that appears to have been contemplated by the regulation.

The petitioner does not believe that the concerns raised in the petition can be resolved by the relief seemingly provided under 35 IAC 811.325(e) and (f). As stated by IEPA Rec at 27

> *" the regulations do not provide a means to determine what constitutes a "significant reduction in risk to actual or potential receptors." As such, due to the non-degradation requirements of Ill Adm. Code Part 811.319(a)(1)(4)(A), the Illinois EPA has consistently and appropriately applied the most conservative non-degradation interpretation (i.e., restoration of background groundwater quality) as the relevant groundwater standard. Current regulatory guidance requires that the Illinois EPA utilize background groundwater quality determined pursuant to 35 Ill Admin. Code Part 811.320 as the trigger concentration to assess the need for corrective action…"*

The petitioner believes that appropriate public health and environmental safety based risk standards such as the Illinois Class I Groundwater Standards referenced at 35 IAC 620.410 are required to define concentrations that provide a significant reduction in risk to actual and potential receptors. Because the Class I standards are the same or in some cases are more stringent than the Federal Safe Drinking Water Act 40 CFR 141 maximum contaminant levels (MCLs) they have already been deemed protective of public health.

The petitioner believes that without the introduction of these GPS or similar risk based values and the elimination the requirement that statistical analyses be conducted for parameters that are not representative of landfill impact at the site (i.e., sulfate, TDS, iron, manganese zinc, etc) that the corrective action requirements would likely be expanded far beyond the current source control measures and would likely include groundwater impacts resulting from previous coal strip mining activities. Such an expansion of the corrective action requirements would bring no significant benefit to public health or the environment and could result in cross-media impacts that increase the potential risks to human health and the environment. Use of the proposed GPS values in combination with MAPC values within the zone of attenuation, should allow the continuation of the source control measures (i.e., landfill gas extraction and leachate extraction system improvements) that have been demonstrated to reduce landfill related impacts (i.e., cis 1,2 -dichloroethene). Most importantly, the petitioner believes that no receptors are being affected by the facility since landfill related groundwater impacts are shown to dissipate before reaching the landfills zone of attenuation.

32. *Comment on whether the following language reflects SCL's request for an adjusted standard as to the regulatory provisions identified. In commenting on this language, assume that the phrase "adjusted groundwater quality standard" is a numerical standard set forth in the format of Question 20.*

    a. *In lieu of 35 Ill. Adm. Code 811.319(b)(3), SCL must comply with the following:*

> *If the analysis of the assessment monitoring data shows that the concentration of one or more constituents, monitored at or beyond the zone of attenuation is above the applicable groundwater quality standards or adjusted groundwater quality standard and is attributable to the solid waste disposal facility, then SCL must determine the nature and extent of the groundwater contamination and must implement the remedial action in accordance with Section 811.319(d).*

Response

The language presented above reflects the petitioner's intent for the compliance trigger at and beyond the landfills zone of attenuation.

b. *In lieu of 35 Ill. Adm. Code 811.319(b)(4), SCL must comply with the following:*

> *If the analysis of the assessment monitoring data shows that the concentration of one or more constituents is attributable to the solid waste disposal facility and exceeds the maximum allowable predicted concentration or adjusted groundwater quality standard within the zone of attenuation, then SCL must conduct a groundwater impact assessment in accordance with the requirements of Section 811.319(c).*

Response

This proposed wording conflicts with 35 IAC 811.320(a)(1). Pursuant to 35 IAC 811.320(a)(1), the applicable groundwater quality standard or Board adjusted standard is not the effective standard within the ZOA. The statement summarizes above equates a Board Adjusted Standard Groundwater Quality Standard with the Groundwater Protection Standards from 40 CFR 258.55(h). As discussed in the response to comments 7 and 26, the GPS values are believed to be distinct from Board adjusted groundwater quality standards since they are meant to be portray toxicological developed numerical risk standards which have been deemed protective for potable public water supplies. Additionally, the Board Adjusted Standard Groundwater Quality Standard is by definition effective outside of the landfills zone of attenuation rather than within the zone of attenuation. For these reasons, the petitioner believes that the terminology from 40 CFR 258.55(h) best fits the petitioners intended use as a risk based numerical standard to be used in conjunction with 35 IAC 811.325(e) and (f).

c. *In lieu of 35 Ill. Adm. Code 811.319(c), SCL must comply with the following:*

> *If required to conduct a groundwater impact assessment in accordance with this adjusted standard, SCL must assess the potential impacts outside the zone of attenuation that may result from confirmed increases above the maximum allowable predicted concentration or adjusted groundwater quality standards within the zone of attenuation, attributable to the facility, in order to determine if there is need for remedial action. In addition to the requirements of Section 811.317, the following requirements apply:*

Response

The petitioner suggests that the term "adjusted groundwater quality standards" be replaced with "*groundwater protection standards*" for the reasons stated in the response to (b).

> *1) SCL must utilize any new information developed since the initial assessment and information from the detection and assessment monitoring programs and such information may be used for the recalibration of the GCT model; and*

Response

The proposed language in (1) is acceptable.

> *2) SCL must submit the groundwater impact assessment and any proposed remedial action plans determined necessary pursuant to Section 811.319(d) to the Agency within 180 days after the start of the assessment monitoring program.*

Response

The proposed language in (2) is acceptable to the petitioner.

> *d. In lieu of 35Ill. Adm. Code 811.319(d)(1)(B), SCL must comply with the following:*
>
> *Any confirmed increase above the applicable groundwater quality standards of Section 811.320 or the adjusted groundwater quality standards is determined to be attributable to the solid waste disposal facility in accordance with Section 811.319(b) of this Section.*

Response

The petitioner accepts the proposed language in (d) since the statement would apply at or beyond the landfills zone of attenuation. Suggest deletion of "*of this Section*".

> *e. In lieu of 35 Ill. Adm. Code 811.319(d)(3)(B), SCL must comply with the following:*
>
> *Establishing that a violation of an applicable groundwater quality standard of Section 811.320 or an adjusted groundwater quality standard is attributable to the solid waste disposal facility in accordance with Section 811.319(b)(3).*

Response

The petitioner accepts the proposed language in (e) since the statement would apply at or beyond the landfills zone of attenuation.

f. *In lieu of 35 ill. Adm. Code 811.319(d)(5)(A), SCL must comply with the following:*

The remedial action program must continue in accordance with the plan until monitoring shows that the concentrations of all monitored constituents are below the maximum allowable predicted concentrations or adjusted groundwater quality standards within the zone of attenuation, below the applicable groundwater quality standards of Section 811.320 or adjusted groundwater quality standards at or beyond the zone of attenuation, over a period of four consecutive quarters no longer exist.

Response

The petitioner suggests that "*adjusted groundwater quality standards*" be replaced with "*groundwater protection standards*" within the zone of attenuation for the reasons stated in the response to (b).

Adjusted Standard Conditions

33. *While the petition is brought under Section 28.1 of the Act authorizing the Board to grant an adjusted standard, the requested relief is styled as a site-specific rule. Pet. App. B. The petition essentially seeks alternate lists of parameters for groundwater monitoring purposes as well as alternate groundwater quality standards used to determine whether corrective action is necessary. Accordingly, it appears that the requested relief should not be structured as line edits to existing rule language. Propose a complete list of adjusted standard conditions, including any conditions pulled from the questions above.*

Response

While Appendix B may appear to be structured in a manner similar to that typically utilized for a Site Specific Regulation, it is the applicant's intent to pursue the requested relief as an adjusted standard petition. The red-line markup of the regulations was intended to portray the manner in which the proposed relief impacts several different regulatory sections. Pursuant to the Board's comments, the relief request has been restructured in the responses to the preceding comments in a more typical manner. However, because the groundwater standard regulations are often cross referenced in other sections, the petitioner believes that it is useful to present the proposed changes in their entirety. As such, Attachment G, provides the proposed adjusted standard changes in their entirety. The proposed changes have been redlined (Appendix G1) in order to call out sections where the proposed relief is requested. Appendix G2 contains the proposed regulatory changes without the redline.

Attachment A

Proposed Assessment Monitoring Parameters and Groundwater Protection Standards

Appendix A
Proposed Assessment Monitoring Parameter and Class I Groundwater based GPS Values
Saline County Landfill
Harrisburg, Illinois

Parameter [2]	40CFR 141 MCL Standard (ug/L)	Suggested Methods (SW-846, 3rd Edition3)	35 IAC 620.410 Class I Groundwater (ug/L unless otherwise indicated)
Bicarbonate Alkalinity		EPA 5.10	
Chloride[#*] (mg/L)	250		200 mg/L
Cyanide, total (mg/L)	0.2	9010A	0.2 mg/L
Fluoride (mg/L)			4 mgL
Nitrate (as N) (mg/L)			10 mgL
Perchlorate		314	4.9
pH		9040C	
Phenols (total phenolics)		420.4	100
Sulfide (mg/L)		376.1	
Sulfate[*] (mg/L)			400 mg/L
TDS[*] (mg/L)		2540C	1200 mg/L
Metals (Total)			
Antimony	6	6010C	6
Arsenic	10	6010C	10
Barium	2000	6010C	2000
Beryllium	4	6010C	4
Boron		6010C	2000
Cadmium	5	6010C	5
Chromium[a]	100	6010C	100
Cobalt		6010C	1000
Copper		6010C	650
Iron*		6010C	5000
Lead	15 (target level)	6010C	7.5
Manganese*		6010C	150
Potassium		6010C	
Nickel		6010C	100
Selenium	50	6010C	50
Silver		6010C	50
Sodium		6010C	
Thallium	2	6010C	2
Tin		6010C	
Vanadium		6010C	49
Zinc *		6010C	5000
Mercury	2	7470A	2
Pesticides/PCBs			
Aldrin		8081A	
alpha-BHC		8081A	0.11
Beta-BHC		8081A	
delta-BHC		8081A	
gamma-BHC; Lindane	0.2	8081A	0.2
Chlordane [6]	2	8081A	2
4,4-DDD		8081A	
4,4-DDE		8081A	
4,4-DDT		8081A	
Dieldrin		8081A	
Endosulfan I		8081A	
Endosulfan II		8081A	

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Harrisburg, Illinois

Parameter [2]	40CFR 141 MCL Standard (ug/L)	Suggested Methods (SW-846, 3^{rd} Edition3)	35 IAC 620.410 Class I Groundwater (ug/L unless otherwise indicated)
Endosulfan sulfate		8081A	
Endrin	2	8081A	2
Endrin aldehyde		8081A	
Heptachlor	0.4	8081A	0.4
Heptachlor epoxide	0.2	8081A	0.2
Methoxychlor	40	8081A	40
Toxaphene [8]	3	8081A	3
Polychlorinated biphenyls; PCBs; Aroclors [7]	0.5	8082	0.5
Herbicides			
Dalapon		8321A	200
Dicamba		8321A	210
2,4-D; 2,4-Dichlorophenoxyacetic acid	70	8321A	70
Dinoseb; DNBP; 2-sec-Butyl-4,6-dinitrophenol	7	8321A	7
Mecoprop (MCPP)		8321A	7
Silvex; 2,4,5-TP.	50	8321A	50
Pentachlorophenol	1	8321A	1
Picloram		8321A	500
2,4,5-T; 2,4,5 Trichlorophenoxyacetic acid		8321A	
Carbofurans			
Carbofuran		EPA531	40
Aldicarb		EPA531	3
Endothall Method 548			
Endothall		EPA548	100
Volatiles		8260B	
Acetone		8260B	6300
Acetonitrile; Methyl cyanide		8260B	
Acrolein		8260B	
Acrylonitrile		8260B	
Allyl chloride		8260B	
Benzene	5	8260B	5
Bromobenzene			
Bromochloromethane; Chlorobromomethane		8260B	
Dibromochloromethane	80 (total trihalomethanes)	8260B	
Bromoform; Tribromomethane	80 (total trihalomethanes)	8260B	
n-Butylbenzene			
sec-Butylbenzene			
tert-Butylbenzene			
Carbon disulfide		8260B	700
Carbon tetrachloride	5	8260B	5
Chlorobenzene	100	8260B	
Chloroethane; Ethyl chloride		8260B	
Chloroform; Trichloromethane	80 (total trihalomethanes)	8260B	70
Chloroprene		8260B	
Chlorodibromomethane	80 (total trihalomethanes)	8260B	
2-Chlorotoluene			

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Saline County Landfill
Harrisburg, Illinois

Parameter [2]	40CFR 141 MCL Standard (ug/L)	Suggested Methods (SW-846, 3rd Edition3)	35 IAC 620.410 Class I Groundwater (ug/L unless otherwise indicated)
4-Chlorotoluene			
Dibromomethane			
o-Dichlorobenzene; 1,2 Dichlorobenzene	600	8260B	600
m-Dichlorobenzene; 1,3-Dichlorobenzene		8260B	
p-Dichlorobenzene; 1,4-Dichlorobenzene	75	8260B	750
trans-1,4-Dichloro-2-butene		8260B	
Dichlorodifluoromethane; CFC-12		8260B	1400
1,1-Dichloroethane; Ethyldidene chloride		8260B	1400
1,2-Dichloroethane; Ethylene dichloride	5	8260B	5
1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	7	8260B	7
cis-1,2-Dichloroethylene cis-1,2-Dichloroethene	70	8260B	70
trans-1,2-Dichloroethylene trans-1,2-Dichloroethene	100	8260B	100
1,2-Dichloropropane; Propylene dichloride	5	8260B	5
1,3-Dichloropropane; Trimethylene dichloride		8260B	
2,2-Dichloropropane; Isopropylidene chloride		8260B	
1,1-Dichloropropene		8260B	
cis-1,3-Dichloropropene		8260B	
trans-1,3-Dichloropropene		8260B	
Ethylbenzene	700	8260B	700[5]
Ethyl methacrylate		8260B	
Hexachlorobutadiene		8260B	
2 Hexanone; Methyl butyl ketone		8260B	
Isobutyl alcohol		8260B	
Isopropylbenzene			700
p-Isopropyltoluene			
Methacrylonitrile		8260B	
Methyl bromide; Bromomethane		8260B	
Methyl-ter-butylether (MTBE)			70
Methyl chloride; Chloromethane		8260B	
Methyl ethyl ketone; MEK 2-Butanone		8260B	
Methyl iodide;Iodomethane		8260B	
Methyl methacrylate		8260B	
4-Methyl-2-pentanone; Methyl isobutyl ketone		8260B	
Methylene bromide; Dibromomethane		8260B	
Methylene chloride; Dichloromethane	5	8260B	5
Naphthalene		8260B	140
Propionitrile; Ethyl cyanide		8260B	
n-Propylbenzene			
Styrene	100	8260B	100
1,1,1,2-Tetrachloroethane		8260B	
1,1,2,2-Tetrachloroethane		8260B	
Tetrachloroethylene; Tetrachloroethane; Perchloroethylene	5	8260B	5
Tetrahydrofuran			
Toluene	1000	8260B	1000
1,2,3-Trichlorobenzene			
1,2,4-Trichlorobenzene	70	8260B	70

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Harrisburg, Illinois

Parameter[2]	40CFR 141 MCL Standard (ug/L)	Suggested Methods (SW-846, 3rd Edition3)	35 IAC 620.410 Class I Groundwater (ug/L unless otherwise indicated)
1,1,1-Trichloroethane; Methylchloroform	200	8260B	200
1,1,2-Trichloroethane	5	8260B	5
Trichloroethylene; Trichloroethene	5	8260B	5
Trichlorofluoromethane; CFC-11		8260B	2100
1,2,3-Trichloropropane		8260B	
1,2,4-Trimethylbenzene			
1,3,5-Trimethylbenzene			
Vinyl acetate		8260B	
Vinyl chloride; Chloroethene	2	8260B	2
Xylene (total)[3]	10,000	8260B	10000
Method 8011 VOCs		8011	
1,2-Dibromo-3-chloropropane; DBCP	0.2	8011	0.2
1,2-Dibromoethane; Ethylene dibromide; EDB	0.05	8011	0.05
Semi-Volatiles (SVOCs)			
Acenaphthene		8270C	420
Acenaphthylene		8270C	
Acetophenone		8270C	
2-Acetylaminofluorene; 2-AAF		8270C	
4-Aminobiphenyl		8270C	
Anthracene		8270C	2100
Benzo[a]anthracenene Benzanthracene		8270C	0.13
Benzo[b]fluoranthene		8270C	0.18
Benzo[k]fluoranthene		8270C	0.17
Benzo[ghi]perylene		8270C	
Benzo[a]pyrene	0.2	8270C SIM	0.2
Benzoic acid		8270C	28,000
Benzyl alcohol		8270C	
Bis(2 chloroethoxy)methane		8270C	
Bis(2-chloroethyl) ether; Dichloroethyl ether		8270C	
Bis(2-chloro-1-methylethyl) ether; 2,2-Dichlorodiisopropyl ether; DCIP, See note 5		8270C	
Bis(2-ethylhexyl) phthalate	6	8270C	6
4-Bromophenyl phenyl ether		8270C	
Butylbenzyl phthalate; Benzyl butyl phthalate		8270C	
p-Chloroaniline; Benzamine, 4-chloro		8270C	
Chlorobenzilate		8270C	
p-Chloro-m-cresol; 4-Chloro-3-methylphenol		8270C	
2-Chloronaphthalene		8270C	
2-Chlorophenol		8270C	
4-Chlorophenyl phenyl ether		8270C	
Chrysene		8270C	12
m-Cresol;3-methylphenol		8270C	
o-Cresol; 2-methylphenol		8270C	350
p-Cresol;4-methylphenol		8270C	
Diallate		8270C	
Dibenz[a,h]anthracene		8270C	0.3
Dibenzofuran		8270C	
Di-n-butyl phthalate		8270C	700
3,3-Dichlorobenzidine		8270C	
2,4-Dichlorophenol		8270C	
2,6-Dichlorophenol		8270C	
Diethyl phthalate		8270C	5600
Dimethoate		8270C	

Appendix A
Proposed Assessment Monitoring Parameter and Class I Groundwater based GPS Values
Saline County Landfill
Harrisburg, Illinois

Parameter [1]	40CFR 141 MCL Standard (ug/L)	Suggested Methods (SW-846, 3rd Edition3)	35 IAC 620.410 Class I Groundwater (ug/L unless otherwise indicated)
p-(Dimethylamino)azobenzene		8270C	
7,12-Dimethylbenz[a]anthracene		8270C	
3,3'-Dimethylbenzidine		8270C	
2,4-Dimethylphenol; m-Xylenol		8270C	
Dimethyl phthalate		8270C	
m-Dinitrobenzene		8270C	
4,6-Dinitro-o-cresol; 4,6 Dinitro-2-methylphenol		8270C	
2,4-Dinitrophenol		8270C	
2,4-Dinitrotoluene		8270C	0.31
2,6-Dinitrotoluene		8270C	0.31
Di-n-octyl phthalate		8270C	
1,4-Dioxane		8270C	7.7
Diphenylamine		8270C	
Ethyl methanesulfonate		8270C	
Famphur		8270C	
Fluoranthene		8270C	280
Fluorene		8270C	280
Hexachlorobenzene	1	8270C	
Hexachlorocyclopentadiene	50	8270C	50
Hexachloroethane		8270C	
Hexachloropropene		8270C	
Indeno (1,2,3 cd) pyrene		8270C	0.43
Isodrin		8270C	
Isophorone		8270C	
Isosafrole		8270C	
Kepone		8270C	
Methapyrilene		8270C	
3-Methylcholanthrene		8270C	
Methyl methanesulfonate		8270C	
2-Methylnaphthalene		8270C	28
1,4-Naphthoquinone		8270C	
1-Naphthylamine		8270C	
2-Naphthylamine		8270C	
o-Nitroaniline; 2-Nitroaniline		8270C	
m-Nitroaniline; 3-Nitroanile		8270C	
p-Nitroaniline; 4-Nitroaniline		8270C	
Nitrobenzene		8270C	
o-Nitrophenol; 2-Nitrophenol		8270C	
p-Nitrophenol; 4-Nitrophenol		8270C	
N-Nitrosodi-n-butylamine		8270C	
N-Nitrosodiethylamine		8270C	
N-Nitrosodimethylamine		8270C	
N-Nitrosodiphenylamine		8270C	
N-Nitrosodipropylamine; N-Nitroso-N-dipropylamine; Di-n-propylni trosamine		8270C	
N-Nitrosomethylethalamine		8270C	
N-Nitrosopiperidine		8270C	
N-Nitrosopyrrolidine		8270C	
5-Nitro-o-toluidine		8270C	
Pentachlorobenzene		8270C	

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Proposed Assessment Monitoring Parameter and Class I Groundwater based GPS Values
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Harrisburg, Illinois

Parameter [2]	40CFR 141 MCL Standard (ug/L)	Suggested Methods (SW-846, 3rd Edition3)	35 IAC 620.410 Class I Groundwater (ug/L unless otherwise indicated)
Pentachloronitrobenzene		8270C	
Phenacetin		8270C	
Phenanthrene		8270C	
Phenol		8270C	100
p-Phenylenediamine		8270C	
Pronamide		8270C	
Pyrene		8270C	210
Safrole		8270C	
1,2,4,5-Tetrachlorobenzene		8270C	
2,3,4,6-Tetrachlorophenol		8270C	
0,0-Diethyl 0-2-pyrazinyl phosphorothioate; Thionazin		8270C	
o-Toluidine		8270C	
2,4,5-Trichlorophenol		8270C	
2,4,6-Trichlorophenol		8270C	
0,0,0-Triethyl phosphorothioate		8270C	
sym-Trinitrobenzene		8270C	
SVOC 8270 Pesticides			
Alachlor			2
Atrazine			3
Disulfoton		8270C	
Methyl parathion; Parathion methyl		8270C	
Parathion		8270C	
Phorate		8270C	
Simazine			4

Notes

Constituents shown in red are currently required but are proposed to be deleted per adjusted atandard petition.

Constituents shown in blue are currently not required but are proposed to be added per adjusted atandard petition.

* - indicates constituents that are proposed to be exempted from the requirements of 35 IAC 811.319(a) (4)(A)(ii and iv)- i.e., subject to 8 monitoring rouind trend analysis but exempt from comparisons to AGQS or MAPCs.

^ - indicates well located within ZOA that is subject to only the 8 Round trend analysis.

- indicates that Board adjusted groundwater quality standards are proposed for this constituent.

1. The regulatory requirements pertain only to the list of substances; the right hand columns (Methods and PQL), are giv
2. Common names are those widely used in government regulations, scientific publications, and commerce; synonyms e
3. Suggested Methods refer to analytical procedure numbers used in USEPA Report SW-846 'Test Methods for Evaluating Solid Waste', Third Edition (as updated by Updates I, II,
4. Practical Quantitation Limits (PQLs) are the lowest concentrations of analytes in ground waters that can be reliably determined within specified limits of precision and accuracy by the indicated methods under routine laboratory operating conditions. The PQLs listed are generally stated to one significant figure. PQLs are based on 5 mL samples for volatile organics and 1 L samples for semi-volatile organics. CAUTION: The PQL values in many cases are based only on a general estimate for the method and not on a determination for individual compounds; PQLs are not a part of the regulation. Changes in Groundwater Standards based on PQLs shall be approvied by IEPA in a Permit Modification Application.
5. This substance is often called Bis(2-chloroisopropyl) ether, the name Chemical Abstracts Service applies to its noncommercial isomer, Propane, 2.2'-oxybis [2-chloro (CAS RN 39638-32-9).
6. Chlordane: This entry includes alpha-chlordane (CAS RN 5103-71-9), beta-chlordane (CAS RN 5103-74-2), gamma-chlordane (CAS RN 5566-34-7), and constituents of chlordane (CAS RN 57-74-9 and CAS RN 12789-03-6). PQL shown is
7. Polychlorinated biphenyls (CAS RN 1336-36-3); this category contains congener chemicals, including constituents of Aroclor 1016 (CAS RN 12674-11-2), Aroclor 1221 (CAS RN 11104-28-2), Aroclor 1232 (CAS RN 11141-16-5), Aroclor 1242 (CAS RN 53469-21-9),
8. Toxaphene: This entry includes congener chemicals contained in technical toxaphene (CAS RN 8001-35-2), i.e., chlorin
9. Xylene (total): This entry includes o-xylene (CAS RN 96-47-6), m-xylene (CAS RN 108-38-3), p-xylene (CAS RN 106-42-3), and unspecified xylenes (dimethylbenzenes) (CAS RN 1330-20-7). PQLs for method 8021 are 0.2 for o xylene and 0.1 for m-or p-xylene. The PQL for m-xylene is 2.0 mg/L by method 8020 or 8260.

Attachment B

Board Adjusted Groundwater Standard Regulatory Justification

Appendix B
35 IAC 811.320(b)(4) Justification of the Proposed Board Adjusted Groundwater Standard

The proposed request to implement Board Adjusted Groundwater Quality Standard for dissolved ammonia, total and dissolved chloride and total and dissolved chromium is justified on the basis of implementability and environmental considerations. The rule of general applicability cannot be implemented due to site specific considerations (i.e., presence of acid mine drainage which results in large fluctuations in the pH of the groundwater (i.e., 3 pH units) and the presence of regionally documented upwelling of saline formation brines. The site specific and regional groundwater quality factors also constrain the ability to develop representative interwell background standards (background developed from pooled upgradient monitoring data). This limitation arises from the close proximity of the landfill to the southeastern or upgradient high wall, the general absence of saturated lacustrine deposits upgradient of the landfill and from the inherent difficulty locating background monitoring wells in fractures capable of characterizing the upward movement of formation brines.

Due to these limitations, it is not possible to develop background values which are representative of the lacustrine, minespoil and shale monitoring units. Attempts to utilize the down gradient data, both from down gradient Unit 1 Landfill wells and from more distal Unit 2 wells have been denied due to the potential for impacts derived from the existing landfill.

The proposed Board adjusted groundwater quality standards are also warranted based on environmental considerations. As previously mentioned, the masking influence of the acid mine drainage results in significant ASD analysis and evaluations which slow down the implementation of assessment monitoring and corrective action. Collection and treatment of the acid mine drainage water may also result in cross-media impacts when the water is sent to the El Dorado Publically Owned Treatment Works (POTW). Acidic drainage water containing elevated concentrations of heavy metals and sulfate are not easily treated, potentially resulting in the treatment effluent passing these constituents into the receiving stream. The proposed parameter list revision and proposed board adjusted groundwater standards will help enable the corrective action to be focused in areas which present clear evidence of landfill release impacts rather than expanding the area to include appreciable volumes of water derived from the strip mined areas which have not been influenced by the landfill.

The adjusted standard petition requests that pursuant to 35 IAC 811.320(a)(1)(B) the Board approve groundwater quality standards for the following constituents: dissolved ammonia, total and dissolved chloride and total and dissolved chromium. In order for this request to receive consideration, 35 IAC 811.320(b) requires that the petitioner provide the statutorily required demonstration of the justification for the adjusted standard. The regulations identify two tiers of demonstration which may be required depending on the resource value of the groundwater. While the proposed adjusted standard seeks to implement Groundwater Protection Standards(GPS) based on the highest possible level of groundwater usage potential (i.e., Class I Groundwater), it is clear that the previous coal strip mining at the site have degraded the groundwater such that the demonstration requirements listed in 35 IAC 811.320(b)(4) are most appropriate. These requirements are restated below in italics along with the petitioners demonstration.

4) *For groundwater which contains naturally occurring constituents which do not meet the standards of 35 Ill. Adm. Code 620.410, 620.420, 620.430 or 620.440, the Board will specify adjusted groundwater quality standards, upon a demonstration by the operator that:*

A) The groundwater does not presently serve as a source of drinking water;

Demonstration

Neither the lacustrine, minespoil nor the hydraulically connected bedrock are utilized as a source of potable water supply. Figure 5 of the petition (pet. p. 112) depicts the location of private water supply wells located in the vicinity of the landfill. The water well construction records for each of these wells is presented in Appendix C (pet pp. 324 -366). As shown by the water supply well drilling record locations shown on Figure 5, the closest potable well (Record 21) is located approximately 0.5 miles upgradient (southeast) of the landfill. This well was drilled to a depth of 185 feet and cased well into the bedrock such that it is not hydraulically connected to the shallow minespoil deposits that the landfill is constructed upon. Furthermore, this well was installed in 1900 and indicated poor water quality (i.e., "mineral deposits in tea kettle") and thus may no longer be in service.

The drilling record No. 11 which is shown approximately 0.5 miles downgradient of the existing landfill area was abandoned and was never completed as a potable water supply well (Refer to Appendix C pet. p. 338). Similarly, Well No. 10 (pet. p. 337) located approximately 4700 ft. northwest (downgradient) of the existing landfill does not appear to have been completed as a potable water supply since no pump was installed in the well or pitless adaptor. The well was cased 100 foot into the bedrock and therefore, is not completed in the minespoil or shallow bedrock upon which the landfill has been constructed. As such, given the degraded nature of the strip mine groundwater quality and the lack of any potable wells completed in the same hydrostratigraphic units in the vicinity of the site, the proposed Board adjusted groundwater quality standards for total and dissolved chloride background (200 mg/L) and total and dissolved chromium (100 ug/L) will not adversely affect any drinking water sources since the proposed standards are based on Class I potable groundwater standards (refer to 35 IAC 620.410). Similarly, as previously mentioned the requested dissolved ammonia standard of 15 mg/L would not adversely affect any drinking water sources since the proposed ammonia standard is based on the Illinois General Use Water Standard (refer to refer to 35 IAC 302.212). Dissolved ammonia concentrations are correlated to strip mine acidic drainage conditions. Even if ammonia derived from the landfill did enter the groundwater, it is relatively immobile under acidic conditions and would be anticipated to be absorbed to soils and/or form relatively immobile salts. As such, ammonia would not be anticipated to migrate significantly in the strip mine environment.

B) The change in standards will not interfere with, or become injurious to, any present or potential beneficial uses for such waters;

Demonstration

The water within the strip mine spoils and the hydraulically connected bedrock is highly degraded due to the previous coal strip mine operations which existed at the site. Because these mine activities existed prior to the landfill, the site groundwater is classified as Class IV or "Other Groundwater" pursuant to 35 IAC 620.240. The request to approve the dissolved and total chloride Class I groundwater standard of 200 mg/L, dissolved and total chromium Class I groundwater standard of 100 ug/L will not interfere or become injurious to, any present or potential beneficial uses of the groundwater since it seeks to maintain chloride and chromium concentrations consistent with the potable groundwater standard presented in 35 IAC 620.410. Similarly, the dissolved ammonia standard of 15 mg/L is based on the General Use Water Standard (refer to 35 IAC 302.212) which is deemed protective of human health. As presented in prior discussions, the ammonia will not be mobile under the acidic conditions which exist at the site. As such the proposed standard of 15 mg/L will not adversely affect public health and/or aquatic life in area streams.

C) The change in standards is necessary for economic or social development, by providing information including, but not limited to, the impacts of the standards on the regional economy, social disbenefits such as loss of jobs or closing of landfills, and economic analysis contrasting the health and environmental benefits with costs likely to be incurred in meeting the standards; and

Demonstration

The proposed adjusted standard to modify the total and dissolved chloride background standard to 200 mg/L, the total and dissolved chromium standard to 100 ug/L and the total and dissolved ammonia background to 15 mg/L will not affect social or economic development or the regional economy in either a positive or a negative manner. As discussed in Sections (e) and (g) of the petition, it is anticipated that the requested adjusted standard will help speed the response to groundwater exceedances by reducing ASD evaluations necessitated by the limitations in developing representative AGQS values. The cost ramification of the adjusted standards is discussed in Section (e) of the petition. Based on this discussion, no social or economic disbenefits are deemed to exist that should preclude the approval of the proposed groundwater standards. Because the proposed standards are based on Illinois Potable Groundwater Standards and/or General Use Standards, they are demonstrated to be protective of public health and the environment. Thus, despite the degraded anthropogenic nature of the strip mine groundwater quality, the petitioner is requesting the implementation of proposed standards for the requested constituents that would convey a much higher resource quality groundwater.

D) The groundwater cannot presently, and will not in the future, serve as a source of drinking water because:

i) It is impossible to remove water in usable quantities;

ii) *The groundwater is situated at a depth or location such that recovery of water for drinking purposes is not technologically feasible or economically reasonable;*

iii) *The groundwater is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption;*

iv) *The total dissolved solids content of the groundwater is more than 3,000 mg/l and that water will not be used to serve a public water supply system; or*

v) *The total dissolved solids content of the groundwater exceeds 10,000 mg/l.*

Demonstration

Sections (i), (ii) and (iii) (stated above) are not deemed relevant to the petition since the petitioner does not question the availability of the groundwater, at least within the saturated minespoil deposits. Rather, the petitioner has demonstrated in Petition Appendices A and I, that the groundwater is so heavily degraded by previous coal strip mine operations that the considerations listed in sections (iii), (iv) and (v) greatly limit any potential use of the groundwater. These considerations are discussed in additional detail in the following paragraph.

As shown by the SCL permit presented in Appendix G, the permitted interwell Total Dissolved Solid (TDS) background concentration within the minespoil unit is 8,579 mg/L (pet p. 528). The intrawell TDS background concentrations in the minespoil unit are often greater than the interwell background concentration and in some cases range in excess of 24,000 mg/L (i.e., well G20S pet. p. 544). Similarly, the shale bedrock intrawell TDS background levels range up to 10,800 mg/L at well G19D (refer to pet. p 548). Eight of the 11 shale monitoring wells have intrawell TDS background concentrations which exceed the 3,000 mg/L referenced above in criterion (iv). Furthermore, every one of the minespoil monitoring wells has a sulfate concentration which greatly exceeds the Class I Groundwater Standard of 400 mg/L. Similarly, the upper portion of the bedrock is hydraulically connected to the minespoil unit such that 10 of the 11 bedrock monitoring wells also exceed the sulfate Class I Groundwater Standard. Sulfate at elevated concentrations acts as a laxative. Due to the elevated sulfate and heavy metal concentrations, it is highly unlikely that the water from either the minespoil or the hydraulically interconnected bedrock will ever be utilized as a public water supply system. Even if such future use could occur, the requested dissolved and total chloride adjusted standard of 200 mg/L, dissolved and total chromium (100 ug/L) or the dissolved ammonia standard of 15 mg/L would in no way impair such a use.

Attachment C

Proposed Detection Monitoring Constituent GPS Values

Appendix C
Proposed Detection Monitoring List G1 Constituents
Saline Co. Landfill
Harrisburg, IL

Parameter	35 IAC 620.410 Class I GW (mg/L)	Analysis Program	Proposed Groundwater Protection Standard (mg/L)	Rationale/Comments
pH		*35 IAC 811.319(a)(4)(A)(i)*	Exempt from MAPC Comparisons	Parameter subject to acid drainage temporal and spatial concentration variations and is therefore exempted from MAPC and AGQS compatisons
Specific Conductance		*35 IAC 811.319(a)(4)(A)(i)*	Exempt from MAPC Comparisons	Parameter subject to acid drainage temporal and spatial concentration variations. Constituent not included in 35 IAC 811.319(a)(2)(A) therefore adjusted standard is not required for this constituent.
dissolved ammonia		*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(iv)*	Exempt from MAPC Comparisons	Proposed Board Adjusted Groundwater Standard based on 35 IAC 302.212 General Use Water Quality Standard effective beyound ZOA.
dissolved arsenic	0.01	*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	Refer to Permit Attachments 1 and 2 for interwell & intrawell MAPCs	In general the existing permitted MAPCs are greater than Class I Std. Therefore, GPS values are generally based on MAPCs. Monitoring data at or beyond the ZOA will be compared to permitted AGQS valus.
total barium	2	*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	Greater of 2.0 mg/L or MAPCs listed in Permit Attachments 1 and 2.	The GPS values are based on the higher of the MAPCs and the Class I Groundwater Standard. Monitoring data at or beyond the ZOA will be compared to permitted AGQS valus.
dissolved boron	2	*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	Greater of 2.0 mg/L or MAPCs listed in Permit Attachments 1 and 2.	The GPS values are based on the higher of the MAPCs and the Class I Groundwater Standard. Monitoring data at or beyond the ZOA will be compared to permitted AGQS valus.
dissolved chloride	200	*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(iv)*	Exempt from MAPC Comparisons	Subject to trend analyses inside of ZOA and comparisons to proposed Board adjusted groundwater Standard at or beyond the ZOA.
dissolved chromium	0.1	*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	0.1	Subject to comparisons to the proposed GPS of 0.1 mg/L inside the ZOA and to the proposed Board adjusted groundwater standard of 0.1 mg/L at or beyond the ZOA.
cyanide total	0.2	*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	0.2	Subject to comparisons to the proposed GPS of 0.2 mg/L inside the ZOA and to Permit Attachment 1 and 2 AGQS values at or beyond the ZOA.
dissolved lead	0.0075	*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	Greater of 0.0075 mg/L or MAPCs listed in Permit Attachments 1 and 2.	The GPS values are based on the higher of the MAPCs and the Class I Groundwater Standard. Monitoring data at or beyond the ZOA will be compared to permitted AGQS valus.
dissolved magnesium		*35 IAC 811.319(a)(4)(A)(i)*	Exempt from MAPC Comparisons	Parameter subject to acid drainage temporal and spatial concentration variations and is therefore exempted from MAPC and AGQS compatisons
dissolved mercury	0.002	*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	Greater of 0.002 mg/L or MAPCs listed in Permit Attachments 1 and 2.	The GPS values are based on the higher of the MAPCs and the Class I Groundwater Standard. Monitoring data at or beyond the ZOA will be compared to permitted AGQS valus.
dissolved nitrate	10	*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	Greater of 10.0 mg/L or MAPCs listed in Permit Attachments 1 and 2.	The GPS values are based on the higher of the MAPCs and the Class I Groundwater Standard. Monitoring data at or beyond the ZOA will be compared to permitted AGQS valus.
dissolved sulfate	400	*35 IAC 811.319(a)(4)(A)(i)*	Exempt from MAPC Comparisons	Parameter subject to acid drainage temporal and spatial concentration variations and is therefore exempted from MAPC and AGQS compatisons
Total Dissolved Solids	1200	*35 IAC 811.319(a)(4)(A)(i)*	Exempt from MAPC Comparisons	Parameter subject to acid drainage temporal and spatial concentration variations and is therefore exempted from MAPC and AGQS compatisons
dissolved zinc	5	*35 IAC 811.319(a)(4)(A)(i)*	Exempt from MAPC Comparisons	Parameter subject to acid drainage temporal and spatial concentration variations and is therefore exempted from MAPC and AGQS compatisons
Bicarbonate Alkalinity		*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	GPS to be based on MAPC, collect data, calculate background and propose GPS as Significant Permit Modification Applic	Subject to comparisons to the MAPC(to be calculated) inside the ZOA and to the AGQS values at or beyond the ZOA
total potassium		*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	Refer to Permit Attachments 1 and 2 for interwell & intrawell MAPCs	Subject to comparisons to the MAPC inside the ZOA and to the AGQS values at or beyond the ZOA
total sodium		*35 IAC 811.319(a)(4)(A)(i)* *35 IAC 811.319(a)(4)(A)(ii)* *35 IAC 811.319(a)(4)(A)(iv)*	Refer to Permit Attachments 1 and 2 for interwell & intrawell MAPCs	Subject to comparisons to the MAPC inside the ZOA and to the AGQS values at or beyond the ZOA

Notes

Due to intrawell Background values, separate MAPCs and AGQS values exist at each site monitoring well. As such, where appropriate, the tabulated summaries reference permit attachments for AGQS/MAPC values.

🟨 highlight indicates the propose addition of this parameter to the List G1 Detection Monitoring program.

Appendix C
Proposed Detection Monitoring List G2 Constituents
Saline Co. Landfill
Harrisburg, IL

	Unit 1 Background^a Concentration (ug/L)	Mine Spoil Unit MAPC (ug/L)	Shale Unit MAPC (ug/L)	40 CFR 141 Maximum Contaminant level (ug/L)	35 IAC 620.410 Class I Groundwater Standard (ug/L)	Proposed Groundwater Protection Standard Spoil Unit (ug/L)	Proposed Groundwater Protection Standard Shale Unit (ug/L)	Basis For GPS Values
Acetone	10	10.4	10		6300	6,300 ug/L	6,300 ug/L	Class I Groundwater Standard
Acrylonitrile	50	52	50			52 ug/L	50 ug/L	Unit 1 MAPC
Benzene	1	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Bromobenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Bromochloromethane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Bromodichloromethane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Bromoform; Tribromomethane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
n-Butylbenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
sec-Butylbenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
tert-Butylbenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Carbon disulfide	1	1.04	1		700	700 ug/L	700 ug/L	Class I Groundwater Standard
Carbon tetrachloride	1	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Chlorobenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Chloroethane	2	2.08	2			2.08 ug/L	2.0 ug/L	Unit 1 MAPC
Chloroform; Trichloromethane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
o-Chlorotoluene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
p-Chlorotoluene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Dibromochloromethane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,2-Dibromo-3-chloropropane	0.05	0.052	0.05		0.2	0.2 ug/L	0.2 ug/L	Class I Groundwater Standard
1,2-Dichlorobenzene	1	1.04	1	600	600	600 ug/L	600 ug/L	Class I Groundwater Standard
1,3-Dichlorobenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,4-Dichlorobenzene	1	1.04	1	75	75	75.0 ug/L	75.0 ug/L	Class I Groundwater Standard
trans-1,4-Dichloro-2-butene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Dichlorodifluoromethane	2	2.08	2		1400	1,400 ug/L	1,400 ug/L	Class I Groundwater Standard
1,1-Dichloroethane	1	1.04	1		1400	1,400 ug/L	1,400 ug/L	Class I Groundwater Standard
1,2-Dichloroethane	1	3.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
1,1-Dichloroethylene	1	1.04	1	7.00	7.00	7.0 ug/L	7.0 ug/L	Class I Groundwater Standard
cis-1,2-Dichloroethylene	1	1.04	1	70	70	70.0 ug/L	70.0 ug/L	Class I Groundwater Standard
trans-1,2-Dicloroethylene	1	1.04	1	100	100	100.0 ug/L	100.0 ug/L	Class I Groundwater Standard
1,2-Dichloropropane	1	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
1,3-Dichloropropane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
2,2-Dichloropropane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,1-Dichloropropene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,3-Dichloropropene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
cis-1,3-Dichloropropene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
trans-1,3-Dichloropropene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Ethylbenzene	1	1.04	1	700	700	700 ug/L	700 ug/L	Class I Groundwater Standard
Hexachlorobutadiene	10	10.4	10			10.4 ug/L	10.0 ug/L	Unit 1 MAPC
2-Hexanone; Methyl butyl ketone	5	5.2	5			5.2 ug/L	5.0 ug/L	Unit 1 MAPC
Isopropylbenzene	1	1.04	1		70	70 ug/L	70 ug/L	Class I Groundwater Standard
p-Isopropyltoluene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC

Appendix C
Proposed Detection Monitoring List G2 Constituents
Saline Co. Landfill
Harrisburg, IL

	Unit 1 Background[a] Concentration (ug/L)	Mine Spoil Unit MAPC (ug/L)	Shale Unit MAPC (ug/L)	40 CFR 141 Maximum Contaminant level (ug/L)	35 IAC 620.410 Class I Groundwater Standard (ug/L)	Proposed Groundwater Protection Standard Spoil Unit (ug/L)	Proposed Groundwater Protection Standard Shale Unit (ug/L)	Basis For GPS Values
Methyl bromide; Bromomethane	2	2.08	2			2.08 ug/L	2.0 ug/L	Unit 1 MAPC
Methyl chloride; Chloromethane	2	2.08	2			2.08 ug/L	2.0 ug/L	Unit 1 MAPC
Methylene bromide; Dibromomethane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Dichloromethane	5	23.75	5	5	5	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Methyl ethyl ketone	5	5.2	5			5.2 ug/L	5.0 ug/L	Unit 1 MAPC
Methyl iodide; Iodomethane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
4-Methyl-2-pentanone	5	5.2	5			5.2 ug/L	5.0 ug/L	Unit 1 MAPC
Naphthalene	10	10.5	10		140	140.0 ug/L	140.0 ug/L	Class I Groundwater Standard
Oil and Grease (hexane soluble)	8	8.32	2			8.32 mg/L	2 mg/L	Unit 1 MAPC
n-Propylbenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Styrene	1	1.04	1	100	100	100.0 ug/L	100.0 ug/L	Class I Groundwater Standard
1,1,1,2-Tetrachloroethane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,1,2,2-Tetrachloroethane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Tetrachloroethylene	1	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Tetrahydrofuran	20	21	20			21.0 ug/L	20.0 ug/L	Unit 1 MAPC
Toluene	1	3.04	1	1,000	1000	1,000 ug/L	1,000 ug/L	Class I Groundwater Standard
Total Phenolics	10	10	10			10.0 ug/L	10.0 ug/L	Unit 1 MAPC
1,2,3-Trichlorobenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,2,4-Trichlorbenzene	1	1.04	1	70	70	70.0 ug/L	70.0 ug/L	Class I Groundwater Standard
1,1,1-Trichloroethane	1	1.04	1	200	200	200 ug/L	200 ug/L	Class I Groundwater Standard
1,1,2-Trichloroethane	1	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Trichloroethylene	1	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Trichlorofluoromethane	1	1.04	1		2100	2,100 ug/L	2,100 ug/L	Class I Groundwater Standard
1,2,3-Trichloropropane	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,2,4-Trimethylbenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,3,5-Trimethylbenzene	1	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Vinyl acetate	5	5.2	5			5.2 ug/L	5.0 ug/L	Unit 1 MAPC
Vinyl chloride	2	2.08	2	2.00	2.00	2.0 ug/L	2.0 ug/L	Class I Groundwater Standard
Xylenes	3	3.12	2	10,000	10,000	10,000 ug/L	10,000 ug/L	Class I Groundwater Standard

Notes

1) Groundwater Protection Standards (GPS) represent trigger levels for for corrective action program (Refer to 40 CFR 258.55 for description of GPS).

2) GPS values are applicable within the landfill zone of attenuation (ZOA). Background concentrations shall be met at or beyond the zone of attenuation.

3) Minespoil MAPCs which are greater than the GPS values shall remain effective within the ZOA. These MAPCs shall form the relavent corrective action trigger for these constituents.

Attachment D

Graphical Analysis

Figure 1
Groundwater Monitoring Results
Saline County Landfill
Dissolved Ammonia

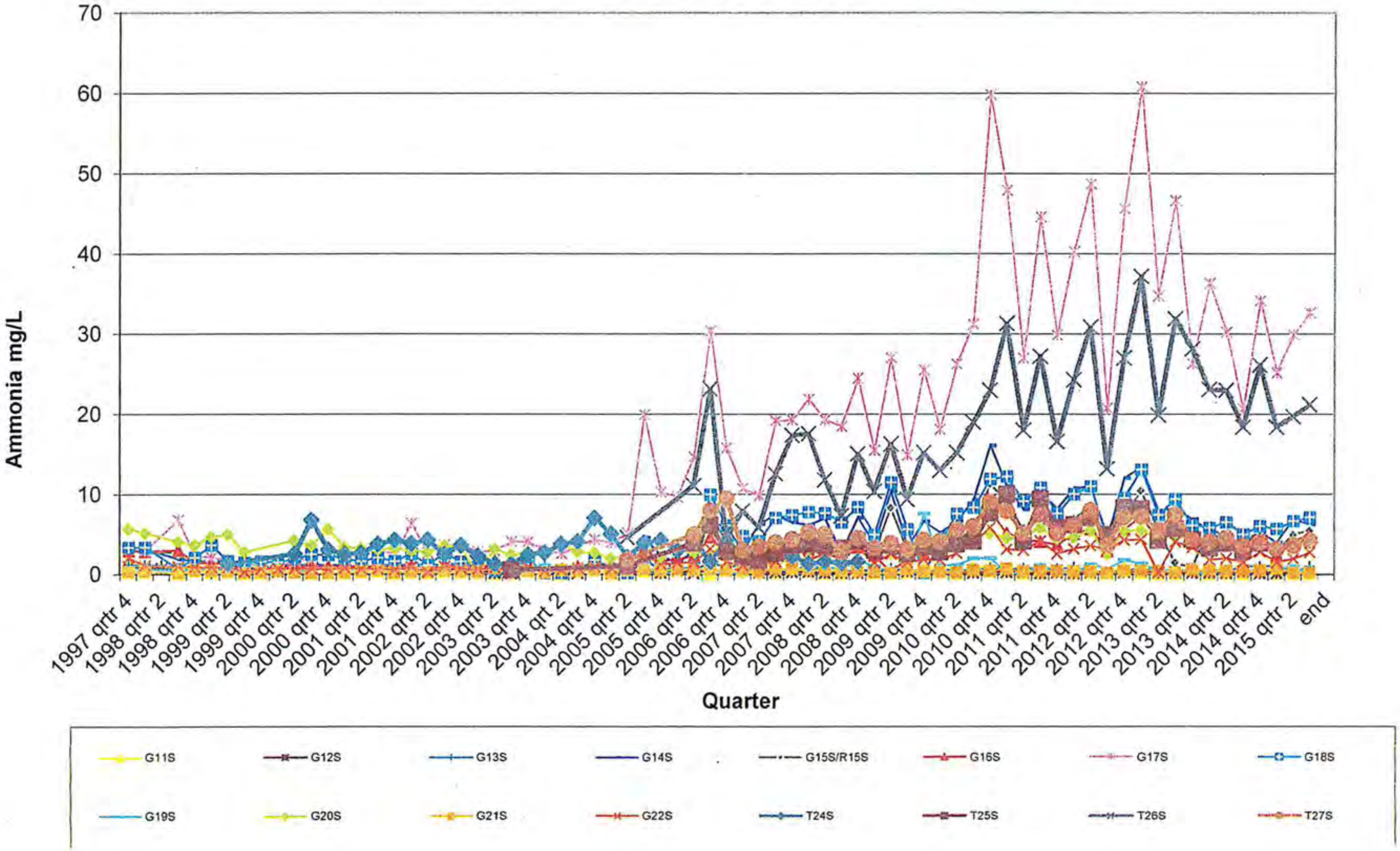
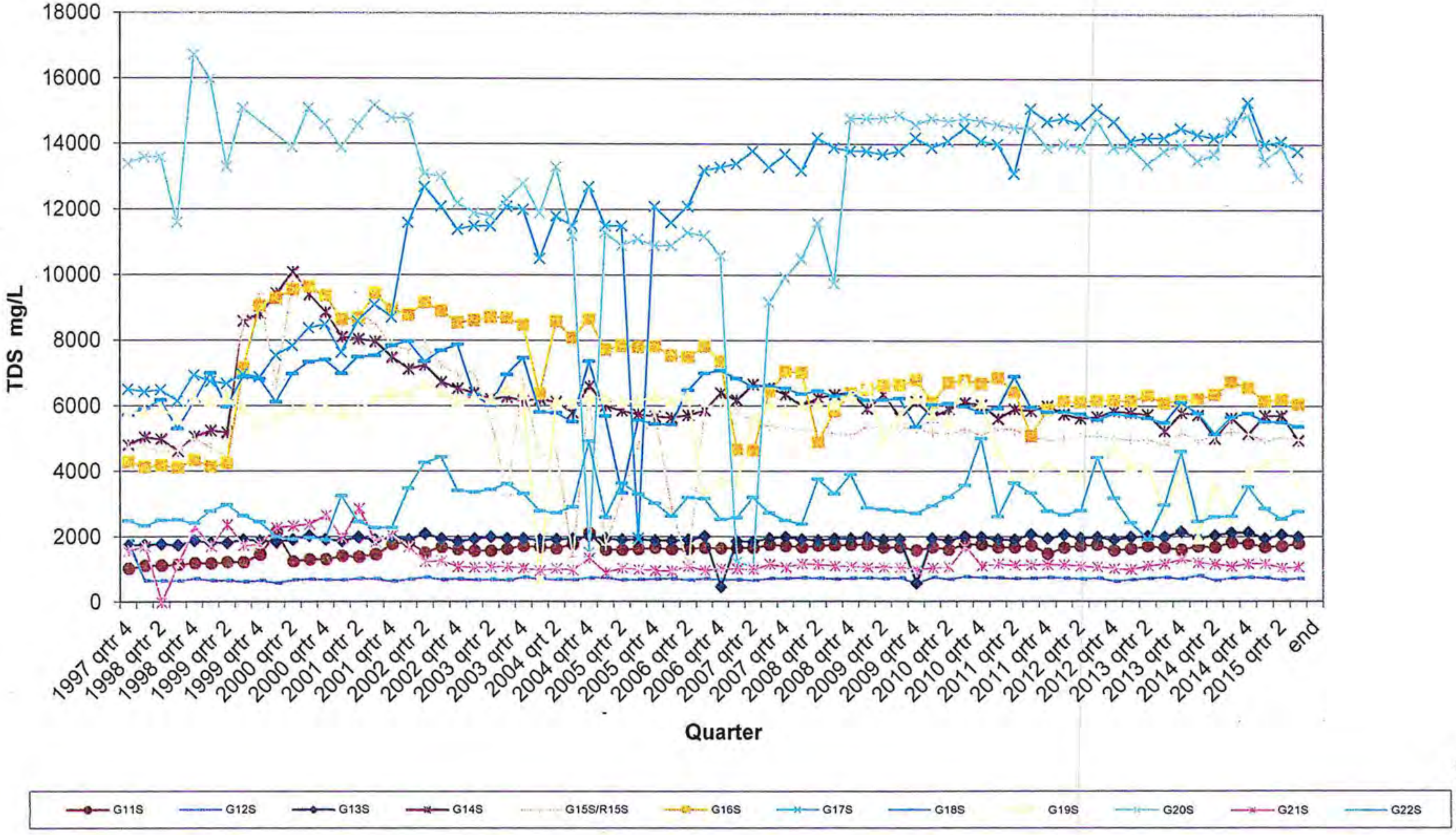


Figure 2
Groundwater Monitoring Results
Saline County Landfill
Total Dissolved Solids



Attachment E

Proposed List G2 Constituent PQL (Unit 1 v. Unit 2) Comparison

Appendix F
Proposed Detection Monitoring List G2 Constituents with PQL value Comparison
Saline Co. Landfill
Harrisburg, IL

	Unit 1 Background[a] Concentration (ug/L)	Unit 2* Background[a] Concentration (ug/L)	Mine Spoil Unit MAPC (ug/L)	Shale Unit MAPC (ug/L)	40 CFR 141 Maximum Contaminant level (ug/L)	35 IAC 620.410 Class I Groundwater Standard (ug/L)	Proposed Groundwater Protection Standard Spoil Unit (ug/L)	Proposed Groundwater Protection Standard Shale Unit (ug/L)	Basis For GPS Values
Acetone	10	10	10.4	10		6300	6,300 ug/L	6,300 ug/L	Class I Groundwater Standard
Acrylonitrile	50	50	52	50			52 ug/L	50 ug/L	Unit 1 MAPC
Benzene	1	5	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Bromobenzene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Bromochloromethane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Bromodichloromethane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Bromoform; Tribromomethane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
n-Butylbenzene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
sec-Butylbenzene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
tert-Butylbenzene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Carbon disulfide	1	5	1.04	1		700	700 ug/L	700 ug/L	Class I Groundwater Standard
Carbon tetrachloride	1	5	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Chlorobenzene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Chloroethane	2	5	2.08	2			2.08 ug/L	2.0 ug/L	Unit 1 MAPC
Chloroform; Trichloromethane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
o-Chlorotoluene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
p-Chlorotoluene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Dibromochloromethane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,2-Dibromo-3-chloropropane	0.05	0.2	0.052	0.05		0.2	0.2 ug/L	0.2 ug/L	Class I Groundwater Standard
1,2-Dichlorobenzene	1	10	1.04	1	600	600	600 ug/L	600 ug/L	Class I Groundwater Standard
1,3-Dichlorobenzene	1	10	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,4-Dichlorobenzene	1	10	1.04	1	75	75	75.0 ug/L	75.0 ug/L	Class I Groundwater Standard
trans-1,4-Dichloro-2-butene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Dichlorodifluoromethane	2	5	2.08	2		1400	1,400 ug/L	1,400 ug/L	Class I Groundwater Standard
1,1-Dichloroethane	1	5	1.04	1		1400	1,400 ug/L	1,400 ug/L	Class I Groundwater Standard
1,2-Dichloroethane	1	5	3.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
1,1-Dichloroethylene	1	5	1.04	1	7.00	7.00	7.0 ug/L	7.0 ug/L	Class I Groundwater Standard
cis-1,2-Dichloroethylene	1	5	1.04	1	70	70	70.0 ug/L	70.0 ug/L	Class I Groundwater Standard
trans-1,2-Dicloroethylene	1	5	1.04	1	100	100	100.0 ug/L	100.0 ug/L	Class I Groundwater Standard
1,2-Dichloropropane	1	5	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
1,3-Dichloropropane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
2,2-Dichloropropane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,1-Dichloropropene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,3-Dichloropropene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
cis-1,3-Dichloropropene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
trans-1,3-Dichloropropene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Ethylbenzene	1	5	1.04	1	700	700	700 ug/L	700 ug/L	Class I Groundwater Standard
Hexachlorobutadiene	10	10	10.4	10			10.4 ug/L	10.0 ug/L	Unit 1 MAPC
2-Hexanone; Methyl butyl ketone	5	10	5.2	5			5.2 ug/L	5.0 ug/L	Unit 1 MAPC
Isopropylbenzene	1	5	1.04	1		70	70 ug/L	70 ug/L	Class I Groundwater Standard
p-Isopropyltoluene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC

Appendix F
Proposed Detection Monitoring List G2 Constituents with PQL value Comparison
Saline Co. Landfill
Harrisburg, IL

	Unit 1 Background[a] Concentration (ug/L)	Unit 2* Background[a] Concentration (ug/L)	Mine Spoil Unit MAPC (ug/L)	Shale Unit MAPC (ug/L)	40 CFR 141 Maximum Contaminant level (ug/L)	35 IAC 620.410 Class I Groundwater Standard (ug/L)	Proposed Groundwater Protection Standard Spoil Unit (ug/L)	Proposed Groundwater Protection Standard Shale Unit (ug/L)	Basis For GPS Values
Methyl bromide; Bromomethane	2	5	2.08	2			2.08 ug/L	2.0 ug/L	Unit 1 MAPC
Methyl chloride; Chloromethane	2	5	2.08	2			2.08 ug/L	2.0 ug/L	Unit 1 MAPC
Methylene bromide; Dibromomethane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Dichloromethane	5	5	23.75	5	5	5	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Methyl ethyl ketone	5	10	5.2	5			5.2 ug/L	5.0 ug/L	Unit 1 MAPC
Methyl iodide; Iodomethane	1	10	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
4-Methyl-2-pentanone	5	10	5.2	5			5.2 ug/L	5.0 ug/L	Unit 1 MAPC
Naphthalene	10	10	10.5	10		140	140.0 ug/L	140.0 ug/L	Class I Groundwater Standard
Oil and Grease (hexane soluble)	8	8	8.32	2			8.32 mg/L	2 mg/L	Unit 1 MAPC
n-Propylbenzene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Styrene	1	5	1.04	1	100	100	100.0 ug/L	100.0 ug/L	Class I Groundwater Standard
1,1,1,2-Tetrachloroethane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,1,2,2-Tetrachloroethane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Tetrachloroethylene	1	5	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Tetrahydrofuran	20	5	21	20			21.0 ug/L	20.0 ug/L	Unit 1 MAPC
Toluene	1	5	3.04	1	1,000	1000	1,000 ug/L	1,000 ug/L	Class I Groundwater Standard
Total Phenolics	10	10	10	10			10.0 ug/L	10.0 ug/L	Unit 1 MAPC
1,2,3-Trichlorobenzene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,2,4-Trichlorbenzene	1	5	1.04	1	70	70	70.0 ug/L	70.0 ug/L	Class I Groundwater Standard
1,1,1-Trichloroethane	1	5	1.04	1	200	200	200 ug/L	200 ug/L	Class I Groundwater Standard
1,1,2-Trichloroethane	1	5	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Trichloroethylene	1	5	1.04	1	5.00	5.00	5.0 ug/L	5.0 ug/L	Class I Groundwater Standard
Trichlorofluoromethane	1	5	1.04	1		2100	2,100 ug/L	2,100 ug/L	Class I Groundwater Standard
1,2,3-Trichloropropane	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,2,4-Trimethylbenzene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
1,3,5-Trimethylbenzene	1	5	1.04	1			1.04 ug/L	1.0 ug/L	Unit 1 MAPC
Vinyl acetate	5	10	5.2	5			5.2 ug/L	5.0 ug/L	Unit 1 MAPC
Vinyl chloride	2	2	2.08	2	2.00	2.00	2.0 ug/L	2.0 ug/L	Class I Groundwater Standard
Xylenes	3	5	3.12	2	10,000	10,000	10,000 ug/L	10,000 ug/L	Class I Groundwater Standard

Notes

1) Groundwater Protection Standards (GPS) represent trigger levels for for corrective action program (Refer to 40 CFR 258.55 for description of GPS).

2) GPS values are Applicable within the landfill zone of attenuation (ZOA). Background concentrations are equivalent to applicable Groundwater Quality Standards which shall be met at or beyond the ZOA.

3) Minespoil MAPCs which are greater than the GPS values shall remain effective within the ZOA. These MAPCs shall form the relavent corrective action trigger for these constituents.

Attachment F

Chromium Leaching Technical Article

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Chromium leaching behavior in soil derived from chromite ore processing waste

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Abstract

To obtain information for the remediation design of chromium waste sites, the leaching behavior of chromium in chromium-contaminated soil (Cr-soil) derived from chromium ore processing residue (COPR) was investigated. Batch leaching experiments were conducted using simulated rainwater as the leaching solution with pH adjusted to cover a range from 2.0 to 12.0. No Cr(VI) was detected in the leachate at low pH (< 2.5). This may be attributed to adsorption of Cr(VI) onto the soil surface and/or reduction of Cr(VI) to Cr(III) by organic matter and/or by ferrous iron (two other major components of the soil); these processes are favored at low pH. Significant amounts of Cr(VI) were leached between pH 4.5 and 12. Results from leaching experiments indicate that approximately 1% of total Cr (26 mg/g) is readily leachable. The major chromium form in Cr-soil was identified as chromite using X-ray diffraction analysis (XRD). The forms of leachable chromium cannot be identified. It can only be hypothesized that Cr(VI) is leached by a dissolution of the chromate salts and attenuated by adsorption/desorption, precipitation, and redox processes that may occur in the soil-water system. Removal of the organic matter from the Cr-soil increases the amount of Cr(VI) leached over the entire pH range, suggesting that the organic matter can reduce Cr(VI) present in the solution. Cr(III) leaching behavior was also investigated as a function of pH. Cr(III) was found in solution at pH < 5. The amount of Cr(III) leached was controlled by the solubility of Cr(III) precipitates, the extent of Cr(VI) reduction, and the magnitude of Cr(III) adsorption onto the soil surface. No Cr(III) was detected between pH 4.5 and 12 which can be attributed to the presence of insoluble precipitates such as $Cr(OH)_3(s)$ and $Cr_xFe_{1-x}(OH)_3(s)$ and the adsorption of Cr(III) species onto the soil particle surface.

Keywords: Chromium; Chromite ore; Processing residue; Leaching

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1. Introduction

Soil contamination by heavy metals is extremely pernicious because these contaminants are environmentally persistent. Unlike most organic contaminants, metals are generally refractory and cannot be degraded or readily detoxified biologically. Toxic metals pose a particularly difficult long-term pollution problem. Chromium is one of the most commonly found metal contaminants in US soils (Ellis et al., 1984).

Chromium ore processing residue (COPR) has been used as the construction or landfill material in several countries, including England, Japan, West Germany, and the United States (McKee, 1988). In the United States, major chromium producing regions are Maryland, New Jersey, Ohio

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and New York (Public Health Service, 1953). Between 1905 and 1976, there were three chromate-processing facilities in Hudson County, NJ. During this time period, approximately 2.75 million tons of processing waste containing 2–5% chromium was generated (Hsieh et al., 1988; ESE, 1989). Over 400 industrial and residential chromium contaminated sites in Hudson County and other areas of northeastern New Jersey have been identified (MEMT, 1990). Since a portion of the chromium is in the hexavalent form, which is a known lung carcinogen, and also a toxin via dermal and oral exposure (ESE, 1989), there has been great public concern over potential exposure of workers and residents in these areas to dust, dirt and contaminated water. The enormous volume of contaminated soil and the extent of urban development in these areas make excavation an impractical means for reduction of exposure. Although substantial research has been conducted pertaining to chromium behavior in soils, some of this information may not be applicable to the specific sites, since the contaminated material is actually soil derived from weathered chromium processing waste. The material is highly alkaline and contains high levels of carbonates and other salts not normally found in soils of the northeastern United States.

Chromium (Cr) is a transition metal that exists primarily as Cr(III) and Cr(VI) in the environment (Udy, 1956). Cr(III) is less toxic than Cr(VI) and is relatively immobile in the aqueous environment due to its strong adsorption onto soils (Amacher and Baker, 1982). Because of its inability to cross cell membranes, it is not readily bioavailable and is a relatively inactive genotoxic agent. In contrast, Cr(VI) is relatively mobile since it is only weakly adsorbed to soils under natural conditions. Cr(VI) compounds are irritants due to their high solubility and diffusivity in tissue which allow them to cross biological membranes easily (MEMT, 1990; Finkel, 1983). Unlike Cr(III), which is a Lewis acid and can form insoluble chromium hydroxide ($Cr(OH)_3$), Cr(VI) is a Lewis base that exists in aqueous solution as an anion. The current limit for soluble Cr in drinking water is 0.05 mg/l (10^{-6} M) (US EPA, 1984).

Adsorption and desorption reactions play a significant role in controlling the aqueous concentration of Cr species in soils, and therefore their mobility. Chromate can be adsorbed by soil colloids such as ferric oxide, aluminum oxide, kaolinite, and montmorillonite (Griffin et al., 1977; MacNaughton, 1977; Honeyman, 1984; Zachara et al., 1987, 1988; Rai et al., 1989). Hsieh et al. (1988) have studied Cr(VI) adsorption onto soil particles at low pH. Mayer and Schick (1981) have shown that Cr(VI) can be removed from the sediment/water interface by a two-step reaction scheme; reduction followed by adsorption on kaolinite or alumina oxide surfaces. Zachara et al. (1988) indicated that the Cr(VI) adsorption edge onto kaolinite is at about pH 7.3. They proposed a pH_{zpc} of 7.3 for the kaolinite edge surface which is about the same value as reported by Rand and Melton (1977) and Wieland (1988). MacNaughton (1977) has found that adsorption of Cr(VI) from aqueous solution onto Al_2O_3 is pH-dependent and has also suggested that a strong coulombic attraction takes place between the Al_2O_3 surface and the anionic Cr(VI) species. As the pH increases above 4.0, Cr(VI) adsorption decreases reaching approximately zero at pH between 8.0 and 9.0, which is near the pH_{zpc} of Al_2O_3. Zachara et al. (1987) have reported that amorphous $Fe_2O_3 \cdot H_2O$ or ferrihydrate, which is a common surface coating of subsoil particles, has a particularly high Cr(VI) adsorption capacity. Adsorption of CrO_4^{2-} onto $Fe_2O_3 \cdot H_2O$ decreases as the pH increases. Apparently, the adsorption of chromate under acidic conditions can be attributed to the favorable electrostatic interaction. The extent of anionic chromate adsorption increases as pH decreases due to a much more favorable electrostatic interaction. A surface complexation model has been successfully used to describe Cr(VI) ion adsorption onto some solid surfaces. Davis and Leckie (1979) have reported that CrO_4^{2-} ion adsorption onto amorphous iron oxyhydroxide can be described by a surface complexation model. It has been suggested that CrO_4^{2-} adsorbs onto soil colloids as an outer-sphere complex (Zachara et al., 1988). Generally, outer-sphere complexes only adsorb weakly onto the soil particle surface. Thus, the CrO_4^{2-} ion is not held onto soil particles strongly.

Intuitively, CrO_4^{2-} can be readily leached from the soil surface. Zachara et al. (1988) have reported that chromate binding is reversible with respect to pH and is inhibited by the presence of SO_4^{2-} and carbonates, which can compete for adsorption sites.

The study of Cr(III) adsorption onto soil and soil components receives little attention probably due to the fact that it is not perceived as an environmental hazard. However, since the bulk of chromium in the New Jersey chromium-contaminated soil (Cr-soil) is in the trivalent form, it is important to know the adsorption behavior of this species. In general, the adsorption characteristics of Cr(III) onto hydrous solids are similar to those of divalent metals (James and Healy, 1972; Griffin et al., 1977). The adsorption characteristics of cationic metals adsorption onto various type of solids have been extensively studied (Huang and Elliott, 1981; Huang and Blankenship, 1984; Huang et al., 1986; Elliott and Huang, 1986; Huang and Coracioglu, 1987; Huang and Rhoads, 1989; Huang and Hao, 1989; Weng and Huang, 1990; Huang et al., 1990). Dzombak and Morel (1990) have also reported that the characteristics of Cr(III) adsorption onto hydrous ferric oxide is the same as that of divalent metal ions such as Pb(II), Cu(II), Cd(II), Zn(II), Ni(II), and Ca(II); the amount of metals adsorbed increases with increasing solution pH. Recently, Charlet and Manceau (1992) have shown that the sorption of Cr(III) by hydrous Fe oxides involves adsorption, surface precipitation, and coprecipitation phenomena. They also reported that the adsorption of a Cr(III) ion onto goethite or hydrous ferric oxide occurs via the formation of strong inner-sphere surface complexes.

Redox reactions are also important processes that affect the aqueous speciation of Cr in soils. The oxidation of Cr(III) to Cr(VI) by Mn-oxides is thermodynamically possible in soils (Bartlett and James, 1979; Amacher and Baker, 1982; Fendorf and Zasoski, 1992). The Cr(III) oxidation by δ-MnO_2, however, can be inhibited at pH values greater than 4 due to the formation of $Cr(OH)_3$ precipitate on the surface of δ-MnO_2 (Fendorf et al., 1992). Reduction of Cr(VI) to Cr(III) with subsequent precipitation of the adsorbed Cr(III) species may occur in the presence of reductive solids (Music et al., 1986). Huang and Wu (1977), Huang and Bowers (1978) and Neufeld et al. (1990) have demonstrated that the reduction of Cr(VI) to Cr(III) by activated carbon occurs only under acidic conditions. It has been reported that Cr(VI) can be rapidly reduced to Cr(III) by both Fe(II) and/or organic matter under acidic conditions (Bartlett and Kimble, 1976; Amacher and Baker, 1982; Eary and Rai, 1991). Bartlett and James (1988) have suggested that in most surface soils, organic compounds can be expected to be the primary reductant in Cr(VI) reduction. Eary and Rai (1989) have reported that Cr(VI) can be reduced to Cr(III) by Fe(II) ions from dissolution of the Fe(II) components of hematite and biotite in acidic media. A two-step reaction was proposed for chromate reduction in the present of the hematite and biotite. First, the Fe(II) is released to solution by dissolution or surface redox reactions. Second, the released Fe(II) is rapidly oxidized to Fe(III) by reaction with Cr(VI) in the aqueous phase. The remaining Fe(III) aqueous species can spontaneously be reduced back to Fe(II) by a coupled-cation electron transfer reaction at the biotite-water interface, but not at the hematite-water interface; the Fe(II) produced from this reaction is then free to react again with the Cr(VI), resulting in additional chromate reduction.

In order to obtain information pertaining to chromium migration behavior in the contaminated areas, the soil containing chromium slag waste (Cr-soil) was sampled from a waste site in northeastern New Jersey. The Cr-soil was characterized for important physicochemical properties. Scanning electron microscopy X-ray energy dispersion analysis (S.E.M.-EDAX) and X-ray diffraction analysis (XRD) were used to identify its chemical constituents and major soil phases. In order to establish a total Cr extraction procedure for Cr-soil, various wet extraction methods were performed and compared. The mobility of both Cr(III) and Cr(VI) as well as other metals were determined in leaching experiments using simulated rainwater with a pH value adjusted to the range of 2.0–12.0.

2. Materials and methods

2.1. Chemicals and soil samples

All chemicals used were ACS (American Chemical Society) certified grade and obtained from Fisher Scientific Company, Springfield, NJ or Aldrich Chemical Company, Milwaukee, WI. Samples of soil derived from a chromite ore processing waste (Cr-soil samples) site were collected from the Liberty State Park, Hudson County, NJ (Fig. 1). Composite Cr-soil samples were taken to a depth of approximately 6 cm at three different locations.

2.2. Characterization of Cr-soil samples

The particle size distribution of the Cr-soil samples was analyzed by sieve analysis (ASTM standard sieves). The specific surface area of the Cr-soil samples was determined by the BET N_2 gas adsorption method using a model QS-7 Quantasorb surface area analyzer (Quantachrom Co., Greenvale, NY). The electrophoretic mobility of

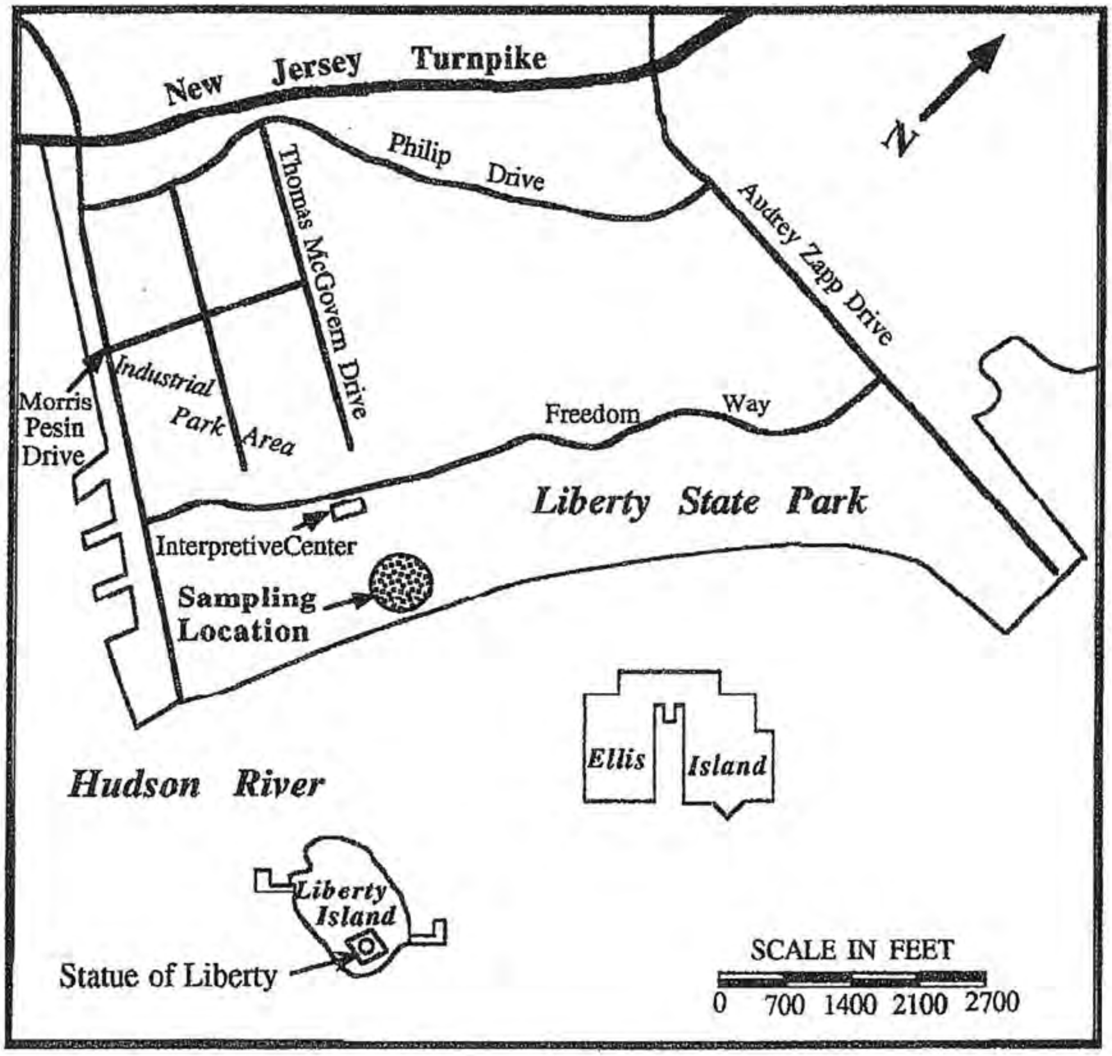


Fig. 1. Map of the Cr soil sampling location.

Cr-soil particles was determined by a zeta-meter (Lazer Zee Meter, Model 500, Pen Kem Inc., Bedford Hills, NY).

The soil pH was measured in water suspensions and in 10^{-2} M $CaCl_2$ solutions at a 1:1 soil/solution volume ratio with a pH meter (Model 3500 digital pH meter, Beckman, Irvine, CA). The procedures followed those of ASTM method D 4972–89 (ASTM, 1990b), a standard test method for soil pH.

The soil organic matter content was determined by combustion (Nelson and Sommers, 1982). Cr-soil samples were heated at 400°C in a furnace for 4 h (Model 1300, Thermolyne Co., Dubuque, IA). The organic matter content was then calculated from the mass lost on combustion.

The major element analyses in the Cr-soil sample was performed by SEM-EDAX (Phillips 501 scanning electron microscope and Phillips EDAX 9100). Three different particle size categories were used for the purpose of comparison. These size categories were classified according to the American Society for Testing Materials (ASTM) standard sieve. Identification of major mineral phases in the soil was performed by XRD analysis. Total metal concentration in the soils were determinated by wet extraction analysis. In order to compare the Cr(VI) extraction efficiency, three wet extraction methods were used. For method I, soil samples were predigested in a 250-ml Teflon beaker with conc. HNO_3 followed by the addition of a 25-ml solution of conc. H_2SO_4, $HClO_4$, and HF at volume ratio of 1:2:5 for 6 h at 60–80°C (Reisenauer, 1982). For method II, soil samples were combusted at 400°C for 4 h, then a 1:1 volume ratio of concentrated HCl/HF was added to the samples in a 250-ml Teflon beaker. The samples were then digested for another 6 h at 60–80°C (Perkin-Elmer, 1982). In method III, the soil samples were combusted in a furnace (400°C) for 4 h, then a 1:3 volume ratio of conc. HNO_3/HCl was added to the samples in a 250-ml Teflon beaker and digested for 6 h at 60–80°C (Delfino and Enderson, 1978).

2.3. Analytical methods

Most metals in the aqueous leachates were determined with an atomic absorption spectrophotometer (AA) (Perkin-Elmer, Model Zeeman 5000, Norwalk, CT) following procedures described in standard methods (APHA, 1985). Fe(II), Fe(III), Cr(VI), and Cr(III) were analyzed by the colorimetric method. Two methods were used to determine total Fe and Cr in the extraction solution: atomic absorption spectrophotometry and colorimetry. Fe(II) was analyzed by the 1,10-phenanthroline method at a wavelength of 510 nm (APHA, 1985). Total Fe was analyzed by the ferrover method using Hach ferrover iron reagent (510 nm, APHA, 1985). Fe(III) was determined from the difference between the total Fe and Fe(II). Cr(VI) was analyzed by the reddish-purple 1,5-diphenylcarbhydrazide chromate complex in an acidic medium at 540 nm (ASTM, 1990a). Total Cr was determined by oxidizing the Cr(III) to Cr(VI) with potassium permanganate then determining the total Cr as Cr(VI) (Huang and Bowers, 1978). Cr(III) was determined from the difference between the total Cr and Cr(VI).

2.4. Simulated rainwater (acid rain)

Synthetic rainwater was prepared to simulate rain of the Mid-Atlantic coastal region following the standard reference methods of the National Bureau of Standards (Koch, 1986). The average values for rainwater from Lewes, DE and Brookhaven, NY were used (Table 1). Many of the average values were greater than the NBS certified SRM 2694 simulated rainwater, because rainwater in the coastal Mid-Atlantic area contains excessive sea salt (i.e. Na^+, Mg^{2+}, Ca^{2+}, and Cl^-). The high acidity of the Mid-Atlantic rainwater may be attributed to active regional industrial activities. However, the average pH value of 4.34 is close to the NBS reference rainwater value of 4.30.

2.5. Leaching experiment

A batch reactor was used to study the equilibrium leaching properties of Cr-soil. The soil samples were air dried, ground with a ball mill (Norton, Chemical Process Products Division, Akron, OH) and sieved to less than 180 μm (ASTM No. 80). This particle size category allows us to obtain uniform physical-chemical properties of soil parti-

Table 1
Chemical composition (μequiv./l) of rainwater and simulated rainwater

Composition	Lewes, DE[a] 1978–1987	Brookhaven, NY[a] 1973–1983	NBS[b] SRM 2694	Average[c]
Average Precipitation (cm/year)	104.8	116.3	—	110.5
H^+	47.9	42.7	—	45.3
pH	4.32	4.37	—	4.34
NH_4^+	14.0	10.3	6.2	12.1
Ca^{2+}	6.0	4.6	0.5	5.3
Na^+	54.2	31.3	8.7	42.7
Mg^{2+}[d]	12.3	—	1.0	12.3
K^+	1.8	—	1.3	1.8
SO_4^{2-}	51.0	43.4	56.2	48.5[e]
Cl^-	64.5	35.9	13.2	50.2
NO_3^-	23.1	18.6	8.1	20.9

[a] Unpublished data from Dr Tom Church, College of Marine Studies, University of Delaware, Newark, DE 19716.
[b] Koch (1986).
[c] Average of [a] and [b] and used for the preparation of simulated rainwater.
[d] Church et al. (1982).
[e] We add 1.2 μequiv./l SO_4^{2-} in order to balance the electroneutrality.

cles for the experimental work. Various amounts of Cr-soil (ranging from 1 to 10 g/l) and 100 ml of simulated rainwater were added to a series of plastic bottles. The pH value of the samples was adjusted as necessary with strong acid (1 N H_2SO_4) or strong base (1 N NaOH). The samples were shaken on a reciprocating shaker (Eberbach Co., Ann Arbor, MI) at 150 excursions per min for 24 h. The equilibrium pH was then recorded and aliquots of the suspensions were taken and filtered with 0.45-μm membrane filter (Supor-450, 25 mm, Gelman Sciences Co., Ann Arbor, MI). The concentration of the metals in the supernatant were determined as described above.

3. Results and discussion

3.1. Characterization of the Cr-soil samples

Results from ASTM standard sieve analyses showed that the Cr-soil samples consist predominately of sand-sized particles with a small percentage of silt-sized particles. Results from SEM-EDAX analyses indicate that Cr is indeed one of the major components in the Cr-soil with ~5% in the soil mass. Other elements such as Ca, Fe, Al, Si, Mg, K, and Ti were also observed by SEM-EDAX analysis (Table 2). Specifically, these soil samples contain, on the average, 39% Ca and 33% Fe. Results from SEM-EDAX analy-

Table 2
Analysis of Cr-soil chemical elements (%) by EDAX

Element	Cr-soil sample I			Cr-soil sample II			Cr-soil sample III		
	(T)	(M)	(B)	(T)	(M)	(B)	(T)	(M)	(B)
Mg	4.42	2.69	1.43	1.25	0.83	1.63	2.70	1.86	1.27
Al	3.76	5.56	5.42	18.13	3.51	8.80	3.40	4.03	4.23
Si	1.32	2.11	16.93	52.30	4.27	18.30	1.57	4.57	5.39
K	—	—	1.54	7.71	0.93	2.68	0.50	0.79	0.80
Ca	54.37	51.75	25.38	5.28	38.66	22.47	61.96	44.56	41.89
Ti	—	0.90	1.41	2.89	1.24	1.64	0.71	1.07	1.24
Cr	4.36	4.42	4.09	2.28	6.65	5.48	3.53	5.64	5.62
Fe	35.34	32.58	33.79	10.17	43.92	39.00	25.63	37.47	39.56

Based on the ASTM sieve analysis, approximately 30% by weight of total soil particles has a particle size > 4.75 mm (T), 40% of size fraction between 4.75 mm and 0.6 mm (M), 30% of size fraction < 0.6 mm (B).

sis also showed that the chemical composition does not vary with particle size. Cr appears to be distributed uniformly in all particle size fractions. Moreover, results from XRD analysis indicate that chromite, $FeO \cdot Cr_2O_3$, is the major Cr form (Fig. 2). This chromite apparently can be considered as a residual chromite waste derived from chromite ore processing or a discarded low grade chromite ore. The high grade ore used in the chromate production usually contains at least 42% Cr_2O_3 (Stowe, 1987). Contrary to what was suggested by some researchers, calcium chromate salts were not observed from XRD analysis. It has been reported that during the early stage of a COPR disposal, the following chromate salts such as calcium chromate ($CaCrO_4$, $3CaOCrO_4$), calcium chromate chromite complex ($CaCrO_4 \cdot Cr_2O_3$), calcium aluminochromate ($3CaO \cdot Al_2O_3CaCrO_4$), tribasic calcium chromate ($Ca_3(CrO_4)_2$), and basic ferric chromate ($Fe(OH)CrO_4$) may be present (Public Health Service, 1953; Breeze, 1972; Gemmell, 1973; Gancy and Wamer, 1976). However, these authors provided no XRD data in their reports. These salts were produced during the chromite ore roasting processes at temperatures of 1800–2200°F in which lime and/or soda ash were added (Public Health Service, 1953). Through decades of weathering, it is expected that these chromium salts may have undergone some chemical changes.

Generally, the amounts of metals extracted by methods I and II are greater than those of method III (Table 3). The amount of total Cr in soil extracted by method I or II is about four times as high as that by method III. Apparently, the use of hydrofluoric acid (HF) significantly increases metal extraction from Cr-soil, especially for total Cr, Fe, Mg, and Al. Clearly, the acid digestion method III, using only HNO_3 and HCl, that commonly used for metal extraction, does not access all Cr from Cr-soil. This is expected since the chromite ore is known to be acid resistant. The Cr form in the Cr-soil is predominantly chromite according to the result of XRD analysis. Comparing method I and method II, method I tends to extract more Cr from the Cr-soil. We therefore suggest that extraction method I, using HNO_3, H_2SO_4, $HClO_4$, and HF, be used to estimate the total Cr in Cr-soil. Results also showed that the total Cr and Fe obtained from AA analyses are the same as those obtained from the colorimetric methods. In general, the Cr-soil contains about 2.5% Cr, 5.4% Ca, and 22% Fe by weight. Other major elements include Mg and Al. The chemical composition of these three Cr-soil samples is generally indistinguishable. For example, the Ca contents of these three Cr-soil samples are 46 g/kg

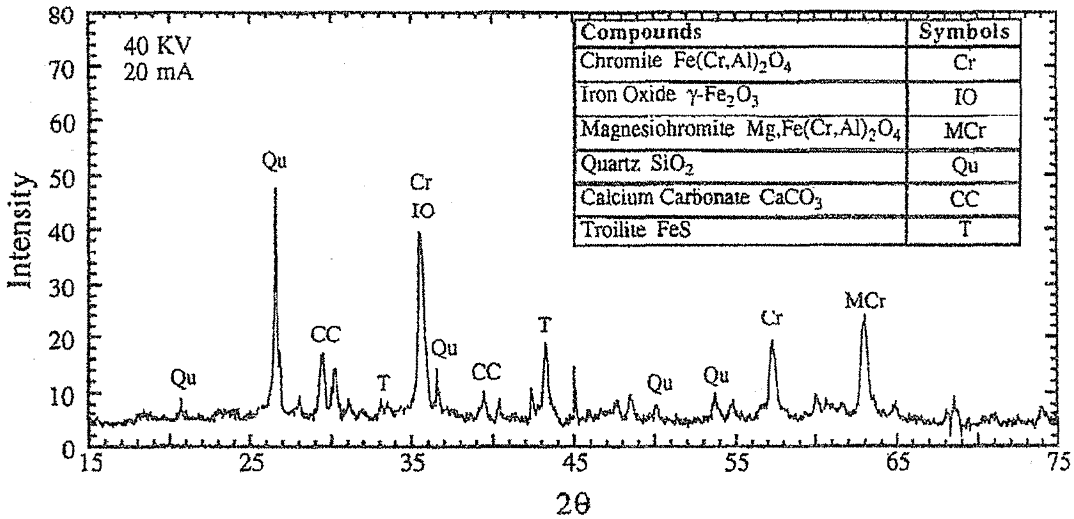


Fig. 2. XRD patterns for Cr-soil sample. The patterns were analyzed based on the Search Manual published by JCPDS (1980).

Table 3
Comparison of various wet extraction methods for preparing Cr-soil samples

Element (g/kg)	Cr-soil sample I Extraction method			Cr-soil sample II Extraction method			Cr-soil sample III Extraction method		
	I	II	III	I	II	III	I	II	III
Cr	25.54	23.38	5.45	24.22	21.22	6.23	33.29	27.42	6.62
Cr[a]	26.90	22.99	5.82	27.37	21.74	6.37	33.47	28.39	6.00
Fe	222.20	240.50	103.30	182.60	188.70	111.90	210.10	232.90	117.00
Fe[b]	232.00	253.50	127.20	171.10	185.50	127.20	216.00	241.50	125.30
Mg	60.35	59.72	29.55	59.78	49.17	28.33	73.24	53.17	27.44
Ca	45.86	46.46	46.21	53.10	53.70	53.79	61.55	63.36	62.76
Al	43.83	50.18	23.55	51.47	48.60	29.46	47.97	39.15	12.42
Na	4.98	3.47	0.96	3.10	2.74	1.19	2.30	2.21	1.46
K	4.17	4.50	0.36	5.01	6.89	0.40	4.17	2.59	0.42
Mn	1.49	1.69	0.90	1.49	1.60	1.07	1.72	1.88	1.11
Zn	0.88	0.86	0.62	2.06	1.00	0.70	1.08	1.01	0.73
Ni	0.97	0.87	0.56	1.07	0.80	0.63	1.17	1.02	0.68
Pb	0.57	0.42	0.34	1.04	1.32	0.63	0.84	0.70	0.51
Cu	0.18	0.16	0.17	0.21	0.22	0.15	0.21	0.17	0.24
Cd	0.05	0.05	< 0.01	0.08	0.08	0.01	0.07	0.07	0.01

Method I: Samples were predigested with concentrated HNO_3 then digested with a 1:2:5 volume ratio of concentrated $H_2SO_4/HClO_4/HF$ (Reisenauer, 1982); *Method II*: Samples were combusted in a furnace (400°C), then digested with a 1:1 volume ratio of concentrated HCl/HF (Perkin-Elmer, 1982). *Method III*: Samples were combusted in a furnace (400°C), then digested with a 1:3 volume ratio of concentrated HNO_3/HCl (Delfino and Enderson, 1978). All metals were analyzed by atomic adsorption spectrophotometry except as noted below.

[a] By oxidization with K_2MnO_4 and spectrophotometry.

[b] By Hach ferroVer iron reagent and spectrophotometry.

for sample I, 53 g/kg for sample II, and 62 g/kg for sample III. Trace amount of metals such as Na, K, Mn, Zn, Ni, Pb, Cu, and Cd were also detected using wet extraction analyses. Results of wet chemical extraction, especially Cr, Fe, Mg, and Al agree with those from surface spectroscopic analysis (Table 2). The result of total Cr content in the Cr-soil from wet extraction analyses is higher than that of ESE (1989) which gives values ranging from 26 to 6600 mg/kg for the same contaminated site at the sampling depths of 3, 6, and 9 ft. Apparently, different sampling depths and locations, as well as analytical method employed can yield different values. According to ESE (1989), surface soils collected from other sites in Hudson County, New Jersey exhibit total

Table 4
Physical-chemical properties of the Cr-soil samples

Properties	Cr-soil sample I	Cr-soil sample II	Cr-soil sample III
Organic matter (% by wt.)	8.56	9.29	8.92
pH_{zpc}	6.8	6.8	6.8
Specific surface area (m^2/g)	21.8	19.9	31.1
Soil pH in distilled water	8.51	8.52	8.11
Soil pH in 10^{-2} M $CaCl_2$	8.27	8.25	8.00

Cr concentrations as high as 1–2.6% on a weight basis. They also reported that Al, Ca, Fe, and Mg were the major components in addition to Cr.

The major physical-chemical properties of the Cr-soil have also been characterized (Table 4). The Cr-soil has an organic matter content of about 9%. It has been reported that high organic content may facilitate the reduction of Cr(VI) to Cr(III) under acidic conditions (Bartlett and Kimble, 1976). The specific surface area of the Cr-soil ranges from 20 to 30 m^2/g (Table 4). The high soil pH value indicates that the Cr-soil is a highly alkaline material and has a strong acid buffering capacity.

Fig. 3 shows the electrophoretic mobility of Cr-soil as a function of pH at various ionic strengths exemplified by sample I. The higher the ionic strength is, the lower the zeta potential. This is caused by electrical double layer compression. The pH at which zero zeta potential occurs is defined as the pH_{zpc}. A pH_{zpc} of 6.8 was obtained for all three Cr-soil samples. The positively charged nature of the soil is indicative of a multicomponent solid mixture (Elliott and Sparks, 1981). In this study, an iron content of about 22% by weight (Table 3) was observed for the Cr-soil samples. Iron, presumably in the oxide form, can exhibit a marked effect on pH_{zpc}, since the Fe-oxides generally have pH_{zpc} values in the neutral pH range. For example, pH_{zpc} values for γ-Fe_2O_3, Fe_3O_4, amorphous $Fe(OH)_3$, and γ-FeOOH are 6.7, 6.5, 8.5–8.8, and 5.9–6.7, respectively (Park, 1965; Stumm and Morgan, 1981). It is speculated that the neutral pH_{zpc} value of Cr-soil particles is attributable to the high iron content of the Cr-soil.

3.2. Leaching experiments

Results from leaching experiments show that pH plays a significant role in the leaching of metals from the Cr-soil (Figs. 4, 6a). At pH $<$ 2.5, the amount of Cr(VI) leached is below the detection limit (0.01 mg/l) (Fig. 6a). Between pH ~2.5 and 4.5, the amount of Cr(VI) leached sharply increases, reaching a maximum value at pH 4.5. The amount of Cr(VI) leached remains constant between pH 4.5 and 12. The absence of leached Cr(VI) at pH $<$ 2.5 is in excellent agreement with results reported by others. Zachara et al. (1989) have found that chromate adsorption occurs on acidic soil enriched in kaolinite and crystalline Fe oxides. Little Cr(VI) is found at pH $<$ 2.5, which may be attributed to the adsorption of Cr(VI) onto the soil and reduction of Cr(VI) to Cr(III) by Fe(II) and/or the organic matter. The Cr(III) could then be coprecipitated with non-crystalline Fe oxyhydroxide (Rai et al., 1989). Under acidic conditions, the soil surface is characterized by a positive charge (i.e. a pH_{zpc} of 6.8 for Cr-soil). Electrostatic interactions favor anionic chromate species adsorption when solution pH is less than pH_{zpc}; electrostatic chromate adsorption onto Cr-soil is not favorable at a high solution pH.

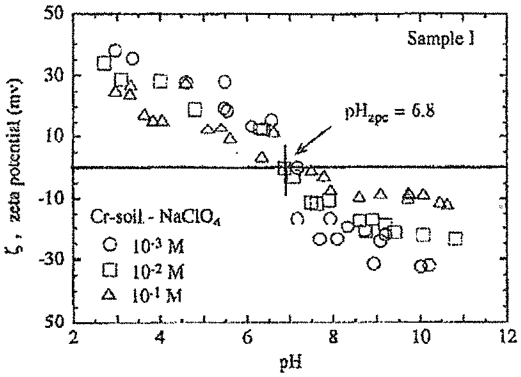


Fig. 3. Electromobility measurement of Cr-soil as a function of pH at various ionic strengths (electrolyte, $NaClO_4$). Experimental conditions: soil/water concentration: 0.5 g/l; 25°C.

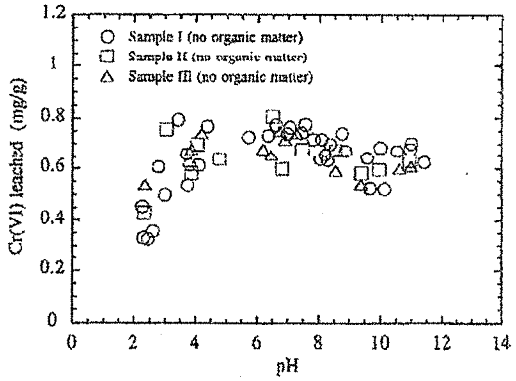


Fig. 4. Cr(VI) leached as a function of pH. The Cr-soil samples were heated in the furnace for 4 h to remove the organic matter content. Experimental conditions: 24-h reaction time; soil/water ratio: 5 g/l; 25°C.

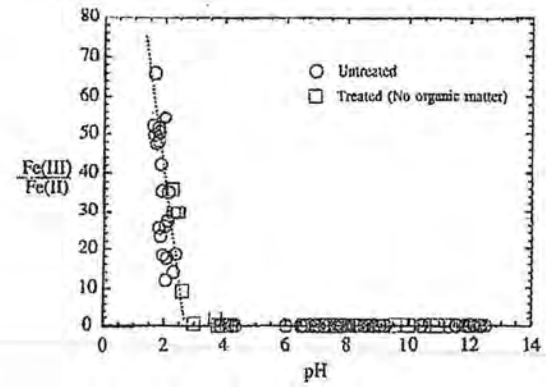
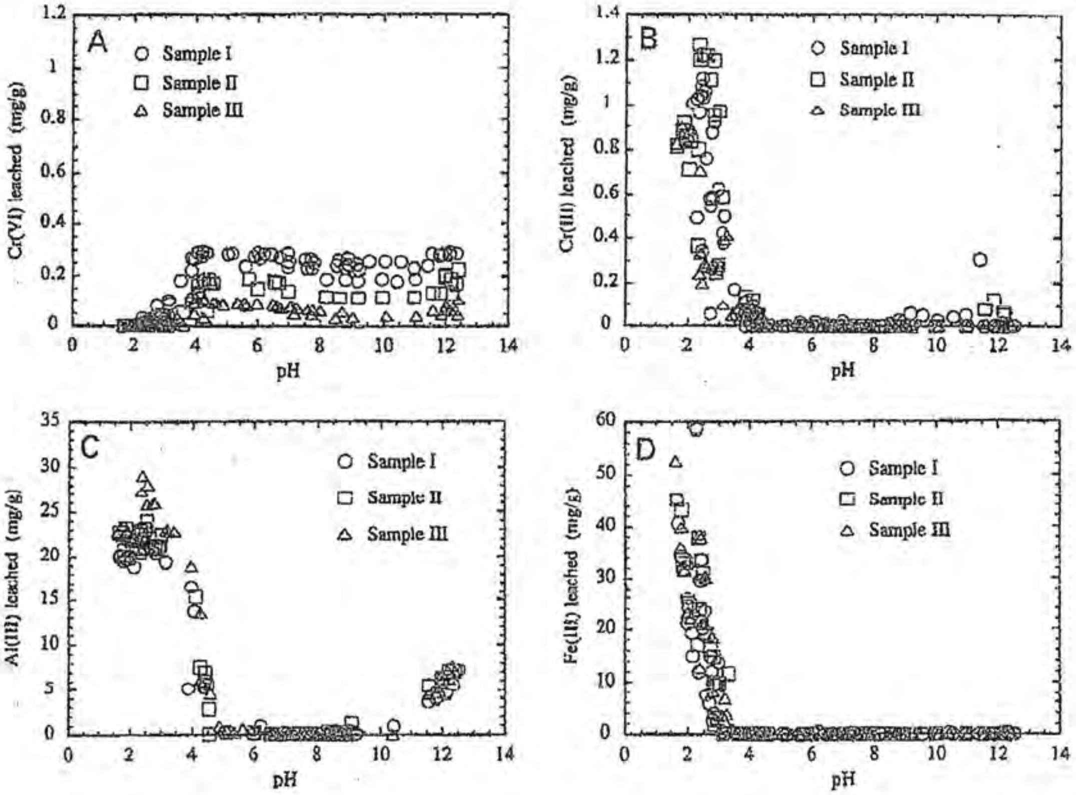


Fig. 5. Comparison of the ratio of Fe(II)/Fe(III) leached as a function of pH for the treated and untreated Cr-soil samples.

The effect of soil organic carbon on Cr(VI) leaching from the Cr-soil was studied by heating soil samples in a furnace to remove the organic matter from the soil. The amounts of Cr(VI) leached from the treated soils (no organic matter, Fig. 4) is about five times as high as that from the untreated soils (Fig. 6a). It appears that organic matter plays an important role in affecting the Cr(VI) leaching. Soil organic matter can reduce Cr(VI) to Cr(III) over a wide range of pH (Bartlett and Kimble, 1976). In fact, there is a similar trend observed of Cr(VI) leaching between treated and untreated Cr-soil samples (Fig. 6a). Between pH 2.5 and 4.5, the amount of Cr(VI) leached increases with increasing pH, while between pH 4.5 and 11, the amount of Cr(VI) leached remains constant. Different amounts of Cr(VI) leached from the untreated Cr-soil samples may be attributed to the different organic matter content of the three soil samples. In contrast, no major difference in the amount of Cr(VI) leached was observed among the three treated Cr-soil samples. Removal of organic matter from the three soil samples did not change the leaching behavior of Cr(III), Fe(III) or Fe(II) from that shown in Fig. 6b,d,e. The presence of Fe(II) found in the



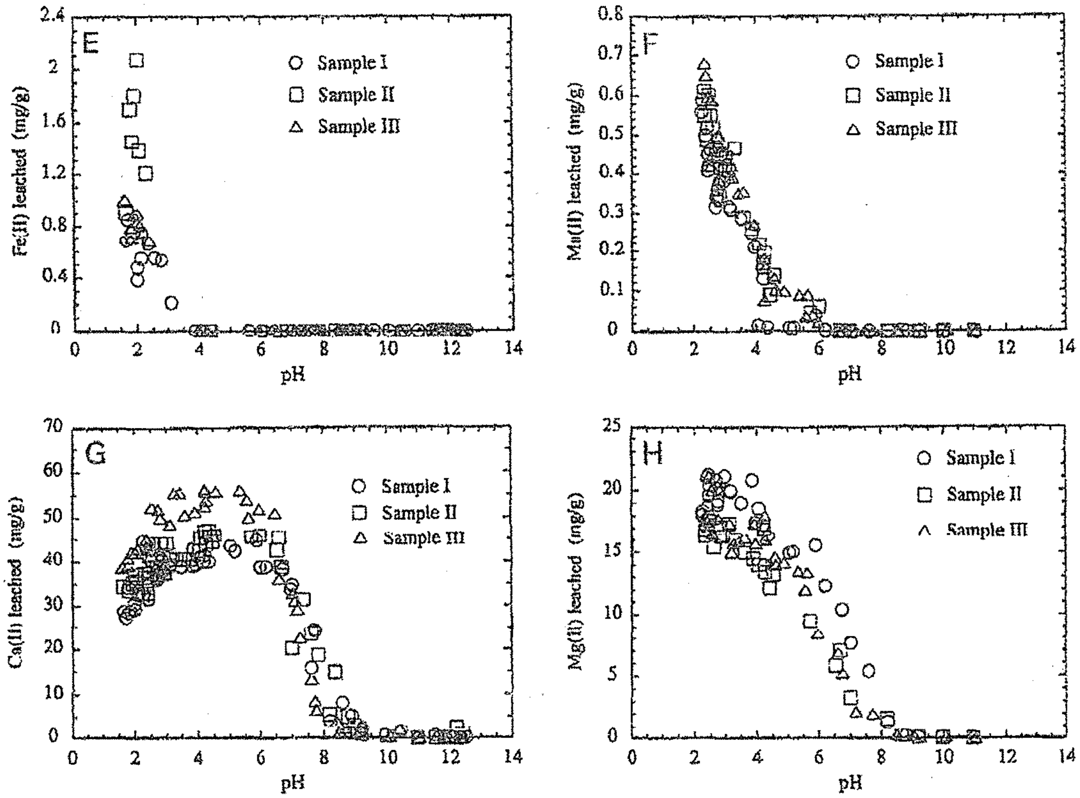


Fig. 6. Metal leached as a function of pH. Experimental conditions: 24-h reaction time; soil/water ratio: 5 g/l; 25°C. (a) Cr(VI), (b) Cr(III), (c) Al(III), (d) Fe(III), (e) Fe(II), (f) Mn(II), (g) Ca(II), and (h) Mg(II).

leachate for both the treated and untreated samples indicates that all of the Fe(II) in the soil did not become oxidized to Fe(III) during the heating process. As shown in Fig. 5, the ratio of Fe(II)/Fe(III) leached from both treated and untreated samples follows an identical relationship. Therefore, we conclude that organic matter plays an important role in Cr(VI) leaching but not Cr(III) leaching behavior.

The leaching behavior of Cr(III) from the Cr-soil is similar to that of Al, Fe, and Mn (Fig. 6b–f). Generally, the amount of metal leached increases sharply with decreasing pH. At pH $<$ 4.5, the amount of Cr(III) leached increases sharply. No soluble Cr(III) was detected at pH $>$ 4.5 except $10.0 < \text{pH} < 12.0$ when a small amount of Cr(III) was observed. This can be attributed to the presence of chromium hydroxide, $Cr(OH)_3$ and/or other precipitates such as $Cr_xFe_{1-x}(OH)_3$ in the Cr-soil (Cranstone and Murray, 1978; Sass and Rai, 1987; Eary and Rai, 1988, 1989, 1991). The results of Cr(VI) and Cr(III) leaching experiments agree well with those of Bartlett and Kimble (1976) and Hsieh et al. (1988). Imai and Gloyna (1990) have reported that the removal of Cr(VI) and Cr(III) by activated sludge strictly depends on solution pH. They found that as pH increases from 4 to 9, the removal of Cr(III) increases, but the reverse is found for Cr(VI). They concluded that adsorption is the main mechanism responsible for both the Cr(III) and Cr(VI) removal.

The leaching of Ca(II) and Mg(II) from Cr-soil samples as a function of pH was also studied (Fig. 6g,h). The release of these two metals, leached in appreciable amounts below pH 9.0, indicates that the Cr-soil is a highly alkaline soil. It is interesting to note that the amount of Ca(II) leached during the leaching experiment is closely related to the total calcium content of the Cr-soil samples from wet extraction analysis. The maximum values of Ca(II) leached from the leaching experiment (Fig. 6g) are 44, 47 and 58 mg/g for samples I, II and III, respectively compared to that of total Ca of 46, 53 and 62 mg/g for samples I, II and III, respectively from wet extraction analyses (method I) (Table 3). Based on these above results and the XRD analysis, it is speculated that the Ca is leached from the solid $CaCO_3$ phase in the Cr-soil.

Fig. 6d,e show the amount of Fe(III) and Fe(II), respectively, leached from the Cr-soil. At $pH < 3.5$, the amount of Fe(III) leached is appreciable. At $pH > 3.5$, no Fe(III) was detected. The same leaching pattern was found for Fe(II) except that the amount of Fe(II) leached is less than that of Fe(III) leached. The small amount of Fe(II) observed may be attributed to redox reactions. It is possible that a portion of Cr(VI) in solution is reduced to Cr(III) at $pH < 6.5$ by Fe^{2+} ion during the leaching experiment. The source of Fe^{2+} may be hydrolysis of ferruginous silicate materials in acidic solutions (Eary and Rai, 1989). The reduction of Fe(III) silicates or Fe(III) oxides by organic acid can also bring Fe(II) into solution (Hering and Stumm, 1990). The high organic matter content (~9%) and total Fe (~22%) in the Cr-soil samples makes it difficult to determine the predominant species contributing to the potential reduction of Cr(VI) to Cr(III). However, in acidic aqueous solutions, the overall reduction reaction of Cr(VI) by Fe(II) can be described as:

$$Cr(VI) + Fe(II) \Rightarrow Cr(III) + Fe(III) \qquad (1)$$

where

$$[Cr(VI)] = [HCrO_4^-] + \left[CrO_4^{2-}\right] + \left[Cr_2O_7^{2-}\right],$$

$$[Fe(II)] = [Fe^{2+}] + [Fe(OH)^+],$$

$$[Cr(III)] = [Cr^{3+}] + \left[Cr(OH)_2^+ + [(CrOH)^{2+}\right],$$

and

$$Fe(III)] = [Fe^{3+}] + [Fe(OH)_2^+] + [Fe(OH)^{2+}].$$

Depending on solution pH, total Cr and Fe content, the composition of the solution, and experimental conditions, the Cr and Fe species will vary. Since Fe^{3+} and Cr^{3+} have the same charge and similar ionic radii — 0.64 Å for Fe^{3+} and 0.63 Å for Cr^{3+}, respectively (Lide, 1991) they are exchangeable between the solid phases formed by these two ions. Sass and Rai (1987) have reported that when both Cr(III) and Fe(III) are present in acidic solutions, a resulting hydroxide precipitate, $Cr_xFe_{1-x}(OH)_3(s)$ will occur under slightly acidic to alkaline solution conditions depending on their concentration. They have proposed the following reaction mechanism:

$$xCr(III) + (1-x)Fe(III) + 3H_2O = Cr_xFe_{1-x}(OH)_3(s) + 3H^+ \qquad (2)$$

where x can vary between 0 to 1. The Cr hydroxide solids, $Cr(OH)_3(s)$ and $Cr_xFe_{1-x}(OH)_3(s)$ can precipitate rapidly under slightly acidic to slightly alkaline solution by the following relationship:

$$\log [Cr(OH)^{2+}] = -2pH + 4.18 + 0.28(1-x)^2 - 1.79(1-x)^3 + \log x \qquad (3)$$

The equation was generated from a series of solubility data and can be used to predict the aqueous Cr(III) concentration between solution pH 2–6. Sass and Rai (1987) have reported an x value of less than 0.69.

Fig. 7 shows the solubility diagram for $Cr(OH)_3(s)$ and $Cr_xFe_{1-x}(OH)(s)$ (Table 5). In this study, we have discovered a brown precipitate under acidic conditions. Precipitates of the same brown color were also reported by Eary and Rai (1988) in their study of chromate reduction with ferrous ion. Based on the experimental procedure used in this study, it is not possible to identify the brown precipitate as $Cr(OH)_3(s)$ or $Cr_xFe_{1-x}(OH)_3(s)$. However, based on the experimental results (Fig. 7), the concentration of Cr(III) in the leachate appears to be controlled by a solubility process rather than an adsorption/desorption reaction, since the experimental points fall near the theoretical solubility lines. The mole fraction of $Cr(OH)_3(am)$ in the precipitate, x, appears to be in the range of 0.01–0.69 according to Equation (5) (Sass and Rai, 1987). The x value is not a constant, rather it is a function of the chemical composition of the solution and the aging time of the precipitate. The value of x was found to vary from 0.01 to 0.69 because of the heterogeneous nature of the leaching system and the short aging time (24-h reaction time). In a similar study, Eary and Rai (1988) have reported a Fe/Cr ratio near 3.0 and concluded that the x value is 0.25, giving the Cr-Fe precipitate a solution composition of $Cr_{0.25}Fe_{0.75}(OH)_3$. In their study of chromate reduction by subsurface soils under acidic conditions, Eary and Rai (1991) reported that the x value is significantly less than 0.25.

Fig. 6f shows the leaching of Mn(II) from Cr-soil. No Mn(II) is detected at pH > 6.5. The amount of leached Mn(II) was small compared to the other metals. However, the possibility of oxidation of Cr(III) to Cr(VI) by manganese oxides should not be ignored.

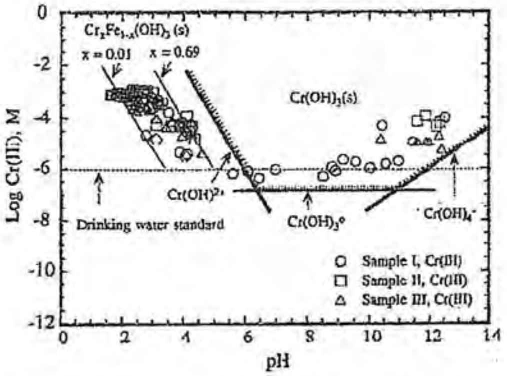


Fig. 7. Data fitting for the solubility of $Cr_xFe_{1-x}(OH)_3(s)$. Thin lines represent $Cr_xFe_{1-x}(OH)_3(s)$ at different values of x (mole fraction of $Cr(OH)_3$). Bold lines represent $Cr(OH)_3(s)$.

4. Conclusions

Soil derived from chromite ore processing waste is a highly alkaline material containing a large amount of calcium, presumably in the form of $CaCO_3$. Total chromium in the material is about 2.5% by weight, and about 1% of this is in the form of hexavalent chromium that is readily leachable at pH between 4 and 12. The bulk of the remaining chromium may contain slightly soluble trivalent chromium. By XRD analysis, the major Cr form was identified as chromite and calcium chromate salts were not identified. Leaching of chromium and all of the other metals with synthetic rainwater is highly pH sensitive. Organic matter plays a significant role in affecting the amount of Cr(VI) leached. The amount of trivalent and hexavalent chromium leached may be controlled by the dissolution of chromate salts and attenuated by various redox, precipitation and adsorption/desorption reactions. It was also

Table 5
Equilibrium constants [log K] for Cr(VI) and Cr(III) hydrolysis reactions

Equilibria	$I = 2.5 \times 10^{-2}$ M[a] Log K	$I = 1 \times 10^{-2}$ M[b] Log K	$I = 0$ M[c] Log K
$Cr(OH)_3(s) + 3H^+ = Cr^{3+} + 3H_2O$	< 9.89	< 9.76	—
$Cr(OH)_3(s) + 2H^+ = Cr(OH)^{2+} + 2H_2O$	6.00	5.96	—
$Cr(OH)_3(s) + H^+ = Cr(OH)_2^+ + H_2O$	< −0.44	< −0.44	—
$Cr(OH)_3(s) = Cr(OH)_3^0$	< −6.84	< −6.84	—
$Cr(OH)_3(s) + H_2O = Cr(OH)_4^- + H^+$	−18.20	−18.25	—
$H_2CrO_4(aq) = HCrO_4^- + H^+$	0.33	—	0.20
$HCrO_4^- = CrO_4^{2-} + H^+$	−6.58	—	−6.51
$2HCrO_4^- = Cr_2O_7^{2-} + H_2O$	1.59	—	1.53

[a] Used for this study. Activity coefficients, γ, for $I = 2.5 \times 10^{-2}$ M are calculated from Davies equation (Stumm and Morgan, 1981).

[b] Source from Rai et al., 1987.

[c] Source from Martell and Smith, 1976.

noted that the amount of Cr leached depends on the extraction procedure. Generally, acid digestion using HNO_3 and HCl cannot leach all Cr from the soil. HF appears to be the most effective extraction for Cr-leaching.

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Attachment G

Proposed Adjusted Standard Regulatory Wording

Attachment G-1

Proposed Adjusted Standard Regulatory Wording
With Redlined Changes

Appendix G
Proposed Adjusted Standard Modifications to the Rule of General Applicability

The proposed site specific modifications to the regulation of general applicability is summarized below.

Section 811.319 Groundwater Monitoring Programs

a) Detection Monitoring Program

Any use of the term maximum allowable predicted concentration in this Section is a reference to Section 811.318(c). The operator shall implement a detection monitoring program in accordance with the following requirements:

1) Monitoring Schedule and Frequency

A) The monitoring period shall begin as soon as waste is placed into the unit of a new landfill or within one year of the effective date of this Part for an existing landfill. Monitoring shall continue for a minimum period of fifteen years after closure, or in the case of MSWLF units, a minimum period of 30 years after closure, except as otherwise provided by subsection (a)(1)(C) of this Section. The operator shall sample all monitoring points for all potential sources of contamination on a quarterly basis except as specified in subsection (a)(3), for a period of five years from the date of issuance of the initial permit for significant modification under 35 Ill. Adm. Code 814.104 or a permit for a new unit pursuant to 35 Ill. Adm. Code 813.104. After the initial five-year period, the sampling frequency for each monitoring point shall be reduced to a semi-annual basis, provided the operator has submitted the certification described in 35 Ill. Adm. Code 813.304(b). Alternatively, after the initial five-year period, the Agency shall allow sampling on a semi-annual basis where the operator demonstrates that monitoring effectiveness has not been compromised, that sufficient quarterly data has been collected to characterize groundwater, and that leachate from the monitored unit does not constitute a threat to groundwater. For the purposes of this Section, the source shall be considered a threat to groundwater if the results of the monitoring indicate either that the concentrations of any of the constituents monitored within the zone of attenuation is above the maximum allowable predicted concentration for that constituent or, for existing landfills, subject to 35 Ill. Adm. Code 814, Subpart D, that the concentration of any constituent has exceeded the applicable standard at the compliance boundary as defined in 35 Ill. Adm. Code 814.402(b)(3).

B) Beginning fifteen years after closure of the unit, or five years after all other potential sources of discharge no longer constitute a threat to groundwater, as defined in subsection (a)(1)(A), the monitoring frequency may change on a well by well basis to an annual schedule if either of the following conditions exist. However, monitoring shall return to a quarterly schedule at any well where a statistically significant increase is determined to have occurred in accordance with Section 811.320(e), in the concentration of any constituent with respect to the previous sample.

i) All constituents monitored within the zone of attenuation have returned to a concentration less than or equal to ten percent of the maximum allowable predicted concentration; or

ii) All constituents monitored within the zone of attenuation are less than or equal to their maximum allowable predicted concentration for eight consecutive quarters.

C) Monitoring shall be continued for a minimum period of: 30 years after closure at MSWLF units, except as otherwise provided by subsections (a)(1)(D) and (a)(1)(E); five years after closure at landfills, other than MSWLF units, which are used exclusively for disposing waste generated at the site; or 15 years after closure at all other landfills regulated under this Part. Monitoring, beyond the minimum period, may be discontinued under the following conditions:

i) No statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for three consecutive years, after changing to an annual monitoring frequency; or

ii) Immediately after contaminated leachate is no longer generated by the unit.

D) The Agency may reduce the groundwater monitoring period at a MSWLF unit upon a demonstration by the owner or operator that the reduced period is sufficient to protect human health and environment.

E) An owner or operator of a MSWLF unit shall petition the Board for an adjusted standard in accordance with Section 811.303, if the owner or operator seeks a reduction of the post closure care monitoring period for all of the following requirements:

i) Inspection and maintenance (Section 811.111);

ii) Leachate collection (Section 811.309);

iii) Gas monitoring (Section 811.310); and

iv) Groundwater monitoring (Section 811.319).

BOARD NOTE: Changes to subsections (a)(1)(A) and (a)(1)(C), and subsections (a)(1)(D) and (a)(1)(E) are derived from 40 CFR 258.61 (1992).

2) Criteria for Choosing Constituents to be Monitored

~~A) The operator shall monitor each well for constituents that will provide a means for detecting groundwater contamination. Constituents shall be chosen for monitoring if they meet the following requirements:~~

A) In lieu of 35 Ill. Adm. Code 811.319(a)(2)(A), The operator shall monitor each well for constituents that will provide a means for detecting groundwater contamination as well as parameters capable of characterizing the acid mine drainage impacts. Detection monitoring constituents utilized for statistical analysis shall be chosen for monitoring if they meet the following requirements.

i) The constituent appears in, or is expected to be in, the leachate~~-~~ at concentrations which are greater than the groundwater; and

ii) ~~Is contained within the following list of constituents:~~

~~Ammonia – Nitrogen (dissolved)~~
~~Arsenic (dissolved)~~
~~Boron (dissolved)~~
~~Cadmium (dissolved)~~
~~Chloride (dissolved)~~
~~Chromium (dissolved)~~
~~Cyanide (total)~~
~~Lead (dissolved)~~
~~Magnesium (dissolved)~~

~~Mercury (dissolved)~~
~~Nitrate (dissolved)~~
~~Sulfate (dissolved)~~
~~Total Dissolved Solids (TDS)~~
~~Zinc (dissolved)~~

In lieu of 35 Ill. Adm. Code 811.319(a)(2)(A)(ii), the operator ~~SCL~~ must monitor for the following list of constituents:

Ammonia- Nitrogen (dissolved)$^{\wedge\#}$
Arsenic (dissolved)
Barium (total)
Bicarbonate Alkalinity (dissolved)
Boron (dissolved)
Chloride (dissolved)$^{\wedge\#}$
Chromium (dissolved$^{)\#}$
Cyanide (total)
Lead (dissolved)
Magnesium (dissolved)*
Mercury (dissolved)
Nitrate (dissolved)
Potassium (total)
Sodium (total)
Sulfate (dissolved)*
Total Dissolved Solids (TDS)*
Zinc (dissolved)*
pH*

iii) This is the minimum list for MSWLFs.

iv) Any facility accepting more than 50% by volume non-municipal waste must determine additional indicator parameters based upon leachate characteristic and waste content.

v) The monitoring of the constituents designated in 35 IAC 811.319(a)(1)(A)(ii) by "*" shall be conducted in order to characterize potential acid mine drainage effects on the groundwater quality. The "*" designated constituents) shall be subject to 35 IAC 811.319(a)(4)(A)(i) -the 8 consecutive monitoring event trend analyses but exempt from 35 IAC 811.319(a)(4)(A)(ii) and (iv)- the statistically based comparisons to maximum allowable predicted concentrations (MAPCs) within the zone of attenuation and the Applicable Groundwater Quality Standard (AGQS) beyond the zone of attenuation.

vi) The constituents designated in 35 IAC 811.319(a)(1)(A)(ii) by "^" shall be subject to 35 IAC 811.319(a)(4)(A)(i) 8 consecutive monitoring event trend analyses but exempt from 35 IAC 811.319(a)(4)(A)(ii) - the statistically based comparisons to maximum allowable predicted concentrations (MAPCs) at wells located within the zone of attenuation.

vii) Constituents designated in 35 IAC 811.319(a)(1)(A)(ii) by "#" have Board adjusted groundwater quality standards. The applicable groundwater quality standard for dissolved ammonia (15 mg/L). dissolved chloride (200 mg/L) and dissolved chromium (100 ug/L) are the effective applicable groundwater quality standard at or beyond the landfill's zone of attenuation.

B) One or more indicator constituents, representative of the transport processes of constituents in the leachate, may be chosen for monitoring in place of the constituents it represents. The use of such indicator constituents must be included in an Agency approved permit.

3) Organic Chemicals Monitoring

The operator shall monitor each existing well that is being used as a part of the monitoring well network at the facility within one year of the effective date of this Part, and monitor each new well within the three months of its establishment. The monitoring required by this subsection (a)(3) shall be for a broad range of organic chemical contaminants in accordance with the procedures described below:

A) The analysis shall be at least as comprehensive and sensitive as the tests for the 51 organic chemicals in drinking water described at 40 CFR 141.40 (1988) and 40 CFR 258.Appendix I (2006), incorporated by reference at 35 Ill. Adm. Code 810.104 and:

Acetone
Acrylonitrile
Benzene
Bromobenzene

Bromochloromethane
Bromodichloromethane
Bromoform; Tribromomethane
n-Butylbenzene
sec-Butylbenzene
tert-Butylbenzene
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform; Trichloromethane
o-Chlorotoluene
p-Chlorotoluene
Dibromochloromethane
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
trans-1,4-Dichloro-2-butene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
cis-1,2-Dichloroethylene
trans-1,2-Dicloroethylene
1,2-Dichloropropane
1,3-Dichloropropane
2,2-Dichloropropane
1,1-Dichloropropene
1,3-Dichloropropene
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
Ethylbenzene
Hexachlorobutadiene
2-Hexanone; Methyl butyl ketone
Isopropylbenzene
p-Isopropyltoluene
Methyl bromide; Bromomethane
Methyl chloride; Chloromethane
Methylene bromide; Dibromomethane
Dichloromethane
Methyl ethyl ketone
Methyl iodide; Iodomethane
4-Methyl-2-pentanone
Naphthalene

Oil and Grease (hexane soluble)
n-Propylbenzene
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
Tetrahydrofuran
Toluene
Total Phenolics
1,2,3-Trichlorobenzene
1,2,4-Trichlorbenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Trichlorofluoromethane
1,2,3-Trichloropropane
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Vinyl acetate
Vinyl chloride
Xylenes

B) At least once every two years, the operator shall monitor each well in accordance with subsection (a)(3)(A).

C) The operator of a MSWLF unit shall monitor each well in accordance with subsection (a)(3)(A) on a semi-annual basis.

BOARD NOTE: Subsection (a)(3)(C) is derived from 40 CFR 258.54(b) (1992).

4) Confirmation of Monitored Increase

A) The confirmation procedures of this subsection shall be used only if the concentrations of the constituents monitored can be measured at or above the practical quantitation limit (PQL). The PQL is defined as the lowest concentration that can be reliably measured within specified limits of precision and accuracy, under routine laboratory operating conditions. The operator shall institute the confirmation procedures of subsection (a)(4)(B) after notifying the Agency in writing, within ten days, of observed increases:

i) The concentration of any inorganic constituent monitored in accordance with subsections (a)(1) and (a)(2) shows a progressive increase over eight consecutive monitoring events;

ii) The concentration of any non-exempted 35 IAC 811.319(a)(2)(A)(ii) constituent or any 35 IAC 811.319(a)(3) organic constituent exceeds the greater of the maximum allowable predicted concentration or the groundwater protection standard developed pursuant to Section 811.320(a)(3)(C) at an established monitoring point within the zone of attenuation;

iii) The concentration of any constituent monitored in accordance with subsection (a)(3) exceeds the preceding measured concentration at any established monitoring point; and

iv) The concentration of any constituent monitored at or beyond the zone of attenuation exceeds the applicable groundwater quality standards or Board adjusted groundwater standard of Section 811.320(a)(1).

B) The confirmation procedures shall include the following:

i) The operator shall verify any observed increase by taking additional samples within 90 days after the initial sampling event and ensure that the samples and sampling protocol used will detect any statistically significant increase in the concentration of the suspect constituent in accordance with Section 811.320(e), so as to confirm the observed increase. The operator shall notify the Agency of any confirmed increase before the end of the next business day following the confirmation.

ii) The operator shall determine the source of any confirmed increase, which may include, but shall not be limited to, natural phenomena, sampling or analysis errors, or an offsite source.

iii) The operator shall notify the Agency in writing of any confirmed increase. The notification must demonstrate a source other than the facility and provide the rationale used in such a determination. The notification must be submitted to the Agency no later than 180 days after the original sampling event. If the facility is permitted by the

Agency, the notification must be filed for review as a significant permit modification pursuant to 35 Ill. Adm. Code 813.Subpart B.

iv) If an alternative source demonstration described in subsections (a)(4)(B)(ii) and (iii) of this Section cannot be made, assessment monitoring is required in accordance with subsection (b) of this Section.

v) If an alternative source demonstration, submitted to the Agency as an application, is denied pursuant to 35 Ill. Adm. Code 813.105, the operator must commence sampling for the constituents listed in subsection (b)(5) of this Section, and submit an assessment monitoring plan as a significant permit modification, both within 30 days after the dated notification of Agency denial. The operator must sample the well or wells that exhibited the confirmed increase.

b) Assessment Monitoring

The operator shall begin an assessment monitoring program in order to confirm that the solid waste disposal facility is the source of the contamination and to provide information needed to carry out a groundwater impact assessment in accordance with subsection (c). The assessment monitoring program shall be conducted in accordance with the following requirements:

1) The assessment monitoring shall be conducted in accordance with this subsection to collect information to assess the nature and extent of groundwater contamination. The owner or operator of a MSWLF unit shall comply with the additional requirements prescribed in subsection (b)(5). The assessment monitoring shall consist of monitoring of additional constituents that might indicate the source and extent of contamination. In addition, assessment monitoring may include any other investigative techniques that will assist in determining the source, nature and extent of the contamination, which may consist of, but need not be limited to:

A) More frequent sampling of the wells in which the observation occurred;
B) More frequent sampling of any surrounding wells; and
C) The placement of additional monitoring wells to determine the source and extent of the contamination.

2) Except as provided for in subsections (a)(4)(B)(iii) and (v) of this Section, the operator of the facility for which assessment monitoring is required shall file the plans for an assessment monitoring program with the

Agency. If the facility is permitted by the Agency, then the plans shall be filed for review as a significant permit modification pursuant to 35 Ill. Adm. Code 813.Subpart B within 180 days after the original sampling event. The assessment monitoring program shall be implemented within 180 days after the original sampling event in accordance with subsection (a)(4) or, in the case of permitted facilities, within 45 days after Agency approval.

3) ~~If the analysis of the assessment monitoring data shows that the concentration of one or more constituents, monitored at or beyond the zone of attenuation is above the applicable groundwater quality standards of Section 811.320 and is attributable to the solid waste disposal facility, then the operator shall determine the nature and extent of the groundwater contamination including an assessment of the potential impact on the groundwater should waste continue to be accepted at the facility shall implement the remedial action in accordance with subsection (d).~~

In lieu of 35 Ill. Adm. Code 811.319(b)(3), the operator must comply with the following:

If the analysis of the assessment monitoring data shows that the concentration of one or more constituents, monitored at or beyond the zone of attenuation is above the applicable groundwater quality standards or adjusted groundwater quality standard and is attributable to the solid waste disposal facility, then the operator must determine the nature and extent of the groundwater contamination and must implement the remedial action in accordance with Section 811.319(d).

4) If the analysis of the assessment monitoring data shows that the concentration of one or more constituents is attributable to the solid waste disposal facility and exceeds the maximum allowable predicted concentration and the Groundwater Protection Standard developed pursuant to 35 IAC 811.320 (a)(3)(c) within the zone of attenuation, then the operator shall conduct a groundwater impact assessment in accordance with the requirements of subsection (c).

5) In addition to the requirements of subsection (b)(1), to collect information to assess the nature and extent of groundwater contamination, the following requirements are applicable to MSWLF units:

A) ~~The monitoring of additional constituents pursuant to subsection (b)(l) must include, at a minimum (except as otherwise provided in subsection (b)(5)(E) of this Section), the constituents listed in 40~~

~~CFR 258.Appendix II, incorporated by reference at 35 Ill. Adm. Code 810.104, and constituents from 35 Ill. Adm. Code 620.410.~~

In lieu of 35 Ill. Adm. Code 811.319(b)(5)(A) the petitioner proposes the following language:

A) The monitoring of additional constituents pursuant to subsection (b)(l) must include, at a minimum (except as otherwise provided in subsection (b)(5)(E) of this Section), the constituents listed in 40 CFR 258.Appendix II, incorporated by reference at 35 Ill. Adm. Code 810.104, and constituents from 35 Ill. Adm. Code 620.410.

i) Additionally, in order to aid in discerning leachate from acid mine drainage related concentration increases, the following constituents shall undergo assessment monitoring in accordance with the monitoring frequency described in subparagraph (D).

Iron (dissolved and total)*
Manganese (dissolved and total)*
Bicarbonate Alkalinity (total)
Potassium (total)
Sodium (total)
Zinc (total)*
Chloride (total)^#
Chromium (total)^#
Sulfate (total)*
TDS*
pH*

ii) The monitoring of the constituents designated above by "*" shall be conducted in order to characterize potential acid mine drainage effects on the groundwater quality. The acid mine drainage indicator constituents listed in in 35 IAC 811.319(b)(5)(A)(i) "*" designated constituents) shall be exempt from the 35 IAC 811.319(b)(3) applicable groundwater quality standard comparisons at monitoring points located at or beyond the landfill's zone of attenuation:

iii) Constituents designated in 35 IAC 811.319(b)(5)(A)(i) with either "*" or "^" shall be exempt from the 35 IAC 811.319(b)(4) maximum allowable predicted concentration and GPS analyses at monitoring points located within the landfill's groundwater zone of attenuation.

iv) Constituents designated in 35 IAC 811.319(b)(5)(A)(i) by either a "*" or "^" shall undergo the temporal trend analyses in accordance with the requirements of 35 IAC 811.319(b)(6).

v) Constituents designated in 35 IAC 811.319(b)(5)(A)(i) by "#" have Board adjusted groundwater quality standards. The applicable groundwater quality standard for dissolved ammonia (15 mg/L). dissolved and total chloride (200 mg/L) and dissolved and total chromium (100 ug/L) are the effective applicable groundwater quality standard at or beyond the landfill's zone of attenuation.

BOARD NOTE: Subsection (b)(5)(A) is derived from 40 CFR 258.55(b) (1992).

B) Within 14 days after obtaining the results of sampling required under subsection (b)(5)(A), the owner or operator shall:

i) Place a notice in the operating record identifying the constituents that have been detected; and

ii) Notify the Agency that such a notice has been placed in the operating record.

BOARD NOTE: Subsection (b)(5)(B) is derived from 40 CFR 258.55(d)(l) (1992).

C) The owner or operator shall establish background concentrations for any constituents detected pursuant to subsection (b)(5)(A) in accordance with Section 811.320(e). The owner or operator shall also develop groundwater protection standards in accordance with the requirements of Section 811.320(a)(3)(C).

BOARD NOTE: Subsection (b)(5)(C) is derived from 40 CFR 258.55(d)(3) (1992).

D) ~~Within 90 days after the initial monitoring in accordance with subsection (b)(5)(A), the owner or operator must monitor for the detected constituents listed in 40 CFR 258.Appendix II and 35 Ill. Adm. Code 620.410 on a semiannual basis during the assessment monitoring. The operator must monitor all the constituents listed~~

~~in 40 CFR 258. Appendix II and 35 Ill. Adm. Code 620.410 on an annual basis during assessment monitoring.~~

Within 90 days after the initial monitoring in accordance with subsection (b)(5)(A) of this Section. the owner or operator must monitor for the detected constituents listed in appendix II to 40 CFR 258. incorporated by reference in 35 Ill. Adm. Code 810.104. and 35 Ill. Adm. Code 620.410 on a semiannual basis during the assessment monitoring. The operator must monitor all the constituents listed in appendix II to 40 CFR 258 and 35 Ill. Adm. Code 620.410 on an annual basis during assessment monitoring. except for the following constituents:

Antimony (total)
Cadmium (total)
Cobalt (total)
Copper (total)
Nickel (total)
Silver (total)
Selenium (total)
Thallium (total)

BOARD NOTE: Subsection (b)(5)(D) is derived from 40 CFR 258.55(d)(2) (1992).

E) The owner or operator may request the Agency to delete any of the 40 CFR 258.Appendix II and 35 Ill. Adm. Code 620.410 constituents by demonstrating to the Agency that the deleted constituents are not reasonably expected to be in or derived from the waste or contained in the leachate at concentrations which could be discerned from the background groundwater quality. Based on this analysis the following constituents are deleted from the Assessment monitoring list at the SCL facility:

Antimony (total)
Cadmium (total)
Cobalt (total)
Copper (total)
Nickel (total)
Silver (total)
Selenium (total)
Thallium (total)

BOARD NOTE: Subsection (b)(5)(E) is derived from 40 CFR 258.55(b) (1992).

F) Within 14 days after finding an exceedance above the applicable groundwater quality standards in accordance with subsection (b)(3), the owner or operator shall:

i) Place a notice in the operating record that identifies the constituents monitored under subsection (b)(1)(D) that have exceeded the groundwater quality standard;

ii) Notify the Agency and the appropriate officials of the local municipality or county within whose boundaries the site is located that such a notice has been placed in the operating record; and

iii) Notify all persons who own land or reside on land that directly overlies any part of the plume of contamination if contaminants have migrated off-site.

BOARD NOTE: Subsection (b)(5)(F) is derived from 40 CFR 258.55(g)(1)(i) through (iii) (1992).

G) ~~If the concentrations of all adjusted standard modified 40 CFR 258.Appendix II and 35 Ill. Adm. Code 620.410 constituents are shown to be at or below background values, using the statistical procedures in Section 811.320(e), for two consecutive sampling events, the owner or operator shall notify the Agency of this finding and may stop monitoring the modified list of 40 CFR 258.Appendix II and 35 Ill. Adm. Code 620.410 constituents~~.

In lieu of 35 Ill. Adm. Code 811.319(b)(5)(G), the operator ~~SCL~~ must comply with the following:

If the concentrations of all constituents in appendix II to 40 CFR 258, incorporated by reference in 35 Ill. Adm. Code 810.104, and 35 IL Adm. Code 620.410, as modified in this adjusted standard are shown to be at or below background values, using the statistical procedures in Section 811.320(e), for two consecutive sampling events, the owner or operator must notify the Agency of this finding and may stop monitoring the constituents.

BOARD NOTE: Subsection (b)(5)(G) is derived from 40 CFR 258.55(e) (1992).

6) The concentration of any inorganic constituent monitored in accordance with subsections (b)(5)(A)(iv) shows a progressive increase over eight consecutive monitoring events. If such an increasing concentration trend is identified, the operator must complete the following confirmation procedures:

i) The operator shall verify any observed increase by taking additional samples within 90 days after the initial sampling event and ensure that the increasing concentration trend exists. The operator shall notify the Agency of any confirmed increase before the end of the next business day following the receipt of confirmation monitoring results.

ii) The operator shall determine the source of any confirmed increase, which may include, but shall not be limited to, natural phenomena, sampling or analysis errors, or an offsite source.

iii) The operator shall notify the Agency in writing of any confirmed increase. The notification must demonstrate a source other than the facility and provide the rationale used in such a determination. The notification must be submitted to the Agency no later than 180 days after the original sampling event. The notification must be filed for review as a significant permit modification pursuant to 35 Ill. Adm. Code 813.Subpart B.

iv) If an alternative source demonstration described in subsections (a)(4)(B)(ii) and (iii) of this Section cannot be made, and the exceedance is attributable to the solid waste disposal facility, then the operator shall determine the nature and extent of the groundwater contamination including an assessment of the potential impact on the groundwater at the facility and shall implement the remedial action in accordance with subsection (d).

c) ~~Assessment of Potential Groundwater Impact. An operator required to conduct a groundwater impact assessment in accordance with subsection (b)(4) shall assess the potential impacts outside the zone of attenuation that may result from confirmed increases above the maximum allowable predicted concentration within the zone of attenuation, attributable to the facility, in order to determine if~~

~~there is need for remedial action. In addition to the requirements of Section 811.317, the following shall apply:~~

c. In lieu of 35 Ill. Adm. Code 811.319(c), the operator must comply with the following:

If required to conduct a groundwater impact assessment in accordance with this adjusted standard, the operator must assess the potential impacts outside the zone of attenuation that may result from confirmed increases above the maximum allowable predicted concentration or groundwater protection standards within the zone of attenuation, attributable to the facility, in order to determine if there is need for remedial action. In addition to the requirements of Section 811.317, the following requirements apply:

~~1) The operator shall utilize any new information developed since the initial assessment and information from the detection and assessment monitoring programs and such information may be used for the recalibration of the GCT model; and~~

1) The operator must utilize any new information developed since the initial assessment and information from the detection and assessment monitoring programs and such information may be used for the recalibration of the GCT model; and

~~2) The operator shall submit the groundwater impact assessment and any proposed remedial action plans determined necessary pursuant to subsection (d) to the Agency within 180 days after the start of the assessment monitoring program.~~

2) The operator must submit the groundwater impact assessment and any proposed remedial action plans determined necessary pursuant to Section 811.319(d) to the Agency within 180 days after the start of the assessment monitoring program.

d) Remedial Action. The owner or operator of a MSWLF unit shall conduct corrective action in accordance with Sections 811.324, 811.325, and 811.326. The owner or operator of a landfill facility, other than a MSWLF unit, shall conduct remedial action in accordance with this subsection.

1) The operator shall submit plans for the remedial action to the Agency. Such plans and all supporting information including data collected during the assessment monitoring shall be submitted within 90 days after determination of either of the following:

A) The groundwater impact assessment, performed in accordance with subsection (c), indicates that remedial action is needed; or

B) ~~Any confirmed increase above the applicable groundwater quality standards of Section 811.320 is determined to be attributable to the solid waste disposal facility in accordance with subsection (b) of this Section.~~

In lieu of 35Ill. Adm. Code 811.319(d)(1)(B). the operator must comply with the following:

Any confirmed increase above the applicable groundwater quality standards of Section 811.320 or the adjusted groundwater quality standards is determined to be attributable to the solid waste disposal facility in accordance with Section 811.319(b)~~of this Section~~.

2) If the facility has been issued a permit by the Agency, then the operator shall submit this information as an application for significant modification to the permit;

3) The operator shall implement the plan for remedial action program within 90 days after the following:

A) Completion of the groundwater impact assessment that requires remedial action;

B) ~~Establishing that a violation of an applicable groundwater quality standard of Section 811.320 is attributable to the solid waste disposal facility in accordance with subsection (b)(3) of this Section; or~~

Inlieu of 35 Ill. Adm. Code 811.319(d)(3)(B). the operator must comply with the following:

Establishing that a violation of an applicable groundwater quality standard of Section 811.320 or an adjusted groundwater quality standard is attributable to the solid waste disposal facility in accordance with Section 811.319(b)(3) of this section;

C) Agency approval of the remedial action plan, where the facility has been permitted by the Agency.

4) The remedial action program shall consist of one or a combination of one of more of the following solutions:

A) Retrofit additional groundwater protective measures within the unit;

B) Construct an additional hydraulic barrier, such as a cutoff wall or slurry wall system

C) Pump and treat the contaminated groundwater; or

D) Any other equivalent technique which will prevent further contamination of groundwater.

5) Termination of the Remedial Action Program

~~A) The remedial action program shall continue in accordance with the plan until monitoring shows that the concentrations of all monitored constituents are below the maximum allowable predicted concentration within the zone of attenuation, below the applicable groundwater quality standards of Section 811.320 at or beyond the zone of attenuation, over a period of four consecutive quarters no longer exist.~~

In lieu of 35 Ill. Adm. Code 811.319(d)(5)(A), the operator must comply with the following:

A) The remedial action program must continue in accordance with the plan until monitoring shows that the concentrations of all monitored constituents are below the greater of the maximum allowable predicted concentrations or the groundwater protection standards within the zone of attenuation and below the applicable groundwater quality standards of Section 811.320 or the Board adjusted groundwater quality standards at or beyond the zone of attenuation, over a period of four consecutive monitoring events.

B) The operator shall submit to the Agency all information collected under subsection (d)(5)(A). If the facility is permitted then the operator shall submit this information as a significant modification of the permit.

(Source: Amended at 31 Ill. Reg. 16172, effective November 27, 2007)

Section 811.320 Groundwater Quality Standards

a) Applicable Groundwater Quality Standards

1) Groundwater quality shall be maintained at each constituent's background concentration, at or beyond the zone of attenuation. The applicable groundwater quality standard established for any constituent shall be:

A) The background concentration; or

B) The Board established standard adjusted by the Board in accordance with the justification procedure of subsection (b).

2) Any statistically significant increase above an applicable groundwater quality standard established pursuant to subsection (a)(1) that is attributable to the facility and which occurs at or beyond the zone of attenuation within 100 years after closure of the last unit accepting waste within such a facility shall constitute a violation.

3) For the purposes of this Part:

A) "Background concentration" means that concentration of a constituent that is established as the background in accordance with subsection (d); and

B) "Board established standard" is the concentration of a constituent adopted by the Board as a groundwater quality standard adopted by the Board pursuant to Section 14.4 of the Act or Section 8 of the Illinois Groundwater Protection Act.

i) Pursuant to 35 Ill. Adm. Code 811.320(a)(1)(B), the operator must meet the following Board established groundwater quality standards at and beyond the zone of attenuation:

Ammonia (dissolved)	15 mg/L
Chloride (dissolved and total)	200 mg/L
Chromium (dissolved and total)	100 ug/L

C) "Groundwater protection standard (GPS)" is the numerical concentration standard that if exceeded at a monitoring well located inside of the landfill's zone of attenuation, due to a release from the landfill, shall require that the operator initiate an assessment of corrective measures as required by 35 IAC 811.324. Pursuant to the requirements of 40 CFR 258.55(h), the groundwater protection standards may be (1) For constituents for which a maximum contaminant level (MCL) has been promulgated under section 1412 of the Safe Drinking Water Act (codified) under 40 CFR part 141, the MCL for that constituent; (2) For constituents for which MCLs have not been promulgated, the Maximum Allowable Predicted Concentration (MAPC) for the constituent established in accordance with 35 IAC 811.318(c); or (3) For constituents for which the MAPC is higher than the MCL or health based levels identified under §258.55(i)(1), the MAPC shall be the effective GPS. (4) The Director of an approved State may establish an alternative groundwater protection standard for constituents for which MCLs have not been established. (5) The State groundwater standards promulgated under 35 IAC 620.410 or general use water standards promulgated under 35 IAC 302.212 may be utilized as health based standards in instances where the state standard is more stringent than the federal MCLs, or in instances where no MCL has been promulgated.

b) Justification for Adjusted Groundwater Quality Standards

1) An operator may petition the Board for an adjusted groundwater quality standard in accordance with the procedures specified in Section 28.1 of the Act and 35 Ill. Adm. Code 104.400.Subpart D.

2) For groundwater which contains naturally occurring constituents which meet the applicable requirements of 35 Ill. Adm. Code 620.410, 620.420, 620.430, or 620.440 the Board will specify adjusted groundwater quality standards no greater than those of 35 Ill. Adm. Code 620.410, 620.420, 620.430 or 620.440, respectively, upon a demonstration by the operator that:

A) The change in standards will not interfere with, or become injurious to, any present or potential beneficial uses for such water;

B) The change in standards is necessary for economic or social development, by providing information including, but not limited to, the impacts of the standards on the regional economy, social disbenefits such as loss of jobs or closing of landfills, and economic analysis contrasting the health and environmental benefits with costs likely to be incurred in meeting the standards ; and

C) All technically feasible and economically reasonable methods are being used to prevent the degradation of the groundwater quality.

3) Notwithstanding subsection (b)(2), in no case shall the Board specify adjusted groundwater quality standards for a MSWLF unit greater than the following levels:

Chemical	Concentration (mg/l
Arsenic	0.05
Barium	1.0
Benzene	0.005
Cadmium	0.01
Carbon tetrachloride	0.005
Chromium (hexavalent)	0.05
2,4-Dichlorophenoxy acetic acid	0.1
1,4-Dichlorobenzene	0.075
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
Endrin	0.0002
Fluoride	4
Lindane	0.004
Lead	0.05
Mercury	0.002
Methoxychlor	0.1
Nitrate	10
Selenium	0.01
Silver	0.05
Toxaphene	0.005
l,l,l-Trichloromethane	0.2
Trichloroethylene	0.005
2,4,5-Trichlorophenoxy acetic acid	0.01
Vinyl Chloride	0.002

4) For groundwater which contains naturally occurring constituents which do not meet the standards of 35 Ill. Adm. Code 620.410, 620.420, 620.430 or 620.440, the Board will specify adjusted groundwater quality standards, upon a demonstration by the operator that:

A) The groundwater does not presently serve as a source of drinking water;

B) The change in standards will not interfere with, or become injurious to, any present or potential beneficial uses for such waters;

C) The change in standards is necessary for economic or social development, by providing information including, but not limited to, the impacts of the standards on the regional economy, social disbenefits such as loss of jobs or closing of landfills, and economic analysis contrasting the health and environmental benefits with costs likely to be incurred in meeting the standards; and

D) The groundwater cannot presently, and will not in the future, serve as a source of drinking water because:

i) It is impossible to remove water in usable quantities;

ii) The groundwater is situated at a depth or location such that recovery of water for drinking purposes is not technologically feasible or economically reasonable;

iii) The groundwater is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption;

iv) The total dissolved solids content of the groundwater is more than 3,000 mg/l and that water will not be used to serve a public water supply system; or

v) The total dissolved solids content of the groundwater exceeds 10,000 mg/l.

c) Determination of the Zone of Attenuation

1) The zone of attenuation, within which concentrations of constituents in leachate discharged from the unit may exceed the applicable groundwater quality standard of this Section, is a volume bounded by a vertical plane at the property boundary or 100 feet from the edge of the unit, whichever is less, extending from the ground surface to the bottom of the uppermost aquifer and excluding the volume occupied by the waste.

2) Zones of attenuation shall not extend to the annual high water mark of navigable surface waters.

3) Overlapping zones of attenuation from units within a single facility may be combined into a single zone for the purposes of establishing a monitoring network.

d) Establishment of Background Concentrations

1) The initial monitoring to determine background concentrations shall commence during the hydrogeological assessment required by Section 811.315. The background concentrations for those parameters identified

in Sections 811.315(e)(1)(G) and 811.319(a)(2) and (a)(3) shall be established based on consecutive quarterly sampling of wells for a minimum of one year, monitored in accordance with the requirements of subsections (d)(2), (d)(3) and (d)(4). Non-consecutive data may be considered by the Agency, if only one data point from a quarterly event is missing, and it can be demonstrated that the remaining data set is representative of consecutive data in terms of any seasonal or temporal variation. Statistical tests and procedures shall be employed, in accordance with subsection (e), depending on the number, type and frequency of samples collected from the wells, to establish the background concentrations.

2) Adjustments to the background concentrations shall be made if changes in the concentrations of constituents observed in background wells over time are determined, in accordance with subsection (e), to be statistically significant, and due to natural temporal or spatial variability or due to an off-site source not associated with the landfill or the landfill activities. Such adjustments may be conducted no more frequently than once every two years during the operation of a facility and modified subject to approval by the Agency. Non-consecutive data may be used for an adjustment upon Agency approval. Adjustments to the background concentration shall not be initiated prior to November 27, 2009 unless required by the Agency.

3) Background concentrations determined in accordance with this subsection shall be used for the purposes of establishing groundwater quality standards, in accordance with subsection (a). The operator shall prepare a list of the background concentrations established in accordance with this subsection. The operator shall maintain such a list at the facility, shall submit a copy of the list to the Agency for establishing standards in accordance with subsection (a), and shall provide updates to the list within ten days of any change to the list.

4) A network of monitoring wells shall be established upgradient from the unit, with respect to groundwater flow, in accordance with the following standards, in order to determine the background concentrations of constituents in the groundwater:

    A) The wells shall be located at such a distance that discharges of contaminants from the unit will not be detectable;

    B) The wells shall be sampled at the same frequency as other monitoring points to provide continuous background concentration data, throughout the monitoring period; and

C) The wells shall be located at several depths to provide data on the spatial variability.

5) A determination of background concentrations may include the sampling of wells that are not hydraulically upgradient of the waste unit where:

A) Hydrogeologic conditions do not allow the owner or operator to determine what wells are hydraulically upgradient of the waste; and

B) Sampling at other wells will provide an indication of background concentrations that is representative of that which would have been provided by upgradient wells.

6) If background concentrations cannot be determined on site, then alternative background concentrations may be determined from actual monitoring data from the aquifer of concern, which includes, but is not limited to, data from another landfill site that overlies the same aquifer.

e) Statistical Analysis of Groundwater Monitoring Data

1) Statistical tests shall be used to analyze groundwater monitoring data. One or more of the normal theory statistical tests shall be chosen first for analyzing the data set or transformations of the data set. Where such normal theory tests are demonstrated to be inappropriate, tests listed in subsection (e)(4) shall be used. The level of significance (Type I error level) shall be no less than 0.01, for individual well comparisons, and no less than 0.05, for multiple well comparisons. The statistical analysis shall include, but not be limited to, the accounting of data below the detection limit of the analytical method used, the establishment of background concentrations and the determination of whether statistically significant changes have occurred in:

A) The concentration of any chemical constituent with respect to the background concentration or maximum allowable predicted concentration; and

B) The established background concentration of any chemical constituents over time.

2) The statistical test or tests used shall be based upon the sampling and collection protocol of Sections 811.318 and 811.319.

3) Monitored data that are below the level of detection shall be reported as not detected (ND). The level of detection for each constituent shall be the practical quantitation limit (PQL), and shall be the lowest concentration

that is protective of human health and the environment, and can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions. In no case, shall the PQL be established above the level that the Board has established for a groundwater quality standard under the Illinois Groundwater Protection Act [415 ILCS 55]. The following procedures shall be used to analyze such data, unless an alternative procedure in accordance with subsection (e)(4), is shown to be applicable:

A) Where the percentage of nondetects in the data base used is less than 15 percent, the operator shall replace NDs with the PQL divided by two, then proceed with the use of one or more of the Normal Theory statistical tests;

B) Where the percentage of nondetects in the data base used is between 15 and 50 percent, and the data are normally distributed, the operator shall use Cohen's or Aitchison's adjustment to the sample mean and standard deviation, followed by an applicable statistical procedure;

C) Where the percentage of nondetects in the database used is above 50 percent, then the owner or operator shall use an alternative procedure in accordance with subsection (e)(4).

4) Nonparametric statistical tests or any other statistical test if it is demonstrated to meet the requirements of 35 Ill. Adm. Code 724.197(i).

BOARD NOTE: Subsection (b)(3) is derived from 40 CFR 258.40 Table 1. (1992).

(Source: Amended at 31 Ill. Reg. 16172, effective November 27, 2007)

Section 811.324 Corrective Action Measures for MSWLF Units

a) The owner or operator shall initiate an assessment of corrective action measures within 14 days of the following:

1) The groundwater impact assessment, performed in accordance with subsection 811.319 (c), indicates that remedial action is needed; or

2) The assessment monitoring, performed in accordance with subsection 811.319(b), indicates that a confirmed increase above the applicable groundwater quality standard or Board established standard outside the zone of attenuation. or the higher of the maximum allowable predicted

concentration or the groundwater protection standard of Section 811. 320(a)(3)(C). inside the zone of attenuation is attributable to the solid waste disposal facility.

b) The owner or operator shall complete the corrective action assessment within 90 days of initiating the assessment of corrective action measures in accordance with subsection (a).

c) The owner or operator shall continue to monitor in accordance with the assessment monitoring program, as specified in Section 811.319(b).

d) The assessment shall include an analysis of the effectiveness of various potential corrective action measures in meeting all of the requirements and objectives of the remedy, as described under Section 811.325, addressing at least the following:

1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

2) The time required to begin and complete the remedy;

3) The costs of remedy implementation; and

4) The institutional requirements, such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedies.

e) The owner or operator must discuss the results of the corrective action measures assessment prior to the selection of a remedy in a public meeting with interested and affected parties. Prior to the public meeting, the owner or operator of the MSWLF unit shall submit to the Agency a report describing the results of the corrective action measures assessment.

BOARD NOTE: Requirements of this Section are derived from 40 CFR 258.56 (1992).

(Source: Added in R93-10 at 18 Ill. Reg. 1308, effective January 13, 1994)

Section 811.325 Selection of remedy for MSWLF Units

a) Within 90 days of the completion of the corrective action measures assessment conducted under Section 811.324, the owner or operator of a MSWLF unit shall:

1) Select a remedy based on the assessment results that, at a minimum, meets the requirements of subsection (b); and

2) Submit to the Agency an application for a significant modification to the landfill permit describing the selected remedy and how it meets the standards set forth in subsection (b).

b) Remedies selected under this Section must meet the following requirements:

1) They must be protective of human health and the environment;

2) They must attain the groundwater quality standard or Board adjusted groundwater standard~~s~~ outside the zone of attenuation and the higher of the maximum allowable predicted concentration or the groundwater protection standard prescribed at Section 811.320(a)(3)(C). within the zone of attenuation;

3) They must control the sources of release so as to reduce or eliminate, to the maximum extent practicable, further releases of constituents detected under the assessment monitoring into the environment that may pose a threat to human health or the environment; and

4) They must comply with standards for management of wastes as specified in Section 811.326(d).

c) In selecting a remedy that meets the requirements of subsection (b), the owner or operator shall consider the following evaluation factors:

1) The long- and short-term effectiveness and protectiveness of the potential remedies, along with the degree of certainty that the remedy will prove successful based on consideration of the following factors:

A) The magnitude of reduction of existing risks;

B) The magnitude of residual risks in terms of likelihood of further releases due to waste remaining following implementation of a remedy;

C) The type and degree of long-term management required, including monitoring, operation, and maintenance;

D) Any short-term risks that might be posed to the community, workers, or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and redisposal or containment;

E) The length of time until full protection is achieved;

F) Any potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, redisposal, or containment;

G) The long-term reliability of engineering and institutional controls; and

H) The potential need for replacement of the remedy.

2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

A) The extent to which containment practices will reduce further releases; and

B) The extent to which treatment technologies may be used.

3) The ease or difficulty of implementing potential remedies based on consideration of the following types of factors:

A) The degree of difficulty associated with constructing the technology;

B) The expected operational reliability of the technologies;

C) The need to coordinate with and obtain necessary approvals and permits from other agencies;

D) The availability of necessary equipment and specialists; and

E) The available capacity and location of needed treatment, storage, and disposal services.

4) The practicable capability of the owner or operator to implement the remedies, including a consideration of the technical and economic capability.

5) The degree to which community concerns are addressed by potential remedies.

d) Schedule for implementing remedial action.

1) The owner or operator shall specify as part of the selected remedy a schedule(s) for initiating and completing remedial activities. Such a

schedule must require the initiation of remedial activities within a reasonable period of time, taking into consideration the factors set forth in subsections (d)(3)(A) through (d)(3)(H).

2) The Agency shall specify the time period for initiating remedial action in the facility's permit.

3) The owner or operator shall consider the following factors in determining the schedule of remedial activities:

A) The extent and nature of contamination;

B) The practical capabilities of remedial technologies in achieving compliance with the applicable groundwater quality standards or the Board established standards at or beyond the zone of attenuation and the greater of the groundwater protection ~~quality~~ standards established under Section 811.320(a)(3)(C) or the maximum allowable predicted concentrations inside of the zone of attenuation and other objectives of the remedy;

C) The availability of treatment or disposal capacity for wastes managed during implementation of the remedy;

D) The desireability of utilizing technologies that are not currently available, but which may offer significant advantages over already available technologies in terms of effectiveness, reliability, safety, or ability to achieve remedial objectives;

E) Any potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;

F) Any resource value of the aquifer including:

i) Any current and future uses;

ii) The proximity and withdrawal rate of users;

iii) The ground-water quantity and quality;

iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituent;

v) The hydrogeologic characteristic of the facility and surrounding land;

vi) The ground-water removal and treatment costs;

vii) The cost and availability of alternative water supplies;

G) The practicable capability of the owner or operator to implement the remedies; and

H) Any other relevant factors.

e) The Agency shall determine that remediation of a release of one or more constituents monitored in accordance with Section 811.319 from a MSWLF unit is not necessary if the owner or operator demonstrates to the Agency that:

1) The groundwater is additionally contaminated by substances that have originated from a source other than the MSWLF unit and those substances are present in such concentrations that cleanup of the release from the MSWLF unit would provide no significant reduction in risk to actual or potential receptors; or

2) The constituents are present in groundwater that:

A) Is not currently or reasonably expected to be a source of drinking water; and

B) Is not hydraulically connected with waters to which the hazardous constituents are migrating or are likely to migrate in concentrations that would exceed the groundwater quality standards established under Section 811.320; or

3) The remediation of the release is technically impracticable; or

4) The remediation results in unacceptable cross-media impacts.

f) A determination by the Agency pursuant to subsection (e) shall not affect the Agency's authority to require the owner or operator to undertake source control measures or other measures that may be necessary to eliminate or minimize further releases to the groundwater, to prevent exposure to the groundwater, or to remediate the groundwater to concentrations that are technically practicable and which reduce threats to human health or the environment.

BOARD NOTE: The requirements of this Section are derived from 40 CFR 258.57 (1992).

(Source: Added in R93-10 at 18 Ill. Reg. 1308, effective January 13, 1994)

Section 811.326 Implementation of the corrective action program at MSWLF Units

a) Based on the schedule established pursuant to Section 811.325(d) for initiation and completion of corrective action, the owner or operator must fulfill the following requirements:

1) It must establish and implement a corrective action groundwater monitoring program that fulfills the following requirements:

A) At a minimum, the program must meet the requirements of an assessment monitoring program pursuant to Section 811.319(b);

B) The program must indicate the effectiveness of the remedy; and

C) The program must demonstrate compliance with groundwater protection standards pursuant to subsection (e) of this Section.

2) It must implement the remedy selected pursuant to Section 811.325.

3) It must take any interim measures necessary to ensure the adequate protection of human health and the environment. The interim measures should, to the greatest extent practicable, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to Section 811.325. The owner or operator must consider the following factors in determining whether interim measures are necessary:

A) The time required to develop and implement a final remedy;

B) Any actual or potential exposure of nearby populations or environmental receptors to hazardous constituents;

C) Any actual or potential contamination of drinking water supplies or sensitive ecosystems;

D) Any further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;

E) The weather conditions that may cause hazardous constituents to migrate or be released;

F) Any risks of fire or explosion, or potential for exposure to hazardous constituents as a result of an accident or failure of a container or handling system; and

G) Any other situations that may pose threats to human health and the environment.

b) If an owner or operator determines, based on information developed after implementation of the remedy has begun or other information, that compliance with requirements of Section 811.325(b) are not being achieved through the remedy selected, the owner or operator must fulfill the following requirements:

1) It must implement other methods or techniques that could practicably achieve compliance with the requirements, unless the owner or operator makes the determination pursuant to subsection (c) of this Section.

2) It must submit to the Agency, prior to implementing any alternative methods pursuant to subsection (b)(1) of this Section, an application for a significant modification to the permit describing the alternative methods or techniques and how they meet the standards of Section 811.325(b).

c) If the owner or operator determines that compliance with the requirements of Section 811.325(b) cannot be practically achieved with any currently available methods, the owner or operator must fulfill the following requirements:

1) It must obtain the certification of a qualified groundwater scientist or a determination by the Agency that compliance with requirements pursuant to Section 811.325(b) cannot be practically achieved with any currently available methods.

2) It must implement alternative measures to control exposure of humans or the environment to residual contamination, as necessary to adequately protect human health and the environment.

3) It must implement alternative measures for control of the sources of contamination, or for removal or decontamination of equipment, units, devices, or structures that fulfill the following requirements:

A) The measures are technically practicable; and

B) The measures are consistent with the overall objective of the remedy.

4) It must submit to the Agency, prior to implementing the alternative measures in accordance with subsection (c) of this Section, an application for a significant modification to the permit justifying the alternative measures.

5) For purposes of this Section, a "qualified groundwater scientist" is a scientist or an engineer who has received a baccalaureate or postgraduate

degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields as may be demonstrated by state registration, professional certifications, or completion of accredited university programs that enable that individual to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action.

d) All solid wastes that are managed pursuant to pursuant to Section 811.325 or subsection (a)(3) of this Section must be managed by the owner or operator in a manner that fulfills the following requirements:

1) It adequately protects human health and the environment; and

2) It complies with applicable requirements of Part 811.

e) Remedies selected pursuant to Section 811.325 must be considered complete when the following requirements are fulfilled:

1) The owner or operator complies with the groundwater quality standards established pursuant to Section 811.320 at all points within the plume of contamination that lie beyond the zone of attenuation established pursuant to Section 811.320;

2) Compliance with the maximum allowable predicted concentrations and the groundwater protection ~~quality~~ standards established pursuant to Section 811.320(a)(3)(C) has been achieved at wells located within the zone of attenuation. Compliance with this requirement shall include a ~~by~~ demonstration~~ng~~ that concentrations of the constituents monitored under the assessment monitoring program pursuant to Section 811.319(b) have not exceeded the greater of the maximum allowable predicted concentrations or the groundwater protection ~~quality~~ standards for a period of three consecutive years using the statistical procedures and performance standards in Section 811.320(e). The Agency may specify an alternative time period during which the owner or operator must demonstrate compliance with the groundwater quality standard(s). The Agency must specify such an alternative time period by considering the following factors:

A) The extent and concentration of the releases;

B) The behavior characteristics of the hazardous constituents in the groundwater;

C) The accuracy of monitoring or modeling techniques, including any seasonal, meteorological, or other environmental variabilities that may affect the accuracy; and

D) The characteristics of the groundwater; and

3) All actions required to complete the remedy have been satisfied.

f) Within 14 days after the completion of the remedy, the owner or operator must submit to the Agency an application for a significant modification of the permit including a certification that the remedy has been completed in compliance with the requirements of subsection (e) of this Section. The certification must be signed by the owner or operator and by a qualified groundwater scientist.

g) Upon Agency review and approval of the certification that the corrective action has been completed, in accordance with subsection (e) of this Section, the Agency must release the owner or operator from the financial assurance requirements for corrective action pursuant to Subpart G of this Part.

BOARD NOTE: Requirements of this Section are derived from 40 CFR 258.58 (2005).

(Source: Amended at 31 Ill. Reg. 1435, effective December 20, 2006

Attachment G-2

Proposed Adjusted Standard Regulatory Wording Without Redlined Changes

Appendix G
Proposed Adjusted Standard Modifications to the Rule of General Applicability

The proposed site specific modifications to the regulation of general applicability is summarized below.

Section 811.319 Groundwater Monitoring Programs

a) Detection Monitoring Program

Any use of the term maximum allowable predicted concentration in this Section is a reference to Section 811.318(c). The operator shall implement a detection monitoring program in accordance with the following requirements:

1) Monitoring Schedule and Frequency

A) The monitoring period shall begin as soon as waste is placed into the unit of a new landfill or within one year of the effective date of this Part for an existing landfill. Monitoring shall continue for a minimum period of fifteen years after closure, or in the case of MSWLF units, a minimum period of 30 years after closure, except as otherwise provided by subsection (a)(1)(C) of this Section. The operator shall sample all monitoring points for all potential sources of contamination on a quarterly basis except as specified in subsection (a)(3), for a period of five years from the date of issuance of the initial permit for significant modification under 35 Ill. Adm. Code 814.104 or a permit for a new unit pursuant to 35 Ill. Adm. Code 813.104. After the initial five-year period, the sampling frequency for each monitoring point shall be reduced to a semi-annual basis, provided the operator has submitted the certification described in 35 Ill. Adm. Code 813.304(b). Alternatively, after the initial five-year period, the Agency shall allow sampling on a semi-annual basis where the operator demonstrates that monitoring effectiveness has not been compromised, that sufficient quarterly data has been collected to characterize groundwater, and that leachate from the monitored unit does not constitute a threat to groundwater. For the purposes of this Section, the source shall be considered a threat to groundwater if the results of the monitoring indicate either that the concentrations of any of the constituents monitored within the zone of attenuation is above the maximum allowable predicted concentration for that constituent or, for existing landfills, subject to 35 Ill. Adm. Code 814, Subpart D, that the concentration of any constituent has exceeded the applicable standard at the compliance boundary as defined in 35 Ill. Adm. Code 814.402(b)(3).

B) Beginning fifteen years after closure of the unit, or five years after all other potential sources of discharge no longer constitute a threat to groundwater, as defined in subsection (a)(1)(A), the monitoring frequency may change on a well by well basis to an annual schedule if either of the following conditions exist. However, monitoring shall return to a quarterly schedule at any well where a statistically significant increase is determined to have occurred in accordance with Section 811.320(e), in the concentration of any constituent with respect to the previous sample.

   i) All constituents monitored within the zone of attenuation have returned to a concentration less than or equal to ten percent of the maximum allowable predicted concentration; or

   ii) All constituents monitored within the zone of attenuation are less than or equal to their maximum allowable predicted concentration for eight consecutive quarters.

C) Monitoring shall be continued for a minimum period of: 30 years after closure at MSWLF units, except as otherwise provided by subsections (a)(1)(D) and (a)(1)(E); five years after closure at landfills, other than MSWLF units, which are used exclusively for disposing waste generated at the site; or 15 years after closure at all other landfills regulated under this Part. Monitoring, beyond the minimum period, may be discontinued under the following conditions:

   i) No statistically significant increase is detected in the concentration of any constituent above that measured and recorded during the immediately preceding scheduled sampling for three consecutive years, after changing to an annual monitoring frequency; or

   ii) Immediately after contaminated leachate is no longer generated by the unit.

D) The Agency may reduce the groundwater monitoring period at a MSWLF unit upon a demonstration by the owner or operator that the reduced period is sufficient to protect human health and environment.

E) An owner or operator of a MSWLF unit shall petition the Board for an adjusted standard in accordance with Section 811.303, if the owner or operator seeks a reduction of the post closure care monitoring period for all of the following requirements:

i) Inspection and maintenance (Section 811.111);

ii) Leachate collection (Section 811.309);

iii) Gas monitoring (Section 811.310); and

iv) Groundwater monitoring (Section 811.319).

BOARD NOTE: Changes to subsections (a)(1)(A) and (a)(1)(C), and subsections (a)(1)(D) and (a)(1)(E) are derived from 40 CFR 258.61 (1992).

2) Criteria for Choosing Constituents to be Monitored.

A) The operator shall monitor each well for constituents that will provide a means for detecting groundwater contamination as well as parameters capable of characterizing the acid mine drainage impacts. Detection monitoring constituents utilized for statistical analysis shall be chosen for monitoring if they meet the following requirements.

i) The constituent appears in, or is expected to be in, the leachate at concentrations which are greater than the groundwater; and

ii)
Ammonia- Nitrogen (dissolved)^#
Arsenic (dissolved)
Barium (total)
Bicarbonate Alkalinity (dissolved)
Boron (dissolved)
Chloride (dissolved)^#
Chromium (dissolved)#
Cyanide (total)
Lead (dissolved)
Magnesium (dissolved)*
Mercury (dissolved)
Nitrate (dissolved)
Potassium (total)
Sodium (total)

Sulfate (dissolved)*
Total Dissolved Solids (TDS)*
Zinc (dissolved)*
pH*

iii) This is the minimum list for MSWLFs.

iv) Any facility accepting more than 50% by volume non-municipal waste must determine additional indicator parameters based upon leachate characteristic and waste content.

v) The monitoring of the constituents designated in 35 IAC 811.319(a)(1)(A)(ii) by "*" shall be conducted in order to characterize potential acid mine drainage effects on the groundwater quality. The "*" designated constituents) shall be subject to 35 IAC 811.319(a)(4)(A)(i) -the 8 consecutive monitoring event trend analyses but exempt from 35 IAC 811.319(a)(4)(A)(ii) and (iv)- the statistically based comparisons to maximum allowable predicted concentrations (MAPCs) within the zone of attenuation and the Applicable Groundwater Quality Standard (AGQS) beyond the zone of attenuation.

vi) The constituents designated in 35 IAC 811.319(a)(1)(A)(ii) by "^" shall be subject to 35 IAC 811.319(a)(4)(A)(i) 8 consecutive monitoring event trend analyses but exempt from 35 IAC 811.319(a)(4)(A)(ii) - the statistically based comparisons to maximum allowable predicted concentrations (MAPCs) at wells located within the zone of attenuation.

vii) Constituents designated in 35 IAC 811.319(a)(1)(A)(ii) by "#" have Board adjusted groundwater quality standards. The applicable groundwater quality standard for dissolved ammonia (15 mg/L), dissolved chloride (200 mg/L) and dissolved chromium (100 ug/L) are the effective applicable groundwater quality standard at or beyond the landfill's zone of attenuation.

B) One or more indicator constituents, representative of the transport processes of constituents in the leachate, may be chosen for monitoring in place of the constituents it represents. The use of such indicator constituents must be included in an Agency approved permit.

3) Organic Chemicals Monitoring

The operator shall monitor each existing well that is being used as a part of the monitoring well network at the facility within one year of the effective date of this Part, and monitor each new well within the three months of its establishment. The monitoring required by this subsection (a)(3) shall be for a broad range of organic chemical contaminants in accordance with the procedures described below:

A) The analysis shall be at least as comprehensive and sensitive as the tests for the 51 organic chemicals in drinking water described at 40 CFR 141.40 (1988) and 40 CFR 258.Appendix I (2006), incorporated by reference at 35 Ill. Adm. Code 810.104 and:

Acetone
Acrylonitrile
Benzene
Bromobenzene
Bromochloromethane
Bromodichloromethane
Bromoform; Tribromomethane
n-Butylbenzene
sec-Butylbenzene
tert-Butylbenzene
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform; Trichloromethane
o-Chlorotoluene
p-Chlorotoluene
Dibromochloromethane
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
trans-1,4-Dichloro-2-butene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene

cis-1,2-Dichloroethylene
trans-1,2-Dicloroethylene
1,2-Dichloropropane
1,3-Dichloropropane
2,2-Dichloropropane
1,1-Dichloropropene
1,3-Dichloropropene
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
Ethylbenzene
Hexachlorobutadiene
2-Hexanone; Methyl butyl ketone
Isopropylbenzene
p-Isopropyltoluene
Methyl bromide; Bromomethane
Methyl chloride; Chloromethane
Methylene bromide; Dibromomethane
Dichloromethane
Methyl ethyl ketone
Methyl iodide; Iodomethane
4-Methyl-2-pentanone
Naphthalene
Oil and Grease (hexane soluble)
n-Propylbenzene
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
Tetrahydrofuran
Toluene
Total Phenolics
1,2,3-Trichlorobenzene
1,2,4-Trichlorbenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Trichlorofluoromethane
1,2,3-Trichloropropane
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Vinyl acetate
Vinyl chloride
Xylenes

B) At least once every two years, the operator shall monitor each well in accordance with subsection (a)(3)(A).

C) The operator of a MSWLF unit shall monitor each well in accordance with subsection (a)(3)(A) on a semi-annual basis.

BOARD NOTE: Subsection (a)(3)(C) is derived from 40 CFR 258.54(b) (1992).

4) Confirmation of Monitored Increase

A) The confirmation procedures of this subsection shall be used only if the concentrations of the constituents monitored can be measured at or above the practical quantitation limit (PQL). The PQL is defined as the lowest concentration that can be reliably measured within specified limits of precision and accuracy, under routine laboratory operating conditions. The operator shall institute the confirmation procedures of subsection (a)(4)(B) after notifying the Agency in writing, within ten days, of observed increases:

i) The concentration of any inorganic constituent monitored in accordance with subsections (a)(1) and (a)(2) shows a progressive increase over eight consecutive monitoring events;

ii) The concentration of any non-exempted 35 IAC 811.319(a)(2)(A)(ii) constituent or any 35 IAC 811.319(a)(3) organic constituent exceeds the greater of the maximum allowable predicted concentration or the groundwater protection standard developed pursuant to Section 811.320(a)(3)(C) at an established monitoring point within the zone of attenuation;

iii) The concentration of any constituent monitored in accordance with subsection (a)(3) exceeds the preceding measured concentration at any established monitoring point; and

iv) The concentration of any constituent monitored at or beyond the zone of attenuation exceeds the applicable groundwater quality standards or Board adjusted groundwater standard of Section 811.320(a)(1).

B) The confirmation procedures shall include the following:

i) The operator shall verify any observed increase by taking additional samples within 90 days after the initial sampling event and ensure that the samples and sampling protocol used will detect any statistically significant increase in the concentration of the suspect constituent in accordance with Section 811.320(e), so as to confirm the observed increase. The operator shall notify the Agency of any confirmed increase before the end of the next business day following the confirmation.

ii) The operator shall determine the source of any confirmed increase, which may include, but shall not be limited to, natural phenomena, sampling or analysis errors, or an offsite source.

iii) The operator shall notify the Agency in writing of any confirmed increase. The notification must demonstrate a source other than the facility and provide the rationale used in such a determination. The notification must be submitted to the Agency no later than 180 days after the original sampling event. If the facility is permitted by the Agency, the notification must be filed for review as a significant permit modification pursuant to 35 Ill. Adm. Code 813.Subpart B.

iv) If an alternative source demonstration described in subsections (a)(4)(B)(ii) and (iii) of this Section cannot be made, assessment monitoring is required in accordance with subsection (b) of this Section.

v) If an alternative source demonstration, submitted to the Agency as an application, is denied pursuant to 35 Ill. Adm. Code 813.105, the operator must commence sampling for the constituents listed in subsection (b)(5) of this Section, and submit an assessment monitoring plan as a significant permit modification, both within 30 days after the dated notification of Agency denial. The operator must sample the well or wells that exhibited the confirmed increase.

b) Assessment Monitoring

The operator shall begin an assessment monitoring program in order to confirm that the solid waste disposal facility is the source of the contamination and to provide information needed to carry out a groundwater impact assessment in accordance with subsection (c). The assessment monitoring program shall be conducted in accordance with the following requirements:

1) The assessment monitoring shall be conducted in accordance with this subsection to collect information to assess the nature and extent of groundwater contamination. The owner or operator of a MSWLF unit shall comply with the additional requirements prescribed in subsection (b)(5). The assessment monitoring shall consist of monitoring of additional constituents that might indicate the source and extent of contamination. In addition, assessment monitoring may include any other investigative techniques that will assist in determining the source, nature and extent of the contamination, which may consist of, but need not be limited to:

   A) More frequent sampling of the wells in which the observation occurred;
   B) More frequent sampling of any surrounding wells; and
   C) The placement of additional monitoring wells to determine the source and extent of the contamination.

2) Except as provided for in subsections (a)(4)(B)(iii) and (v) of this Section, the operator of the facility for which assessment monitoring is required shall file the plans for an assessment monitoring program with the Agency. If the facility is permitted by the Agency, then the plans shall be filed for review as a significant permit modification pursuant to 35 Ill. Adm. Code 813.Subpart B within 180 days after the original sampling event. The assessment monitoring program shall be implemented within 180 days after the original sampling event in accordance with subsection (a)(4) or, in the case of permitted facilities, within 45 days after Agency approval.

3) If the analysis of the assessment monitoring data shows that the concentration of one or more constituents, monitored at or beyond the zone of attenuation is above the applicable groundwater quality standards or adjusted groundwater quality standard and is attributable to the solid waste disposal facility, then the operator must determine the nature and extent of the groundwater contamination and must implement the remedial action in accordance with Section 811.319(d).

4) If the analysis of the assessment monitoring data shows that the concentration of one or more constituents is attributable to the solid waste disposal facility and exceeds the maximum allowable predicted concentration and the Groundwater Protection Standard developed pursuant to 35 IAC 811.320 (a)(3)(c) within the zone of attenuation, then

the operator shall conduct a groundwater impact assessment in accordance with the requirements of subsection (c).

5) In addition to the requirements of subsection (b)(1), to collect information to assess the nature and extent of groundwater contamination, the following requirements are applicable to MSWLF units:

A) The monitoring of additional constituents pursuant to subsection (b)(l) must include, at a minimum (except as otherwise provided in subsection (b)(5)(E) of this Section), the constituents listed in 40 CFR 258.Appendix II, incorporated by reference at 35 Ill. Adm. Code 810.104, and constituents from 35 Ill. Adm. Code 620.410.

i) Additionally, in order to aid in discerning leachate from acid mine drainage related concentration increases, the following constituents shall undergo assessment monitoring in accordance with the monitoring frequency described in subparagraph (D).

Iron (dissolved and total)*
Manganese (dissolved and total)*
Bicarbonate Alkalinity (total)
Potassium (total)
Sodium (total)
Zinc (total)*
Chloride (total)^#
Chromium (total)^#
Sulfate (total)*
TDS*
pH*

ii) The monitoring of the constituents designated above by "*" shall be conducted in order to characterize potential acid mine drainage effects on the groundwater quality. The acid mine drainage indicator constituents listed in in 35 IAC 811.319(b)(5)(A)(i) "*" designated constituents) shall be exempt from the 35 IAC 811.319(b)(3) applicable groundwater quality standard comparisons at monitoring points located at or beyond the landfill's zone of attenuation;

iii) Constituents designated in 35 IAC 811.319(b)(5)(A)(i) with either "*" or "^" shall be exempt from the 35 IAC 811.319(b)(4) maximum allowable predicted concentration and GPS analyses at monitoring points located within the landfill's groundwater zone of attenuation.

iv) Constituents designated in 35 IAC 811.319(b)(5)(A)(i) by either a "*" or "^" shall undergo the temporal trend analyses in accordance with the requirements of 35 IAC 811.319(b)(6).

v) Constituents designated in 35 IAC 811.319(b)(5)(A)(i) by "#" have Board adjusted groundwater quality standards. The applicable groundwater quality standard for dissolved ammonia (15 mg/L), dissolved and total chloride (200 mg/L) and dissolved and total chromium (100 ug/L) are the effective applicable groundwater quality standard at or beyond the landfill's zone of attenuation.

BOARD NOTE: Subsection (b)(5)(A) is derived from 40 CFR 258.55(b) (1992).

B) Within 14 days after obtaining the results of sampling required under subsection (b)(5)(A), the owner or operator shall:

i) Place a notice in the operating record identifying the constituents that have been detected; and

ii) Notify the Agency that such a notice has been placed in the operating record.

BOARD NOTE: Subsection (b)(5)(B) is derived from 40 CFR 258.55(d)(l) (1992).

C) The owner or operator shall establish background concentrations for any constituents detected pursuant to subsection (b)(5)(A) in accordance with Section 811.320(e). The owner or operator shall also develop groundwater protection standards in accordance with the requirements of Section 811.320(a)(3)(C).

BOARD NOTE: Subsection (b)(5)(C) is derived from 40 CFR 258.55(d)(3) (1992).

D) Within 90 days after the initial monitoring in accordance with subsection (b)(5)(A) of this Section, the owner or operator must monitor for the detected constituents listed in appendix II to 40

CFR 258, incorporated by reference in 35 Ill. Adm. Code 810.104, and 35 Ill. Adm. Code 620.410 on a semiannual basis during the assessment monitoring. The operator must monitor all the constituents listed in appendix II to 40 CFR 258 and 35 Ill. Adm. Code 620.410 on an annual basis during assessment monitoring, except for the following constituents:

Antimony (total)
Cadmium (total)
Cobalt (total)
Copper (total)
Nickel (total)
Silver (total)
Selenium (total)
Thallium (total)

BOARD NOTE: Subsection (b)(5)(D) is derived from 40 CFR 258.55(d)(2) (1992).

E) The owner or operator may request the Agency to delete any of the 40 CFR 258.Appendix II and 35 Ill. Adm. Code 620.410 constituents by demonstrating to the Agency that the deleted constituents are not reasonably expected to be in or derived from the waste or contained in the leachate at concentrations which could be discerned from the background groundwater quality. Based on this analysis the following constituents are deleted from the Assessment monitoring list at the SCL facility:

Antimony (total)
Cadmium (total)
Cobalt (total)
Copper (total)
Nickel (total)
Silver (total)
Selenium (total)
Thallium (total)

BOARD NOTE: Subsection (b)(5)(E) is derived from 40 CFR 258.55(b) (1992).

F) Within 14 days after finding an exceedance above the applicable groundwater quality standards in accordance with subsection (b)(3), the owner or operator shall:

i) Place a notice in the operating record that identifies the constituents monitored under subsection (b)(1)(D) that have exceeded the groundwater quality standard;

ii) Notify the Agency and the appropriate officials of the local municipality or county within whose boundaries the site is located that such a notice has been placed in the operating record; and

iii) Notify all persons who own land or reside on land that directly overlies any part of the plume of contamination if contaminants have migrated off-site.

BOARD NOTE: Subsection (b)(5)(F) is derived from 40 CFR 258.55(g)(1)(i) through (iii) (1992).

G) If the concentrations of all constituents in appendix II to 40 CFR 258, incorporated by reference in 35 Ill. Adm. Code 810.104, and 35 IL Adm. Code 620.410, as modified in this adjusted standard are shown to be at or below background values, using the statistical procedures in Section 811.320(e), for two consecutive sampling events, the owner or operator must notify the Agency of this finding and may stop monitoring the constituents.

BOARD NOTE: Subsection (b)(5)(G) is derived from 40 CFR 258.55(e) (1992).

6) The concentration of any inorganic constituent monitored in accordance with subsections (b)(5)(A)(iv) shows a progressive increase over eight consecutive monitoring events. If such an increasing concentration trend is identified, the operator must complete the following confirmation procedures:

i) The operator shall verify any observed increase by taking additional samples within 90 days after the initial sampling event and ensure that the increasing concentration trend exists. The operator shall notify the Agency of any confirmed increase before the end of the next business day following the receipt of confirmation monitoring results.

ii) The operator shall determine the source of any confirmed increase, which may include, but shall not be limited to, natural phenomena, sampling or analysis errors, or an offsite source.

iii) The operator shall notify the Agency in writing of any confirmed increase. The notification must demonstrate a source other than the facility and provide the rationale used in such a determination. The notification must be submitted to the Agency no later than 180 days after the original sampling event. The notification must be filed for review as a significant permit modification pursuant to 35 Ill. Adm. Code 813.Subpart B.

iv) If an alternative source demonstration described in subsections (a)(4)(B)(ii) and (iii) of this Section cannot be made, and the exceedance is attributable to the solid waste disposal facility, then the operator shall determine the nature and extent of the groundwater contamination including an assessment of the potential impact on the groundwater at the facility and shall implement the remedial action in accordance with subsection (d).

c) If required to conduct a groundwater impact assessment in accordance with this adjusted standard, the operator must assess the potential impacts outside the zone of attenuation that may result from confirmed increases above the maximum allowable predicted concentration or groundwater protection standards within the zone of attenuation, attributable to the facility, in order to determine if there is need for remedial action. In addition to the requirements of Section 811.317, the following requirements apply:

1) The operator must utilize any new information developed since the initial assessment and information from the detection and assessment monitoring programs and such information may be used for the recalibration of the GCT model; and

2) The operator must submit the groundwater impact assessment and any proposed remedial action plans determined necessary pursuant to Section 811.319(d) to the Agency within 180 days after the start of the assessment monitoring program.

d) Remedial Action. The owner or operator of a MSWLF unit shall conduct corrective action in accordance with Sections 811.324, 811.325, and 811.326. The owner or operator of a landfill facility, other than a MSWLF unit, shall conduct remedial action in accordance with this subsection.

1) The operator shall submit plans for the remedial action to the Agency. Such plans and all supporting information including data collected during the assessment monitoring shall be submitted within 90 days after determination of either of the following:

A) The groundwater impact assessment, performed in accordance with subsection (c), indicates that remedial action is needed; or

B) Any confirmed increase above the applicable groundwater quality standards of Section 811.320 or the adjusted groundwater quality standards is determined to be attributable to the solid waste disposal facility in accordance with Section 811.319(b).

2) If the facility has been issued a permit by the Agency, then the operator shall submit this information as an application for significant modification to the permit;

3) The operator shall implement the plan for remedial action program within 90 days after the following:

A) Completion of the groundwater impact assessment that requires remedial action;

B) Establishing that a violation of an applicable groundwater quality standard of Section 811.320 or an adjusted groundwater quality standard is attributable to the solid waste disposal facility in accordance with Section 811.319(b)(3) of this section;

C) Agency approval of the remedial action plan, where the facility has been permitted by the Agency.

4) The remedial action program shall consist of one or a combination of one of more of the following solutions:

A) Retrofit additional groundwater protective measures within the unit;

B) Construct an additional hydraulic barrier, such as a cutoff wall or slurry wall system

C) Pump and treat the contaminated groundwater; or

D) Any other equivalent technique which will prevent further contamination of groundwater.

5) Termination of the Remedial Action Program

A) The remedial action program must continue in accordance with the plan until monitoring shows that the concentrations of all monitored constituents are below the greater of the maximum allowable predicted concentrations or the groundwater protection standards within the zone of attenuation and below the applicable groundwater quality standards of Section 811.320 or the Board adjusted groundwater quality standards at or beyond the zone of attenuation, over a period of four consecutive monitoring events.

B) The operator shall submit to the Agency all information collected under subsection (d)(5)(A). If the facility is permitted then the operator shall submit this information as a significant modification of the permit.

(Source: Amended at 31 Ill. Reg. 16172, effective November 27, 2007)

Section 811.320 Groundwater Quality Standards

a) Applicable Groundwater Quality Standards

1) Groundwater quality shall be maintained at each constituent's background concentration, at or beyond the zone of attenuation. The applicable groundwater quality standard established for any constituent shall be:

A) The background concentration; or

B) The Board established standard adjusted by the Board in accordance with the justification procedure of subsection (b).

2) Any statistically significant increase above an applicable groundwater quality standard established pursuant to subsection (a)(1) that is attributable to the facility and which occurs at or beyond the zone of

attenuation within 100 years after closure of the last unit accepting waste within such a facility shall constitute a violation.

3) For the purposes of this Part:

A) "Background concentration" means that concentration of a constituent that is established as the background in accordance with subsection (d); and

B) "Board established standard" is the concentration of a constituent adopted by the Board as a groundwater quality standard adopted by the Board pursuant to Section 14.4 of the Act or Section 8 of the Illinois Groundwater Protection Act.

i) Pursuant to 35 Ill. Adm. Code 811.320(a)(1)(B), the operator must meet the following Board established groundwater quality standards at and beyond the zone of attenuation:

Ammonia (dissolved)	15 mg/L
Chloride (dissolved and total)	200 mg/L
Chromium (dissolved and total)	100 ug/L

C) "Groundwater protection standard (GPS)" is the numerical concentration standard that if exceeded at a monitoring well located inside of the landfill's zone of attenuation, due to a release from the landfill, shall require that the operator initiate an assessment of corrective measures as required by 35 IAC 811.324. Pursuant to the requirements of 40 CFR 258.55(h), the groundwater protection standards may be (1) For constituents for which a maximum contaminant level (MCL) has been promulgated under section 1412 of the Safe Drinking Water Act (codified) under 40 CFR part 141, the MCL for that constituent; (2) For constituents for which MCLs have not been promulgated, the Maximum Allowable Predicted Concentration (MAPC) for the constituent established in accordance with 35 IAC 811.318(c); or (3) For constituents for which the MAPC is higher than the MCL or health based levels identified under §258.55(i)(1), the MAPC shall be the effective GPS. (4) The Director of an approved State may establish an alternative groundwater protection standard for constituents for which MCLs have not been established. (5) The State groundwater standards promulgated under 35 IAC 620.410 or general use water standards promulgated under 35 IAC 302.212 may be utilized as health based standards in instances where the state standard is more stringent than the federal MCLs, or in instances where no MCL has been promulgated.

b) Justification for Adjusted Groundwater Quality Standards

1) An operator may petition the Board for an adjusted groundwater quality standard in accordance with the procedures specified in Section 28.1 of the Act and 35 Ill. Adm. Code 104.400.Subpart D.

2) For groundwater which contains naturally occurring constituents which meet the applicable requirements of 35 Ill. Adm. Code 620.410, 620.420, 620.430, or 620.440 the Board will specify adjusted groundwater quality standards no greater than those of 35 Ill. Adm. Code 620.410, 620.420, 620.430 or 620.440, respectively, upon a demonstration by the operator that:

A) The change in standards will not interfere with, or become injurious to, any present or potential beneficial uses for such water;

B) The change in standards is necessary for economic or social development, by providing information including, but not limited to, the impacts of the standards on the regional economy, social disbenefits such as loss of jobs or closing of landfills, and economic analysis contrasting the health and environmental benefits with costs likely to be incurred in meeting the standards ; and

C) All technically feasible and economically reasonable methods are being used to prevent the degradation of the groundwater quality.

3) Notwithstanding subsection (b)(2), in no case shall the Board specify adjusted groundwater quality standards for a MSWLF unit greater than the following levels:

Chemical	Concentration (mg/l
Arsenic	0.05
Barium	1.0
Benzene	0.005
Cadmium	0.01
Carbon tetrachloride	0.005
Chromium (hexavalent)	0.05
2,4-Dichlorophenoxy acetic acid	0.1
1,4-Dichlorobenzene	0.075
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
Endrin	0.0002
Fluoride	4

Lindane	0.004
Lead	0.05
Mercury	0.002
Methoxychlor	0.1
Nitrate	10
Selenium	0.01
Silver	0.05
Toxaphene	0.005
l,l,l-Trichloromethane	0.2
Trichloroethylene	0.005
2,4,5-Trichlorophenoxy acetic acid	0.01
Vinyl Chloride	0.002

4) For groundwater which contains naturally occurring constituents which do not meet the standards of 35 Ill. Adm. Code 620.410, 620.420, 620.430 or 620.440, the Board will specify adjusted groundwater quality standards, upon a demonstration by the operator that:

A) The groundwater does not presently serve as a source of drinking water;

B) The change in standards will not interfere with, or become injurious to, any present or potential beneficial uses for such waters;

C) The change in standards is necessary for economic or social development, by providing information including, but not limited to, the impacts of the standards on the regional economy, social disbenefits such as loss of jobs or closing of landfills, and economic analysis contrasting the health and environmental benefits with costs likely to be incurred in meeting the standards; and

D) The groundwater cannot presently, and will not in the future, serve as a source of drinking water because:

i) It is impossible to remove water in usable quantities;

ii) The groundwater is situated at a depth or location such that recovery of water for drinking purposes is not technologically feasible or economically reasonable;

iii) The groundwater is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption;

iv) The total dissolved solids content of the groundwater is more than 3,000 mg/l and that water will not be used to serve a public water supply system; or

v) The total dissolved solids content of the groundwater exceeds 10,000 mg/l.

c) Determination of the Zone of Attenuation

1) The zone of attenuation, within which concentrations of constituents in leachate discharged from the unit may exceed the applicable groundwater quality standard of this Section, is a volume bounded by a vertical plane at the property boundary or 100 feet from the edge of the unit, whichever is less, extending from the ground surface to the bottom of the uppermost aquifer and excluding the volume occupied by the waste.

2) Zones of attenuation shall not extend to the annual high water mark of navigable surface waters.

3) Overlapping zones of attenuation from units within a single facility may be combined into a single zone for the purposes of establishing a monitoring network.

d) Establishment of Background Concentrations

1) The initial monitoring to determine background concentrations shall commence during the hydrogeological assessment required by Section 811.315. The background concentrations for those parameters identified in Sections 811.315(e)(1)(G) and 811.319(a)(2) and (a)(3) shall be established based on consecutive quarterly sampling of wells for a minimum of one year, monitored in accordance with the requirements of subsections (d)(2), (d)(3) and (d)(4). Non-consecutive data may be considered by the Agency, if only one data point from a quarterly event is missing, and it can be demonstrated that the remaining data set is representative of consecutive data in terms of any seasonal or temporal variation. Statistical tests and procedures shall be employed, in accordance with subsection (e), depending on the number, type and frequency of samples collected from the wells, to establish the background concentrations.

2) Adjustments to the background concentrations shall be made if changes in the concentrations of constituents observed in background wells over time are determined, in accordance with subsection (e), to be statistically significant, and due to natural temporal or spatial variability or due to an off-site source not associated with the landfill or the landfill activities. Such adjustments may be conducted no more frequently than once every

two years during the operation of a facility and modified subject to approval by the Agency. Non-consecutive data may be used for an adjustment upon Agency approval. Adjustments to the background concentration shall not be initiated prior to November 27, 2009 unless required by the Agency.

3) Background concentrations determined in accordance with this subsection shall be used for the purposes of establishing groundwater quality standards, in accordance with subsection (a). The operator shall prepare a list of the background concentrations established in accordance with this subsection. The operator shall maintain such a list at the facility, shall submit a copy of the list to the Agency for establishing standards in accordance with subsection (a), and shall provide updates to the list within ten days of any change to the list.

4) A network of monitoring wells shall be established upgradient from the unit, with respect to groundwater flow, in accordance with the following standards, in order to determine the background concentrations of constituents in the groundwater:

   A) The wells shall be located at such a distance that discharges of contaminants from the unit will not be detectable;

   B) The wells shall be sampled at the same frequency as other monitoring points to provide continuous background concentration data, throughout the monitoring period; and

   C) The wells shall be located at several depths to provide data on the spatial variability.

5) A determination of background concentrations may include the sampling of wells that are not hydraulically upgradient of the waste unit where:

   A) Hydrogeologic conditions do not allow the owner or operator to determine what wells are hydraulically upgradient of the waste; and

   B) Sampling at other wells will provide an indication of background concentrations that is representative of that which would have been provided by upgradient wells.

6) If background concentrations cannot be determined on site, then alternative background concentrations may be determined from actual monitoring data from the aquifer of concern, which includes, but is not limited to, data from another landfill site that overlies the same aquifer.

e) Statistical Analysis of Groundwater Monitoring Data

1) Statistical tests shall be used to analyze groundwater monitoring data. One or more of the normal theory statistical tests shall be chosen first for analyzing the data set or transformations of the data set. Where such normal theory tests are demonstrated to be inappropriate, tests listed in subsection (e)(4) shall be used. The level of significance (Type I error level) shall be no less than 0.01, for individual well comparisons, and no less than 0.05, for multiple well comparisons. The statistical analysis shall include, but not be limited to, the accounting of data below the detection limit of the analytical method used, the establishment of background concentrations and the determination of whether statistically significant changes have occurred in:

A) The concentration of any chemical constituent with respect to the background concentration or maximum allowable predicted concentration; and

B) The established background concentration of any chemical constituents over time.

2) The statistical test or tests used shall be based upon the sampling and collection protocol of Sections 811.318 and 811.319.

3) Monitored data that are below the level of detection shall be reported as not detected (ND). The level of detection for each constituent shall be the practical quantitation limit (PQL), and shall be the lowest concentration that is protective of human health and the environment, and can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions. In no case, shall the PQL be established above the level that the Board has established for a groundwater quality standard under the Illinois Groundwater Protection Act [415 ILCS 55]. The following procedures shall be used to analyze such data, unless an alternative procedure in accordance with subsection (e)(4), is shown to be applicable:

A) Where the percentage of nondetects in the data base used is less than 15 percent, the operator shall replace NDs with the PQL divided by two, then proceed with the use of one or more of the Normal Theory statistical tests;

B) Where the percentage of nondetects in the data base used is between 15 and 50 percent, and the data are normally distributed, the operator shall use Cohen's or Aitchison's adjustment to the sample mean and standard deviation, followed by an applicable statistical procedure;

C) Where the percentage of nondetects in the database used is above 50 percent, then the owner or operator shall use an alternative procedure in accordance with subsection (e)(4).

4) Nonparametric statistical tests or any other statistical test if it is demonstrated to meet the requirements of 35 Ill. Adm. Code 724.197(i).

BOARD NOTE: Subsection (b)(3) is derived from 40 CFR 258.40 Table 1. (1992).

(Source: Amended at 31 Ill. Reg. 16172, effective November 27, 2007)

Section 811.324 Corrective Action Measures for MSWLF Units

a) The owner or operator shall initiate an assessment of corrective action measures within 14 days of the following:

1) The groundwater impact assessment, performed in accordance with subsection 811.319 (c), indicates that remedial action is needed; or

2) The assessment monitoring, performed in accordance with subsection 811.319(b), indicates that a confirmed increase above the applicable groundwater quality standard or Board established standard outside the zone of attenuation, or the higher of the maximum allowable predicted concentration or the groundwater protection standard of Section 811.320(a)(3)(C), inside the zone of attenuation is attributable to the solid waste disposal facility.

b) The owner or operator shall complete the corrective action assessment within 90 days of initiating the assessment of corrective action measures in accordance with subsection (a).

c) The owner or operator shall continue to monitor in accordance with the assessment monitoring program, as specified in Section 811.319(b).

d) The assessment shall include an analysis of the effectiveness of various potential corrective action measures in meeting all of the requirements and objectives of the remedy, as described under Section 811.325, addressing at least the following:

1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

2) The time required to begin and complete the remedy;

3) The costs of remedy implementation; and

4) The institutional requirements, such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedies.

e) The owner or operator must discuss the results of the corrective action measures assessment prior to the selection of a remedy in a public meeting with interested and affected parties. Prior to the public meeting, the owner or operator of the MSWLF unit shall submit to the Agency a report describing the results of the corrective action measures assessment.

BOARD NOTE: Requirements of this Section are derived from 40 CFR 258.56 (1992).

(Source: Added in R93-10 at 18 Ill. Reg. 1308, effective January 13, 1994)

Section 811.325 Selection of remedy for MSWLF Units

a) Within 90 days of the completion of the corrective action measures assessment conducted under Section 811.324, the owner or operator of a MSWLF unit shall:

1) Select a remedy based on the assessment results that, at a minimum, meets the requirements of subsection (b); and

2) Submit to the Agency an application for a significant modification to the landfill permit describing the selected remedy and how it meets the standards set forth in subsection (b).

b) Remedies selected under this Section must meet the following requirements:

1) They must be protective of human health and the environment;

2) They must attain the groundwater_quality standard or Board adjusted groundwater standard outside the zone of attenuation and the higher of the maximum allowable predicted concentration or the groundwater protection standard prescribed at Section 811.320(a)(3)(C), within the zone of attenuation;

3) They must control the sources of release so as to reduce or eliminate, to the maximum extent practicable, further releases of constituents detected under the assessment monitoring into the environment that may pose a threat to human health or the environment; and

4) They must comply with standards for management of wastes as specified in Section 811.326(d).

c) In selecting a remedy that meets the requirements of subsection (b), the owner or operator shall consider the following evaluation factors:

1) The long- and short-term effectiveness and protectiveness of the potential remedies, along with the degree of certainty that the remedy will prove successful based on consideration of the following factors:

A) The magnitude of reduction of existing risks;

B) The magnitude of residual risks in terms of likelihood of further releases due to waste remaining following implementation of a remedy;

C) The type and degree of long-term management required, including monitoring, operation, and maintenance;

D) Any short-term risks that might be posed to the community, workers, or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and redisposal or containment;

E) The length of time until full protection is achieved;

F) Any potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, redisposal, or containment;

G) The long-term reliability of engineering and institutional controls; and

H) The potential need for replacement of the remedy.

2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

A) The extent to which containment practices will reduce further releases; and

B) The extent to which treatment technologies may be used.

3) The ease or difficulty of implementing potential remedies based on consideration of the following types of factors:

A) The degree of difficulty associated with constructing the technology;

B) The expected operational reliability of the technologies;

C) The need to coordinate with and obtain necessary approvals and permits from other agencies;

D) The availability of necessary equipment and specialists; and

E) The available capacity and location of needed treatment, storage, and disposal services.

4) The practicable capability of the owner or operator to implement the remedies, including a consideration of the technical and economic capability.

5) The degree to which community concerns are addressed by potential remedies.

d) Schedule for implementing remedial action.

1) The owner or operator shall specify as part of the selected remedy a schedule(s) for initiating and completing remedial activities. Such a schedule must require the initiation of remedial activities within a reasonable period of time, taking into consideration the factors set forth in subsections (d)(3)(A) through (d)(3)(H).

2) The Agency shall specify the time period for initiating remedial action in the facility's permit.

3) The owner or operator shall consider the following factors in determining the schedule of remedial activities:

A) The extent and nature of contamination;

B) The practical capabilities of remedial technologies in achieving compliance with the applicable groundwater quality standards or the Board established standards at or beyond the zone of attenuation and the greater of the groundwater protection standards established under Section 811.320(a)(3)(C) or the maximum allowable predicted concentrations inside of the zone of attenuation and other objectives of the remedy;

C) The availability of treatment or disposal capacity for wastes managed during implementation of the remedy;

D) The desireability of utilizing technologies that are not currently available, but which may offer significant advantages over already available technologies in terms of effectiveness, reliability, safety, or ability to achieve remedial objectives;

E) Any potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;

F) Any resource value of the aquifer including:

  i) Any current and future uses;

  ii) The proximity and withdrawal rate of users;

  iii) The ground-water quantity and quality;

  iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituent;

  v) The hydrogeologic characteristic of the facility and surrounding land;

  vi) The ground-water removal and treatment costs;

  vii) The cost and availability of alternative water supplies;

G) The practicable capability of the owner or operator to implement the remedies; and

H) Any other relevant factors.

e) The Agency shall determine that remediation of a release of one or more constituents monitored in accordance with Section 811.319 from a MSWLF unit is not necessary if the owner or operator demonstrates to the Agency that:

1) The groundwater is additionally contaminated by substances that have originated from a source other than the MSWLF unit and those substances are present in such concentrations that cleanup of the release from the MSWLF unit would provide no significant reduction in risk to actual or potential receptors; or

2) The constituents are present in groundwater that:

A) Is not currently or reasonably expected to be a source of drinking water; and

B) Is not hydraulically connected with waters to which the hazardous constituents are migrating or are likely to migrate in concentrations that would exceed the groundwater quality standards established under Section 811.320; or

3) The remediation of the release is technically impracticable; or

4) The remediation results in unacceptable cross-media impacts.

f) A determination by the Agency pursuant to subsection (e) shall not affect the Agency's authority to require the owner or operator to undertake source control measures or other measures that may be necessary to eliminate or minimize further releases to the groundwater, to prevent exposure to the groundwater, or to remediate the groundwater to concentrations that are technically practicable and which reduce threats to human health or the environment.

BOARD NOTE: The requirements of this Section are derived from 40 CFR 258.57 (1992).

(Source: Added in R93-10 at 18 Ill. Reg. 1308, effective January 13, 1994)

Section 811.326 Implementation of the corrective action program at MSWLF Units

a) Based on the schedule established pursuant to Section 811.325(d) for initiation and completion of corrective action, the owner or operator must fulfill the following requirements:

1) It must establish and implement a corrective action groundwater monitoring program that fulfills the following requirements:

A) At a minimum, the program must meet the requirements of an assessment monitoring program pursuant to Section 811.319(b);

B) The program must indicate the effectiveness of the remedy; and

C) The program must demonstrate compliance with groundwater protection standards pursuant to subsection (e) of this Section.

2) It must implement the remedy selected pursuant to Section 811.325.

3) It must take any interim measures necessary to ensure the adequate protection of human health and the environment. The interim measures should, to the greatest extent practicable, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to Section 811.325. The owner or operator must consider the following factors in determining whether interim measures are necessary:

   A) The time required to develop and implement a final remedy;

   B) Any actual or potential exposure of nearby populations or environmental receptors to hazardous constituents;

   C) Any actual or potential contamination of drinking water supplies or sensitive ecosystems;

   D) Any further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;

   E) The weather conditions that may cause hazardous constituents to migrate or be released;

   F) Any risks of fire or explosion, or potential for exposure to hazardous constituents as a result of an accident or failure of a container or handling system; and

   G) Any other situations that may pose threats to human health and the environment.

b) If an owner or operator determines, based on information developed after implementation of the remedy has begun or other information, that compliance with requirements of Section 811.325(b) are not being achieved through the remedy selected, the owner or operator must fulfill the following requirements:

   1) It must implement other methods or techniques that could practicably achieve compliance with the requirements, unless the owner or operator makes the determination pursuant to subsection (c) of this Section.

   2) It must submit to the Agency, prior to implementing any alternative methods pursuant to subsection (b)(1) of this Section, an application for a significant modification to the permit describing the alternative methods or techniques and how they meet the standards of Section 811.325(b).

c) If the owner or operator determines that compliance with the requirements of Section 811.325(b) cannot be practically achieved with any currently available methods, the owner or operator must fulfill the following requirements:

1) It must obtain the certification of a qualified groundwater scientist or a determination by the Agency that compliance with requirements pursuant to Section 811.325(b) cannot be practically achieved with any currently available methods.

2) It must implement alternative measures to control exposure of humans or the environment to residual contamination, as necessary to adequately protect human health and the environment.

3) It must implement alternative measures for control of the sources of contamination, or for removal or decontamination of equipment, units, devices, or structures that fulfill the following requirements:

    A) The measures are technically practicable; and

    B) The measures are consistent with the overall objective of the remedy.

4) It must submit to the Agency, prior to implementing the alternative measures in accordance with subsection (c) of this Section, an application for a significant modification to the permit justifying the alternative measures.

5) For purposes of this Section, a "qualified groundwater scientist" is a scientist or an engineer who has received a baccalaureate or postgraduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields as may be demonstrated by state registration, professional certifications, or completion of accredited university programs that enable that individual to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action.

d) All solid wastes that are managed pursuant to pursuant to Section 811.325 or subsection (a)(3) of this Section must be managed by the owner or operator in a manner that fulfills the following requirements:

1) It adequately protects human health and the environment; and

2) It complies with applicable requirements of Part 811.

e) Remedies selected pursuant to Section 811.325 must be considered complete when the following requirements are fulfilled:

1) The owner or operator complies with the groundwater quality standards established pursuant to Section 811.320 at all points within the plume of

contamination that lie beyond the zone of attenuation established pursuant to Section 811.320;

2) Compliance with the maximum allowable predicted concentrations and the groundwater protection standards established pursuant to Section 811.320(a)(3)(C) has been achieved at wells located within the zone of attenuation. Compliance with this requirement shall include a demonstration that concentrations of the constituents monitored under the assessment monitoring program pursuant to Section 811.319(b) have not exceeded the greater of the maximum allowable predicted concentrations or the groundwater protection standards for a period of three consecutive years using the statistical procedures and performance standards in Section 811.320(e). The Agency may specify an alternative time period during which the owner or operator must demonstrate compliance with the groundwater quality standard(s). The Agency must specify such an alternative time period by considering the following factors:

A) The extent and concentration of the releases;

B) The behavior characteristics of the hazardous constituents in the groundwater;

C) The accuracy of monitoring or modeling techniques, including any seasonal, meteorological, or other environmental variabilities that may affect the accuracy; and

D) The characteristics of the groundwater; and

3) All actions required to complete the remedy have been satisfied.

f) Within 14 days after the completion of the remedy, the owner or operator must submit to the Agency an application for a significant modification of the permit including a certification that the remedy has been completed in compliance with the requirements of subsection (e) of this Section. The certification must be signed by the owner or operator and by a qualified groundwater scientist.

g) Upon Agency review and approval of the certification that the corrective action has been completed, in accordance with subsection (e) of this Section, the Agency must release the owner or operator from the financial assurance requirements for corrective action pursuant to Subpart G of this Part.

BOARD NOTE: Requirements of this Section are derived from 40 CFR 258.58 (2005).

(Source: Amended at 31 Ill. Reg. 1435, effective December 20, 2006