MINNESOTA POLLUTION
CONTROL AGENCY

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October 31, 2017

Mr. Larry Deeney
General Mills, Inc.
One General Mills Boulevard
Minneapolis, MN 55426-1347

RE: General Mills/Henkel Corp. Superfund Site, 2010 East Hennepin Avenue, Minneapolis
MPCA Project Number: SR3
MPCA Response to General Mills Inc. Letters Dated March 15, 2017 and August 25, 2017

Dear Mr. Deeney:

Minnesota Pollution Control Agency (MPCA) staff have reviewed the General Mills Inc. (GMI) response letter titled "*Former General Mills 2010 East Hennepin Site (the Site)*" dated March 15, 2017 (GMI Letter). MPCA staff's response to the assertions in the GMI Letter are included in Attachment A.

MPCA staff have also reviewed two supporting technical documents provided with the GMI Letter:

- *"Evaluation of Remedy Completeness at the General Mills/Henkel Corp. Superfund Site"* prepared by GSI Environmental Inc., dated March 14, 2017
- *"Supplemental Report on VOC sources and Remediation at the General Mills/Henkel Corp. Superfund Site"* prepared by Geosyntec Consultants, dated March 15, 2017.

MPCA staff's technical review comments regarding the two supporting technical documents are included in Attachment B.

At the request of MPCA, the United States Environmental Protection Agency (US EPA) also reviewed the "*Evaluation of Remedy Completeness at the General Mills/Henkel Corp. Superfund Site"* prepared by GSI Environmental Inc., dated March 14, 2017. A copy of US EPA's technical review is included as Attachment C.

MPCA staff also reviewed the GMI Letter "*Southeast Hennepin Groundwater and Vapor Intrusion Site*" dated August 25, 2017 including supplemental reports by Geosyntec Consultants and GSI Environmental Inc. The GMI Letter demanded that the MPCA do two things:

1. Demand that those parties responsible for the up gradient TCE sources, including Sears, Investigate and remediate those releases; and
2. Delist the General Mills/Henkel site from the Minnesota Permanent List of Priorities (PLP) and cooperate with the U.S. EPA to delist the General Mills/Henkel site from the National Priority List (NPL).

MPCA's responses to GMI's demands listed above are as follows:

1. MPCA is currently in the process of conducting site investigation activities to evaluate potential contamination sources within the Southeast Hennepin Area Groundwater and Vapor Site.
2. MPCA staff does not concur that removal of the General Mills/Henkel site from the Minnesota PLP is appropriate at this time. MPCA is in full cooperation with the US EPA in regards to the NPL listing status for this site.

Based on MPCA staff review of the above referenced documents, MPCA reiterates the directive to GMI from our November 28, 2016 letter to submit to MPCA a plan to cover the following elements:

1. An O&M plan for all mitigation systems installed for the Site as well as any future mitigation systems installed by GMI.
2. A schedule for reimbursing property owners for electrical costs associated with mitigation system operation.
3. Develop a plan for buildings in the study area that have had sub-slab VOC concentrations above 10X intrusion screening values (ISVs) and have not been mitigated. Installation of mitigation systems or additional ongoing vapor assessment is required for all of these buildings.
4. Continue ongoing sentinel monitoring for the soil-gas monitoring network and ongoing groundwater monitoring of the glacial drift aquifer monitoring network. If sentinel monitoring indicates that buildings outside of the mitigation area (Central area) are at risk due to an increasing concentration trend for soil-gas and/or groundwater, additional sub-slab testing may be required.

MPCA staff are available to meet with you to discuss the technical contents of this letter as well as the MPCA directives for ongoing site work. Please contact me at timothy.grape@state.mn.us or 651-757-2893 or Hans Neve at hans.neve@state.mn.us or 651-757-2608 with any questions and/or to schedule a meeting with MPCA staff.

Sincerely,

Timothy J. Grape

Timothy J. Grape, P.G.
Environmental Specialist 4
Site Remediation & Redevelopment Section
Remediation Division

TG:bhj

Attachment A – MPCA staff technical review of the General Mills Inc. (GMI) Letter Titled "*Former General Mills 2010 East Hennepin Site*", Dated March 15, 2017

Attachment B – MPCA staff technical review of the "*Evaluation of Remedy Completeness of the General Mills/Henkel Corp. Superfund Site*", Prepared by GSI Environmental Inc., Dated March 14, 2017 and MPCA staff technical review of the *"Supplemental Report on VOC Sources and*

*Remediation at the General Mills/Henkel Corp. Superfund Site"*, Prepared by Geosyntec Consultants, Dated March 15, 2017

Attachment C – US EPA review of "*Evaluation of Remedy Completeness at the General Mills/Henkel Corporation Superfund Site",* Prepared by GSI Environmental Inc., Dated March 14, 2017

cc: Ann E. Cohen, Assistant Attorney General (via email only, w/encl.)
Carmen Netten, Minnesota Pollution Control Agency (via email only, w/encl.)
Leah Evison, Environmental Protection Agency (via email only, w/encl.)
David Jones, Minnesota Department of Health (via email only, w/encl.)
Delmar Ehrich, The Law Firm of Faegre Baker Daniels (via email only, w/encl.)
Mary Sands, Barr Engineering Co. (via email only, w/encl.)
Thomas McHugh, GSI Environmental, Inc. (via email only, w/encl.)
Michael Kavanaugh, Geosyntec Consultants (via email only, w/encl.)
Tom Frame, City of Minneapolis (via email only, w/encl.)
John Evans, Hennepin County (via email only, w/encl.)

# Attachment A

## MPCA Staff Technical Review of the General Mills Inc. (GMI) Letter Titled "*Former General Mills 2010 East Hennepin Site*", Dated March 15, 2017

1. Page 1, 2nd paragraph states; "Also enclosed are the expert reports with full technical substantiation demonstrating that the Site has been fully remediated."
    a. **MPCA does not agree that the expert reports demonstrate the Site has been fully remediated. MPCA's detailed technical review comments for the GSI Environmental Inc. and Geosyntec Consultants Reports are provided in Attachment B.**

2. Page 2, Section II, 1st paragraph states; "From the 1940's to 1962, small amounts of solvent waste from research facility were disposed in the ground at the south end of the Site ("the disposal area.")"
    a. **MPCA does not agree that the amounts of solvent waste (including TCE) disposed in the ground at the south end of the Site were small. Part C. 2 ("Statement of Facts") of the Response Order by Consent (Consent Order) dated October 25, 1984, states "General Mills has estimated that as much as one thousand gallons of certain laboratory solvents per year were disposed of in the soil absorption pit." The release of one thousand gallons of solvents over a 15-year period is not a small amount. The "Site Characterization Study and Remedial Action Plan" (RAP), dated June 1983, stated that "(n)o records are available upon which to accurately determine the quantity of solvents that was disposed of in this manner." While the "new information" provided in the GMI Letter and associated technical documents attempts to clarify and minimize the amount and/or ratio of TCE released compared to the other solvent waste compounds, the information does not provide any basis for questioning the total volume estimate of solvent waste disposal at the Site.**

3. Page 3, paragraph 4, states; "These investigations led to the discovery of concentrations of TCE in groundwater up gradient of the Site that were an order of magnitude greater than those present down gradient of the Site."
    a. **MPCA acknowledges that, based on recent (since 2013) MPCA and General Mills investigations, the maximum TCE concentrations in groundwater up gradient of the Site (up to 4,270 µg/L in MW 301GD) are currently greater than the maximum TCE groundwater concentrations at the Site (172 µg/L in MW 311GD). However, it is important to recognize that the maximum historical TCE groundwater concentrations at the Site (7,200 µg/L in monitoring well 106) were higher than the maximum historical or current TCE concentrations up gradient of the Site. The GSI Evaluation proposes that the elevated groundwater concentrations observed in well 106 were associated with "carry down" of contaminated soils during drilling of the monitoring well. However, this phenomenon is most likely to occur in clay soils and the soil boring logs completed in the former disposal area do not indicate the presence of clay soils in the upper soil profile above the water table. If the high concentrations in the groundwater are attributable to soil contamination from above, this reinforces the concept that there were significant amounts of solvent wastes (including TCE) disposed of by GMI at this location in the unsaturated soils. This does not support GMI's proposed Site conceptual**

**model positing that most of the TCE contamination migrated to the Site via groundwater contamination from upgradient sources.**

4. Page 4, conclusion #1, states; "The only evidence that the disposal area was a significant source of TCE was the presence of the TCE plume in the Glacial Drift aquifer."
    a. **GMI's previous groundwater investigation activities included water quality and groundwater elevation monitoring in the bedrock aquifers at the Site. These investigations showed that the Carimona Member of the Platteville Formation (now assigned to the Decorah Shale Formation) was contaminated with TCE and other chlorinated VOCs including 1,1-DCA and 1,2-DCA that GMI claims were associated with the waste material disposed of at the Site. Historical TCE groundwater concentrations in Carimona monitoring well MW 108 (located near the disposal area) were as high as 1,500 µg/L. GMI's investigations showed that groundwater flow in the Carimona was towards the northwest instead of towards the southwest as observed in the Glacial Drift aquifer. In addition, Part C. 6 of the Consent Order states that "The results of sampling and analysis of ground water from monitoring wells in the drift aquifer, the Carimona Member of the Platteville Formation and the Magnolia Member of the Platteville Formation, show that ground water contains one or more of the solvents listed in Attachment C of Exhibit A to this Order." These facts provide additional evidence that the disposal area at the GMI Facility was a significant historical source of TCE to both the shallow Glacial Drift groundwater as well as deeper bedrock aquifers in the area.**

5. Page 4, conclusion #3, states; "Because the General Mills waste was comprised mostly of petroleum solvents with a smaller amount of chlorinated solvents (including minor amounts of TCE), the resulting mixture was less dense than water, a light non-aqueous phase liquid ("LNAPL"). We know this because the disposal area investigation results found the highest concentrations of solvents in soil samples collected from above or on the top of the Glacial Drift aquifer. These results demonstrate that the solvent wastes did not migrate downwards below the top of the Glacial Drift aquifer."
    a. **MPCA disagrees that the GMI waste was entirely comprised of LNAPL and that it did not migrate downwards below the top of the Glacial Drift aquifer. GMI's investigations in the disposal area suggest that the solvent wastes did indeed migrate downwards below the top of the Glacial Drift aquifer (also see comment #4 above).**

6. Page 5, conclusion #5, states, "The site is fully remediated. The "pump and treat" remediation system that General Mills operated from 1985 to 2010 successfully remediated the chlorinated solvent soil and groundwater impacts from the site by 1991. These chlorinated solvents were "non-detect" by 1996".
    a. **MPCA disagrees that the site is fully remediated and that the remediation system successfully remediated chlorinated solvent soil and groundwater impacts from the site by 1991. Barr Engineering's report titled "Shallow Soil Investigation Around the Former Disposal Site" dated August 30, 2001, indicates that chlorinated solvents, including TCE and several other chlorinated compounds listed as part of the "unique fingerprint" of GMI's waste material, were detected in shallow soil samples collected above the groundwater table from multiple soil borings within the vicinity of the former disposal area in 2001. TCE soil concentrations as high as 25,000 µg/kg were detected in soil boring GP-3 from a depth of 7-8 feet below ground surface (bgs) in 2001, ten years after GMI claims the chlorinated solvent impacts were successfully remediated from the Site.**

**Other chlorinated solvents listed as part of GMI's "unique fingerprint" including 1,1 dichloroethane (DCA), 1,2 DCA, 1,1,2,2-tetrachloroethane (TCA), and tetrachloroethylene (PCE), were also detected in soil samples collected from above the groundwater table in multiple soil borings conducted in the vicinity of the former disposal area. The presence of these chlorinated solvents in soil above the groundwater table indicates that the site soils were not "fully remediated" by 1991 or even by 1996. The presence of chlorinated solvents in the soil above soil leaching values (SLVs) in the unsaturated zone also indicates a likely ongoing source of chlorinated solvents to local groundwater contamination.**

**The analytical soil and groundwater data provided is not sufficient to support the conclusion that there is a "unique fingerprint" of GMI waste material in the groundwater characterized by minor amounts of TCE along with other CVOCs in greater amounts, and that any TCE formerly attributable to the Site has been remediated by the pump and treat system. Additional technical discussion around the "unique fingerprint" of GMI waste material is provided in the GSI Report technical review provided in Attachment B.**

7. Page 5, Conclusion #6 states; "The Site is not a source of TCE to groundwater or soil vapor." And "There is no evidence that the Site contributes to the groundwater or the vapor intrusion pathway in the area."
    a. **MPCA does not agree that the Site is not a source of TCE to groundwater or soil vapor, or that there is no evidence that the Site contributes to the groundwater or the vapor intrusion pathway in the area. For the Site property alone, there are four buildings (buildings 10, 11, 12 and 14), that have sub-slab TCE vapor concentrations above MPCA vapor action levels. The source of the elevated TCE soil-gas beneath these buildings is likely associated with an onsite release at or near the buildings. Multiple soil gas samples from sentinel vapor points (SVP-29 and SVP-30) located directly up-gradient (northeast) of these buildings, were orders of magnitude lower than sub-slab concentrations beneath the buildings. The majority of the residential homes located directly upgradient (northeast) of these Site buildings did not require mitigation due to a lack of elevated TCE concentrations in sub-slab samples.**

    b. **TCE groundwater concentrations in the shallow Glacial Drift aquifer increase down gradient (south-southwest) of the GMI Site Glacial Drift pumping well 109. The majority of the vapor mitigation area is also located down gradient of the GMI Site pumping wells, and the likely source of the vapor impacts in this area is the shallow TCE groundwater contamination. Since the GMI Site contributed to the shallow TCE groundwater contamination, the remaining GMI contamination contributes to the vapor intrusion pathway risk to homes and buildings in the area.**

8. Pages 6-7, Conclusion #8 states; "No additional remedial actions are necessary to address impacts from the East Hennepin Site." And "the East Hennepin Site is completely cleaned up, does not pose a threat to human health or the environment, and meets all requirements for de-listing."
    a. **MPCA is currently deferring decisions regarding remedial actions to address remaining groundwater and soil-gas impacts in the area until additional investigation work is completed associated with the adjacent Southeast Hennepin Superfund Site (SR 1401).**

**However, MPCA does not agree that the East Hennepin Site (General Mills/Henkel Corp. Site) is:**

   i. **completely cleaned up**
   ii. **does not pose a threat to human health or the environment**
   iii. **meets all requirements for delisting**

9. Page 10, last paragraph states; "General Mills is prepared to meet with MPCA promptly to terminate the Consent Order and RAP Modification, delist the Site and effect an orderly transition, bringing General Mills' involvement to an end.
   a. **MPCA does not agree that termination of the Consent Order and RAP Modification and delisting of the Site from the State of Minnesota Permanent List of Priorities (PLP) are appropriate at this time.**

# Attachment B

## MPCA Staff Technical Review of "*Evaluation of Remedy Completeness of the General Mills/Henkel Corp. Superfund Site*", Prepared by GSI Environmental Inc., Dated March 14, 2017

1. Page 3, Section 1.3, Item 3) states; "The solvent waste disposed at the Facility from the 1940's to 1962 was a complex mixture dominated by petroleum solvents that also included a number of different chlorinated solvents. TCE was a minor component of the General Mills waste; other chlorinated solvents were present in higher amounts. The General Mills waste material had a unique fingerprint that was distinct from the upgradient source of TCE. We have used this unique fingerprint to evaluate the effectiveness of the General Mills remedy. Specifically, the removal of other chlorinated solvents such as 1,1,1-trichloroethane (1,1,1-TCA) and chloroform down to non-detectable concentrations in groundwater at the Facility demonstrates that all TCE associated with the Facility has also been removed from groundwater."
    a. **MPCA disagrees with the conclusion that use of the unique fingerprint of the GMI waste to evaluate the effectiveness of the GMI remedy demonstrates that all TCE associated with the Facility has been removed from groundwater. Technical discussion regarding MPCA's position is provided below and throughout remaining sections of this response.**
        i. **The GSI Evaluation concludes that TCE was a minor component of the GMI waste. MPCA does not agree that TCE was a minor component of the GMI waste. The soil, groundwater and soil-gas analytical data suggest that TCE was a significant component of the GMI waste. According to the GSI Evaluation, "the mixture of chemicals disposed of at the Facility can be characterized by the results of chemical analysis of soil samples collected above the groundwater." To characterize the unique fingerprint of the GMI waste material, the GSI Evaluation utilizes analytical results from three soil borings that were conducted in the vicinity of the soil absorption pit by Soil Exploration Company in 1981. The results of the soil samples collected from soil borings #2, #3 and #4 at depths beneath the base of the soil absorption pit (14.5-16 ft. bgs) indicate the presence of TCE in addition to other chlorinated VOCs (CVOCs). The following CVOCs are listed as program parameters in Attachment C of the October 25, 1984 Response Order by Consent;**
            - **1,1 Dichloroethane (DCA)**
            - **1,2 DCA**
            - **1,1,1 TCA**
            - **1,1,2,2 Tetrachloroethane**

            **Of the above listed CVOCs, 1,2-DCA was the only compound with concentrations exceeding TCE in the soil samples collected from borings #2 and #4. 1,1,1, TCA was the only CVOC of those listed above with a concentration exceeding TCE in boring #3. TCE was the second highest program parameter CVOC detected in all three of the soil samples collected from below the absorption pit and above the water table interface,**

indicating that TCE was a significant component of the CVOC waste material released from the GMI Facility.

The only groundwater samples presented in Table 4 (Section 3.4, page 19) as representative of groundwater conditions within the former soil absorption pit and indicative of the unique fingerprint of the GMI waste material, are two groundwater samples collected in April of 1983 from monitoring well 106. The TCE concentrations in monitoring well 106 were higher than the other program parameter CVOCs listed in the Consent Order for both sampling events and higher than any other groundwater samples collected at the Site indicating TCE was a primary component of the GMI waste material. However, in Section 3.5, the GSI Evaluation states "the high concentrations of benzene, TCE, and other VOCs in the water samples collected from Well 106 were an artifact of drilling through contaminated soil and were not representative of actual aquifer contamination." If this phenomenon caused TCE concentrations to be detected at higher concentrations in the groundwater samples, it would also likely result in higher concentrations of other CVOCs detected. If the groundwater sample results from Well 106 are not representative of actual aquifer contamination, then they should not be used as evidence for the unique signature of groundwater contamination for the GMI disposal area. If the conclusion that high VOCs present in the groundwater at Well 106 are an artifact of drilling through soil contamination is valid, this would further support that TCE is a significant component of the GMI waste materials. This is based on the TCE groundwater concentrations at Well 106 being higher than any of the other program parameter CVOCs detected at this location, and significantly higher than the upgradient off-site TCE groundwater concentrations.

The use of average soil concentrations to characterize historic releases and evaluate associated groundwater impacts for chlorinated solvents is complicated by the fact that low polarity chlorinated solvents, like TCE, do not readily adsorb to soil particles. Using average soil concentrations from soil samples collected above the water table several decades after the release occurred likely under represents the actual contaminant types and concentrations originally released. The fact that these contaminants were still present and detectable in the vadose zone soils several decades after the release indicates a significant release occurred at the Site.

ii. A piezometer (Piezometer A) was installed in Boring 12 located in the vicinity of the former soil absorption pit on June 19, 1981. A groundwater sample collected from piezometer A identified TCE at a concentration of 2,400 µg/l. Several other CVOCs (1,1-DCA, 1,1,1 TCA and 1,1,2,2-Tetrachloroethane) included on the program parameter list and included in GMI's list of "unique fingerprint" CVOCs for the GMI waste materials, were also identified in the groundwater collected from this location. However, the concentrations of the other CVOCs were all one to two orders of magnitude less than TCE.

        iii. **In addition to 1,1,1-TCA and chloroform, Section 3.4, page 17, states "Chlorinated solvents in the waste material included, at a minimum, 1,1-dichloroethane, chloroform, 1,2-dichloroethane, 1,1-dichloroethene, trans-1,2-dichlorethene, 1,1,1-TCA, 1,1,2,2,-tetrachloroethane, TCE, and PCE." Several of the above CVOCs that GMI identifies as part of their specific waste solvent material disposed at the soil absorption pit (including 1,1,1-TCA, 1,2 DCA, 1,1-DCA and PCE) were identified in groundwater samples from multiple temporary and permanent monitoring wells at the Site and down gradient of the Site after 1996.**

2. Page 3, Section 1.3, Item 4) states; "The soil and groundwater impacts associated with the historical disposal of waste at the soil absorption pit were limited to the immediate vicinity of this disposal location."
    a. **MPCA disagrees that impacts associated with the historical disposal of waste at the soil absorption pit were limited to the immediate vicinity of the disposal location. As stated above, the investigation and remedial action work did not start until approximately 34 years after the waste disposal activities began. The quantity (estimated at 1,000 gallons per year) and nature (petroleum compounds and chlorinated solvents) of wastes released over this time period would have resulted in impacts well beyond the disposal location even before investigation and clean-up activities were initiated by GMI in the early 1980s. The petroleum contaminants released as part of the GMI wastes would likely have a smaller footprint beyond the disposal location as they are more readily broken down in the aerobic conditions present in the shallow glacial drift aquifer. However, the chlorinated solvents that GMI claims are part of their unique fingerprint of waste materials (including TCE) were and are present in the Glacial Drift aquifer down gradient of the Site as well as in multiple deeper bedrock aquifers beneath the Site.**

3. Page 3, Section 1.3, Item 5) states; "The high concentrations of petroleum and chlorinated solvents detected in Monitoring Well 106 were an artifact of drilling and not indicative of aquifer contamination."
    a. **If the groundwater concentrations in monitoring well 106 are "not indicative of aquifer contamination" as stated, then they should not be used to characterize the unique fingerprint of GMI waste material in groundwater within the disposal area as represented in Table 4 on page 19.**

    b. **Section 3.5 provides a discussion of the groundwater results from Well 106 and the dangers of drilling through shallow soil contamination when installing a monitoring well. The reference on page 24 states "the potential for this to occur is greatest in cohesive clayey deposits." The well and boring record for monitoring well 106 indicates that soil samples were not collected in the upper 20 feet of the boring. The soil sample collected from well 106 at 20-22 feet consisted of fine grained sand. Replacement well 311GS installed in the approximate location of well 106 did not indicate the presence of clay soils in the upper 20 feet of shallow unsaturated soils. The soils observed in well 311GS at the base of the absorption pit, where the highest unsaturated soil concentrations were observed, also consisted of poorly graded, fine grained sand. It is less likely for sandy soils to be carried down and "smeared" along the side of a borehole in the same fashion as clay soils.**

   c. **If the elevated groundwater impacts were an artifact of drilling activities, TCE was the second highest chlorinated compound observed in the groundwater samples collected at monitoring well 106 in 1983. This would indicate a significant contribution of TCE from the impacted soils associated with the waste material from the soil absorption pit, which is inconsistent with the theory that TCE was a minor component of the GMI waste materials identified in soil samples collected from the soil absorption pit.**

   d. **Monitoring well 107 was also drilled in the immediate vicinity (within 20 ft) of the former absorption pit adjacent to monitoring well 106. Monitoring well 107 was drilled to a depth of approximately 39 feet bgs on April 11, 1983. The well record for monitoring well 107 indicates the stratigraphy in the unsaturated zone consisted of sand and peat. Monitoring well 107 was sampled on April 28, 1983 and the TCE concentration was 1,300 µg/l. Other program parameter CVOCs including 1,1 DCA, 1,2 DCA and 1,1,1 TCA were also detected in monitoring well 107. However, GMI claims in Table 4 that even though well 107 is located within 20 ft of the soil absorption pit, it is screened below the zone of affected soil at a depth of 34 to 39 ft bgs. Therefore, GMI claims that the groundwater data from monitoring well 107 is not representative of GMI waste material from within 20 ft of the former soil absorption pit. If the point is to characterize TCE percentage in the Glacial Drift groundwater within 20 ft of the former soil absorption pit, then the groundwater data from well 107 should be characterized as within 20 ft of the former soil absorption pit. Additional discussion regarding characterization of impacts within the former soil absorption pit is provided in item 9 below.**

4. Page 3, Section 1.3, Item 7) states; “The pump and treat remediation system operated by General Mills from 1985 to 2010 successfully remediated the chlorinated solvent groundwater impacts associated with the Facility by 1991. The chlorinated solvents associated with the General Mills waste, including any TCE disposed at the Facility, are no longer detectable. No additional remediation is required to address impacts associated with the Facility. All detectable TCE in groundwater is associated with other sources.”
   a. **MPCA does not agree that the pump and treat remediation system successfully remediated the chlorinated solvent groundwater impacts associated with the Facility by 1991. MPCA does not agree that the chlorinated solvents associated with the General Mills waste, including any TCE disposed at the Facility, are no longer detectable. MPCA does not agree that all detectable TCE in groundwater is associated with other sources.**
      i. **As referenced in items 1 and 3 above, there is evidence that GMI released a significant amount of TCE in addition to other CVOCs and petroleum VOCs at the Site over an approximately 15 year period. Remedial action to clean-up the groundwater impacts did not begin until approximately 34 years after the initial disposal activities began, allowing for significant vertical and horizontal migration of contamination. Even with evidence of TCE migration from upgradient sources into the area of the GMI release, there is not sufficient evidence that GMI has captured and removed all chlorinated solvents associated with the GMI waste materials, including TCE. TCE, along with several other CVOCs (1,1 DCA, 1,2 DCA, 1,1,2,2 tetrachloroethene and PCE) listed in the Site program parameters, were still present in soil samples collected from within 25 feet of the former absorption pit at the Site in 2001.**

**TCE contamination in the upper portion of the glacial drift aquifer is an important part of the site conceptual model as it is likely the primary source of elevated TCE in soil-gas present beneath homes and buildings in the area. Area-wide groundwater sampling of permanent monitoring wells conducted by GMI in 2014-2016 indicates that TCE concentrations in the upper portion of the glacial drift aquifer, directly upgradient of the Site, are generally lower than concentrations in the shallow glacial drift aquifer at the Site and downgradient of the Site. Specifically, TCE concentrations in offsite monitoring well 307GS were <0.40 µg/l and 0.98 µg/l for the December 2014 and March 2015 sampling events respectively. Shallow Site monitoring wells 308GS and B are located directly downgradient (southwest) of monitoring well 307GS. TCE groundwater concentrations in Site monitoring well 308GS were 37.9 µg/l and 35.8 µg/l for the December 2014 and March 2015 sampling events respectively. TCE groundwater concentrations in Site monitoring well B were 82 µg/l and 55.5 µg/l for the December 2014 and March 2015 sampling events respectively. The increase in TCE concentrations in the shallow glacial drift aquifer at the Site and down gradient of the Site indicate that the GMI release remains a source of TCE groundwater and soil-gas contamination in the area.**

**High concentrations of TCE (3,320 µg/m$^3$ and 2,210 µg/m$^3$) were detected in sub-slab samples (3954I and 3954J respectively) collected from beneath Site building #12. Soil-gas samples collected from Site soil-gas monitoring point (SVP-30) located directly upgradient of Site building #12 did not detect TCE above 11.0 µg/m$^3$. The highest TCE concentration in soil-gas samples collected from sentinel monitoring point SVP-29 located offsite and due east of Site building #12, was 289 µg/m$^3$, which is still an order of magnitude less than the sub-slab concentrations beneath building #12.**

**The presence of elevated TCE concentrations in shallow onsite groundwater and sub-slab samples compared to the lower upgradient concentrations in this area indicates the likely presence of a TCE release source beneath, or in the immediate vicinity of, Site building #12.**

5. Page 8, Section 3.2, the title of this section states “There are multiple sources of TCE and other chlorinated solvents not associated with the Facility”
    a. **The report does not identify which “other chlorinated solvents not associated with the Facility” are present. This information is pertinent to the argument that the GMI waste material had a unique signature of other chlorinated solvents besides TCE.**

6. Page 16, Figure 5: VOC Contamination in Soil in the Vicinity of the Former Soil Absorption Pit: 1980’s Investigation Results
    a. **Figure 5 illustrates soil contamination from the 1980s only. It does not include the soil data from the 2001 shallow soil investigation data, which indicates additional soil contamination in the vadose zone within 25 ft of the former soil absorption pit with TCE as a primary component of the CVOCs detected. The Key Point listed below Figure 5 states “impacts associated with the historical disposal of GMI solvent waste were limited to within 20 ft of the former soil absorption pit.” “TCE was only a small**

**component of this mixture." Directly disposing of solvent waste via an injection type well at a depth of 10-12 ft below the surface in sandy soils would not typically result in a wide horizontal plume of soil contamination within the vadose zone as the contaminants would readily migrate vertically until reaching the groundwater table or a confining layer of limited permeability. This same limited horizontal extent of contamination would not be expected once the contaminants reach the groundwater table where they would migrate readily both vertically and horizontally with and/or through the groundwater. Lack of soil contamination in the vadose zone beyond 20-25 ft of the former soil absorption pit, several decades after the release began, does not indicate that the groundwater impacts associated with the release are also limited to the same 20-25 foot area.**

7. Page 17-18, Section 3.4, states; "The soil and groundwater impacts associated with the historical disposal of waste at the soil absorption pit were limited to the immediate vicinity of the pit."
    a. **MPCA does not agree that the GMI waste material impacts in soil and groundwater were limited to the immediate vicinity of the pit. The release of thousands of gallons of chlorinated solvent and petroleum wastes, directly into the ground over 15 years, with an additional 20 years of time passing for the contamination to migrate within the subsurface prior to remedial actions, would result in an extensive area of contamination far beyond the immediate vicinity of the pit and beyond the Site property boundaries. The Site and surrounding shallow subsurface soils consist primarily of fine sand and the shallow groundwater table is encountered at approximately 20 feet bgs in the area. The shallow site stratigraphy and hydrogeologic conditions would allow contaminants to readily migrate beyond the immediate release area. CVOCs that GMI readily admits were released at its facility over a 15-year period have been detected in a groundwater plume that extends over 2,000 ft downgradient of the Site and within multiple aquifers beneath the Site.**

8. Page 18, Table 3: Average Concentration of Chlorinated Solvents in GMI Source Soil Samples
    a. **Table 3 indicates the data used for the table include; "Source soil samples defined as source area soil samples containing greater than 1 mg/kg total chlorinated VOCs." It is not clear if the calculation includes soil samples collected from both above and below the water table and exactly which soil samples were used for this calculation. Are these the same soil samples as those used in Table 4 for samples located within 20 ft of the soil absorption pit (borings #2, #3 and #4)?**

9. Page 19, Section 3.4; Table 4 summarizes the "Percentage of TCE in Soil and Water Samples Collected within 20 ft. of the Former Soil Absorption Pit Compared to Samples Collected Greater than 20 ft. from the Former Soil Absorption Pit"
    a. **Table 4 of the GSI Evaluation includes soil analytical results from three soil borings (B-2, B-3 and B-4) advanced in 1981 within 20 feet of the former absorption pit. Additional soil analytical data was collected from nine push probe borings (GP-1 thru GP-9) advanced in May of 2001 within 25 feet of the former soil absorption pit. The soil analytical results from the 2001 push probe borings indicate that the percentage of TCE in soil above the water table was significantly higher in this area (see Table 1 below) than what was identified in the three borings conducted in 1981. The 2001 soil data contradicts the conclusion provided, that the GMI waste material had a "unique fingerprint" where TCE was a minor component of the chlorinated solvents. The**

**presence of TCE in soils above the water table as far away as 25 feet from the former soil absorption pit, also indicates that chlorinated solvents, including TCE, were released on Site throughout the area and not just directly into the former soil absorption pit.**

**Table 1:**
**Percentage of TCE in soil samples collected within 25 feet of the former soil absorption pit in 2001**

| **Soil Boring ID** | **Sample Type** | **Sample Depth (bgs)** | **Distance from Absorption Pit (Direction)** | **Sample Date** | **Number of Chlorinated Solvents Analyzed** | **Percent TCE*** |
|---|---|---|---|---|---|---|
| *Soil samples located within 25 feet of the former soil absorption pit* | | | | | | |
| GP-2 | Soil | 3 – 4 ft | 15 ft (NW) | 5/21/01 | 8 | 76% |
| GP-3 | Soil | 3 – 4 ft | 25 ft (NW) | 5/21/01 | 8 | 79% |
| GP-3 | Soil | 7 – 8 ft | 25 ft (NW) | 5/21/01 | 8 | 15% |
| GP-3 | Soil | 11 – 12 ft | 25 ft (NW) | 5/21/01 | 8 | 7% |
| GP-6 | Soil | 11 – 12 ft | 15 ft (E) | 5/21/01 | 8 | 57% |
| GP-7 | Soil | 7 – 8 ft | 25 ft (NW) | 5/21/01 | 8 | 84% |
| GP-7 | Soil | 11 – 12 ft | 25 ft (NW) | 5/21/01 | 8 | 38% |
| GP-8 | Soil | 7 – 8 ft | 15 ft (N-NE) | 5/21/01 | 8 | 42% |
| GP-9 | Soil | 7 – 8 ft | 25 ft (N-NE) | 5/21/01 | 8 | 59% |

*Percent TCE is TCE as a percentage of the total concentration of chlorinated solvents in the sample

10. Pages 27-28, Section 3.7 states; "The pump and treat remediation system successfully remediated groundwater impacts associated with the Facility by 1991."
    a. **The analytical data provided does not support the conclusion that the pump and treat system successfully remediated groundwater impacts specifically associated with the Site by 1991. No viable groundwater analytical data from the former absorption pit area was provided that supports the conclusion of a unique fingerprint of GMI waste material where TCE was a minor component of the overall CVOCs.**

       **The groundwater data evaluated to conclude that the chlorinated solvents associated with the GMI facility were successfully remediated by 1991, and non-detect by 1996, was pump and treat system influent data consisting of a mix of groundwater from three separate pumping wells (wells 108, 109 and 110.) Pumping well 108 was screened in the Carimona bedrock aquifer, not the glacial drift aquifer. Contaminant concentrations from well 108 are not representative of the glacial drift aquifer conditions. Pumping well 110 was located offsite, approximately 500 feet southwest of the former absorption pit area. Contaminant contributions from well 110 should not be used to evaluate groundwater conditions in the glacial drift aquifer within 20 feet of the former absorption pit. Pumping well 109 was the only monitoring well that was actually located in the vicinity of the former absorption pit and no individual groundwater sample results from pumping well 109 were identified until 1998, two years after GMI claims the Site was successfully remediated. Therefore, the mixed water samples collected from the pump and treat system influent are not representative of groundwater collected from a specific aquifer or location (i.e. representative of the former soil**

**absorption pit area) and cannot be used to claim that a specific waste mixture has been successfully remediated from any one location.**

11. Page 29, Figure 10: Chlorinated Solvent Concentrations in Recovered Groundwater Sent to the On-site Treatment System: 1985 to 1996
    a. **As stated above, the groundwater data used for this figure is a mix of groundwater from three separate pumping wells including one well screened in the bedrock unit beneath the glacial drift aquifer. The pump and treat system influent groundwater analytical results are not indicative of groundwater conditions within the glacial drift aquifer at the former soil absorption pit. The initial TCE concentrations are two orders of magnitude higher than the other CVOCs. Comparing the percent of concentration decrease between TCE and the other three COVCs is not a valid direct comparison as the other CVOCs began with significantly lower concentrations. No viable data has been provided that distinguishes the amount of TCE directly attributable to the GMI release that was cleaned up or the amount of GMI TCE that remains.**
    b. **The "Key Point" listed beneath Figure 10 states "1,1,1-TCA was present in the General Mills waste in concentrations approximately 8 times higher than TCE." This information is based on limited soil analytical data from three soil borings conducted in 1981, not groundwater. The same correlation between 1,1,1-TCA and TCE was not observed in the groundwater from the former soil absorption pit area or in the other soil samples collected from the vicinity of the former soil absorption pit in 2001. The "Key Point" also states "1,1,-dichloroethane and 1,2-dichloroethane were also significant components of the General Mills waste." However, average concentrations of TCE in GMI source soil were nearly three times higher than 1,2-DCA according to Table 3 of the GSI Evaluation. Average TCE concentrations in soil for the same samples collected in 1981 were more than 400 times higher than 1,1-DCA. The soil analytical data and parameters used to identify the unique fingerprint of the GMI waste material is selective and does not translate to what is observed in other vadose zone soil samples or groundwater samples collected at the site. The Site soil, soil-gas and groundwater data does indicate that the GMI release consisted of chlorinated solvent compounds including significant amounts of TCE. The data provided does not effectively illustrate the amount of TCE, past or present, attributable to the GMI release compared to offsite and upgradient release sources.**

## Attachment B (continued)

## MPCA Staff Technical Review of "*Supplemental Report on VOC Sources and Remediation at the General Mills/Henkel Corp. Superfund Site*", Prepared by Geosyntec Consultants, Dated March 15, 2017

1. Page 1, Section 1.0, Introduction; **The report does not mention that the Site is also listed on the US EPA's National Priorities List (NPL).**

2. Page 2, Section 2.2, paragraph 2 states; "In deposition testimony collected in the 1990's as part of an insurance matter, researchers who had formerly worked at the facility reported primarily using petroleum-based solvents in their work…In contrast, they had little or no recollection of TCE use based on review of deposition transcripts."
    a. **This method of documenting solvent use at the facility (depositions taken in 1998-1999) is somewhat analogous to using limited soil and groundwater investigation data from approximately 30 years after disposal allegedly ended (i.e., 1962). It is pertinent to note that labels for commercial solvent products often show that these products are usually mixtures of several different solvents. It is possible that researchers may not have recognized (or remembered), that TCE could have been a component of these products.**

3. Page 2, Section 2.2, paragraph 2 also states; "These former facility researchers reported that "slop" solvents (lab solvent waste) were collected and stored in the lab in red, 5-gallon safety cans with lids (Hujanen, 2000). The safety cans were transported to a disposal area on the facility and discharged to a "soil absorption pit" (former disposal location)….."
    **a. This information documents that solvents were used at the Site in locations other than the former disposal area and that the solvent wastes were hand carried to the disposal area in 5-gallon cans. The use and storage of solvents within research laboratory buildings and the method of transport and disposal of the spent solvents indicates there are likely multiple solvent release locations at the Site other than directly within the soil absorption pit. Site analytical data provides evidence that solvents were released at other areas of the Site in addition to direct disposal into the soil absorption pit. Elevated sub-slab concentrations were detected directly beneath Site buildings 10, 11, 12 and 14 indicating a potential release associated with historic solvent use in or near these buildings. Soil contamination (including TCE) was detected in shallow (7-8 feet bgs) vadose zone soil samples collected approximately 25 feet upgradient (GP-9, 2001) and cross-gradient (GP-3, 2001) from the soil absorption pit. The presence of vadose zone soil contamination 25 feet away from the soil absorption pit at depths (3-8 feet bgs) above the bottom of the soil absorption pit (12 feet bgs) indicates that solvents were also likely released at the surface in the area around the former soil absorption pit. The locations and depths of the vadose zone soil contamination are consistent with spillage of the 5-gallon cans as employees walked from the laboratory buildings to the soil absorption pit to dispose of the solvent wastes.**

4. Page 3, Section 2.2, last sentence states; "Barr reports that while TCE was detected in sub-slab soil vapor samples from the Site buildings, no chlorinated solvents were detected in vadose zone soil samples (Barr, 2015)."
    a. **It is important to note that none of the vadose zone soil samples were collected in the areas where TCE was detected in sub-slab soil vapor samples.**

5. Page 10, Section 3.2.2, 1st paragraph, states; "The apparent separation between the so-called up-gradient and down-gradient TCE plumes in this MPCA depiction is likely due to over-interpolation and spatial variability in the Glacial Drift aquifer. In fact, there is no basis for stating that this represents two separate plumes with different sources. A careful review of the data over the entire spatial extent of the plume, including consideration of the soil gas sampling results, clearly supports a continuous plume, with multiple up-gradient sources, none of which have been carefully investigated."
    a. **This interpretation does not include a consideration of the temporal elements to the groundwater and soil gas data. If the data are evaluated in their proper spatial and temporal context, the separation between the so-called up-gradient and down-gradient TCE plumes appears to be a valid interpretation.**

6. Page 11, Section 3.3, The text includes the following sentence: "However, a more comprehensive evaluation of both past and recent investigations provides multiple lines of evidence to support our conclusion that the current revised CSM should be further modified to eliminate the former General Mills Site as a continuing source of TCE to the TCE plume and that the only scientifically defensible position is that the all of the measurable TCE impacts today are due to up-gradient sources."
    a. **MPCA agrees that a comprehensive evaluation of both past and recent investigations provides multiple lines of evidence to assess the TCE plume in the areas up gradient and down gradient of the General Mills Site. Currently, investigation data for the area up gradient (i.e., northeast) of the General Mills Site are limited. More investigation work is needed to adequately characterize the TCE plume in the area up gradient of the General Mills Site. In contrast, investigation data for the area down gradient (i.e., southwest) of the General Mills Site are more complete than those data for the up-gradient area. GMI conducted past and recent investigations in the down-gradient area to evaluate the approximate extent and magnitude of the TCE plume in the upper and lower portions of the Glacial Drift aquifer. The groundwater data from these investigations show the consistency of the historical and current extent of the TCE plume. Although these investigations do not rule out the possibility of up-gradient sources of TCE, taken together, they strongly suggest that residual contamination from the General Mills Site is part of the current down-gradient TCE plume. Therefore, the MPCA does not agree that "all of the measurable TCE impacts today are due to up-gradient sources."**

7. Page 12, Section 4.1, 3rd paragraph sates; "The results of this soil investigation demonstrate that the former disposal area is the only source of VOCs at the Site."
    a. **MPCA disagrees with this conclusion. A significant limitation to this soil investigation is shown by the extremely limited sampling in the areas where elevated TCE concentrations (>1,000 µg/m$^3$) were detected in sub-slab samples (beneath or near on-site buildings 11, 12, and 14). Additional investigations in these areas are required to**

**evaluate potential vapor intrusion risks and evaluate potential sources of TCE in the vadose zone.**

8. Page 13, Section 4.2, first paragraph states; “the unique chemical fingerprint of the mixture (is) represented by vadose zone soil samples collected near the former disposal area.”
    a. **The report concludes that these soil data support the former workers’ characterization of the complex mix of disposed lab solvents. This logic is rather tenuous, since it is combining two completely different (and likely flawed) sources of information. MPCA disagrees that the results of the 1981 and 1983 soil sampling can accurately represent the mixture of solvent wastes that were allegedly disposed in the soil adsorption pit between 1947 and 1962. The passage of nearly 20 years since disposal allegedly ended could allow significant physical and chemical changes to occur in the vicinity of the disposal area. After 20 or more years, solvent mixtures including TCE and other heavier-than-water chlorinated compounds may have already migrated vertically and horizontally away from the vadose zone and the disposal area. After 20 or more years, biodegradation may have already begun to break down some of the solvents in the mixture.**

9. Page 14, Section 4.2, second paragraph states; “the chemical signature of organic chemicals in the soil samples from the groundwater zone is distinctly richer in chlorinated solvents than samples collected from the vadose zone.”
    a. **MPCA disagrees with the report’s conclusion that “This change in chemical signature between the vadose zone and the ground water zone is likely due to transport of chlorinated solvents from up-gradient sources via groundwater flow.” As stated in comment #7 above, the passage of nearly 20 years since disposal allegedly ended could allow significant physical and chemical changes to occur in the vicinity of the disposal area (see examples above).**

10. Page 14, Section 4.2, third paragraph states; “These data show that after 11 years of groundwater extraction nearly complete removal of these VOCs was achieved and any contribution from the Site was essentially eliminated by 1996.”
    a. **As pointed out in the comments on the GSI Evaluation, Pumping well 108 was screened in the Carimona, not the glacial drift aquifer. Contaminant concentrations from well 108 are not representative of the glacial drift aquifer conditions. Pumping well 110 was located offsite, approximately 500 feet southwest of the former absorption pit area. Contaminant contributions from well 110 should not be used to evaluate groundwater conditions in the glacial drift aquifer within 20 feet of the former absorption pit. Pumping well 109 was the only monitoring well that was actually located in the vicinity of the former absorption pit and no individual groundwater sample results from pumping well 109 were identified until 1998, two years after GMI claims the Site was successfully remediated. Therefore, the mixed water samples collected from the pump and treat system influent are not representative of any specific water sample collected from a specific aquifer or location (i.e. representative of the former soil absorption pit area) and cannot be used to claim that a specific waste mixture has been successfully remediated from any one location.**

11. Page 14, Section 4.2, third paragraph states; "The continued detection of TCE in groundwater after 1996 in samples from Well 109, provides another line of evidence that the TCE in groundwater in this timeframe is not sourced from the Site as the chemical signature does not reflect the chemical composition of waste solvents at the release Site."
    a. **As mentioned in comments 7 and 8 above, the logic used to characterize the chemical signature of the disposed wastes is rather tenuous, and is based on limited information that is likely flawed. In addition, the persistence of some solvents (especially TCE) in groundwater may skew the chemical signature, and may make it more difficult to identify a specific up-gradient source. The report also states "Up-gradient sources must be a cause of the persistent TCE plume." Further investigations in the area up-gradient of the General Mills Site are necessary to verify this conclusion.**

12. Page 14, Section 4.3, Small Extent of VOC Impacts at the Disposal Site Indicates Modest Historical TCE Contribution from Site;
    a. **The text reiterates that "no records were kept regarding timing, frequency or duration of disposal of laboratory waste solvents." The report also states "The preliminary estimate by General Mills in 1981 was that approximately 1,000 gallons of solvents per year (or about 19 gallons per week) may have been disposed at the former soil absorption pit." The report uses several lines of reasoning to discount the 1981 estimate. The text states "Had the volume of liquid wastes been as high as estimated, soil sampling should have revealed levels of organic liquids in the percent range (i.e., greater than 10,000 ppm) with a large areal footprint." The report goes on to conclude "The small areal footprint in the groundwater zone soil is consistent with the hypothesis of a relatively modest amount of waste solvents disposed at the Site." Neither of these statements considers the amount of time that had passed between disposal and sampling events. As mentioned in comments 7 and 8 above, the passage of nearly 20 years since disposal allegedly ended could allow significant physical and chemical changes to occur in the vicinity of the disposal area. Data from soil sampling in 1981 and 1983 may not have been an accurate measure of the chemical signature of the disposed wastes. Furthermore, the depositions regarding waste disposal that were given in 1998-1999 may not necessarily be more accurate than General Mills' 1981 estimate.**

13. Page 16, Section 4.4, This section uses soil analytical data from the early 1980's to support the conclusions that the solvent wastes "would have consisted of a single liquid phase with a variety of chemical components, i.e., a mixed NAPL with varying chemical composition" and that "the mixed NAPL would have behaved like an LNAPL in the subsurface, remaining at the water table rather than sinking deep into the saturated zone."
    a. **There are several problems with this line of reasoning. Soil data from the early 1980s ("approximately 19 years after waste disposal ceased") shows that the soils were mostly sands and fine sands. Most solvents, including TCE, do not adhere well to those types of soils. Thus, the soil analytical data collected 19 years after disposal, and after the effects of time and biodegradation, cannot accurately represent the chemical composition of the solvent wastes. Table 4.4 shows the densities of various mixtures of TCE and benzene. This is certainly a simplification of the waste solvent mixture. The presence of elevated concentrations of TCE in groundwater samples from the Carimona, Magnolia, St. Peter and Prairie du Chien wells, at or near the Site, strongly suggests that TCE from the Site migrated deep into the saturated zone.**

14. Page 18, Section 4.6, first paragraph states; "The groundwater P & T system was designed to capture the plume, prevent continued migration and achieve the groundwater RAO specified by the MPCA and was operated for over 25 years (MPCA, 2014)."
    a. **It appears that neither of the two documents listed as "MPCA, 2014" in the list of References in Section 7.0 contains the language cited here. The Consent Order contains language regarding plume capture, but the cited MPCA references do not. This section also contains the sentence "In 2010, the MPCA concluded, based on groundwater monitoring data, that the remedial system had achieved the RAOs and was shut down (Barr, 2012a)." It is important to clarify that, in 2010, the MPCA approved the *temporary* shutdown of the groundwater pump and treat system. The text states "However, TCE levels in the Glacial Drift aquifer persisted at levels below the RAO target. This persistent TCE plume ultimately was found to be the source of the vapor intrusion threats above this plume." MPCA agrees with these two statements, and based on data from the shallow Glacial Drift aquifer, concludes that this persistent TCE plume is at least in part due to General Mills historical operations at the Site.**

15. Pages 20-22, Section 4.6.2, Residual TCE Mass Remaining After Site Remediation is Insignificant;

    **The report contains some questionable logic regarding the use of data from the pump-out wells. VOC data from combined (i.e., composite) groundwater samples from pump-out wells 108, 109, and 110 were used in Figure 4-6 to show concentration reductions of several VOCs. Wells 108 and 109 are on-site wells, and 110 is an off-site well. Well 108 extracted water from the Carimona Member of the Platteville (now Decorah), while 109 and 110 extracted water from the Glacial Drift aquifer. Well 108 was replaced by two Magnolia Member wells (MG-1 and MG-2) in 1992. The use of combined groundwater results from multiple wells screened in different aquifers is not representative of groundwater concentrations from any specific location or even a specific aquifer.**

    **In addition, the report emphasizes the greater percent reductions of the concentrations of 1,1,1-TCA, 1,2-DCA, and 1,1-DCA as compared with the percent reductions of the concentrations of TCE. It is important to note that the concentrations of TCE in these wells (regardless of the issues mentioned here) are significantly greater than the concentrations of the other three VOCs: approximately 100-1,200 μg/L versus approximately 1-30 μg/L. For a variety of reasons, these differences in absolute concentrations between TCE and the other VOCs make the percent reduction comparison much less valid as an indicator of an off-site source contribution.**

16. Page 25, Section 5.3, first paragraph states; "Investigations in 2014 as described in Section 4 did not locate any on-Site TCE sources at or near Well B (Barr, 2014a)."
    a. **This statement fails to acknowledge that the investigations in 2014 included the collection of sub-slab soil gas samples in on-Site buildings 10, 11, 12 and 14 that showed TCE sub-slab concentrations greater than 1,000 μg/m$^3$. The shallow groundwater samples collected in this area (i.e., near Well B) showed TCE concentrations from 9.6 to 149 μg/L. These soil gas and groundwater results from 2014 suggest that a source of TCE to the soil vapor pathway may indeed be present in the vadose zone beneath one or more of these buildings.**

17. Page 25, Section 5.3, second paragraph, Past Groundwater Results Confirm TCE Impacts from Up-Gradient Sources to TCE Plume Down-Gradient of Site Prior to 1980;

   a. **This paragraph infers that up-gradient sources are responsible for elevated TCE concentrations in groundwater samples from the Carimona. The report points to the high TCE concentrations at Well BB (2,200 µg/L on April 4, 1986) and Well WW (2,300 µg/L on October 22, 1985) as support for this interpretation. However, the cross-section (Figure 5) in the "Site Characterization Study and Remedial Action Plan", dated June 1983, shows the upper surface of clay till sloping northeastward from the disposal site toward Well BB. No clay till was encountered in Well BB. The June 1983 document also states that "there would be recharge from the glacial drift to the Carimona in areas where the clay till and Decorah are thin or missing." This document adds that "(g)roundwater movement in the Carimona appears to be especially complex." This submittal also states that "the directions of groundwater movement are not necessarily orthogonal to piezometric contours, the contours in Figure 8 indicate that the site overlies a trough in the Platteville piezometric surface." Based on the stratigraphy, the water level data and Barr's interpretations, it is possible that the elevated TCE concentrations in Well BB and Well WW are due to releases from the General Mills disposal site.**

18. Page 29, Section 6.1 states; "An extensive Facility-wide assessment of potential VOC sources confirmed that there are no current TCE sources on the Site."
    a. **See Comment #15 above.**

19. Page 30, Section 6.2 states; "Based on Site documents and sampling data, TCE is shown to have been a small component of the waste solvents, which were primarily petroleum-based."
    a. **As explained in Comments 2, 7, 8 and 12, the Site documents and sampling data used to make this conclusion are mainly based on old information or indirect information that was collected 20 or more years after the time when waste disposal occurred. That kind of information cannot lead to the definitive conclusion that is reached and stated in this section.**

20. Page 30, Section 6.3, There is no Evidence of TCE DNAPL Release from the Site;
    a. **MPCA concurs that TCE DNAPL has not been identified in the subsurface at the release Site. However, the lines of evidence provided in this report and section to refute this hypothesis are mainly based on soil and groundwater data collected 20 or more years after the time when waste disposal occurred. See also Comments 7 and 8 above.**

21. Page 31, Section 6.6, The Site Does Not Pose a Threat to Human Health and the Environment;
    a. **MPCA does not agree with this conclusion. As mentioned in Comments 6 and 14 above, sub-slab data from several buildings indicate elevated TCE concentrations in soil gas beneath these buildings. Additional investigations are necessary to determine if these elevated soil gas concentrations pose a threat to human health. Furthermore, the MPCA does not agree with conclusion iii, which states "the P&T system effectively removed all constituents from the groundwater that can be attributed to waste solvent releases." Evidence from many pump-and-treat systems at many sites, as provided in the cited reference, "Alternatives for Groundwater Cleanup" (NRC, 1994), shows that these systems are not able to remove all VOC constituents from groundwater contamination sites. All of the sites mentioned in this publication show residual groundwater contamination that was not effectively removed by the pump-and-treat systems at the sites.**

# Attachment C

## US EPA Review of "*Evaluation of Remedy Completeness at the General Mills/Henkel Corp. Superfund Site*", prepared by GSI Environmental, Inc., dated March 14, 2017

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
Region 5 Superfund Division
Chicago, Illinois

October 17, 2017

Mr. Timothy Grape
Project Leader
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55102

Dear Mr. Grape:

As requested by the Minnesota Pollution Control Agency (MPCA), the U.S. Environmental Protection Agency (EPA) has reviewed the report *Evaluation of Remedy Completeness at the General Mills/Henkel Corp. Superfund Site*, dated March 14, 2017, prepared by GSI Environmental, Inc. EPA has a number of concerns with the report, summarized in the attached document, prepared with guidance from internal EPA technical assistance.

If you have other questions, please feel free to contact me at evison.leah@epa.gov or (651) 757-2898.

Sincerely yours,

Leah Evison

Leah Evison
Remedial Project Manager
Superfund Division

Sincerely,

Leah Evison

## Review of *Evaluation of Remedy Completeness at the General Mills/Henkel Corp. Superfund Site,* dated March 14, 2017, prepared by GSI Environmental, Inc (Evaluation)

As presented in the Evaluation, the General Mill's facility disposed of solvent waste through a three-stacked perforated 55-gallon drums buried to about 12 ft below ground surface (acting as a sort of drywell), and employees disposed of an estimated 1,000 gallons of solvent per year. GSI obtained testimonies from former employees who reported that the predominate types of waste used and dumped were hydrocarbons and that they could not recall if TCE was ever used. Data analysis of the hydrocarbon/TCE fingerprint, GSI argues, is different from the TCE composition found upgradient and just east of the site. The Evaluation indicates that soil testing results from 1980 confirmed the testimonies where TCE was a minor component. The Evaluation disregards the findings of MW106, a well installed in the immediate vicinity of the soil absorption pit (stacked 55-gallon drums), where concentrations indicated a much higher percentage of TCE used, and similar to Benzene concentrations, and indicates that the MW106 data are anomalous and related to the well having been drilled through the contaminated material, carrying with it, the heavily contaminated soils from the pit and therefore biasing the groundwater results. The Evaluation also states and presents information about upgradient and side-gradient locations that may have contributed to the TCE plume and makes a case that the smaller General Mills/Henkel Site TCE plume is a fraction of a much larger, ongoing, and upgradient source that comingled years ago. EPA has a number of concerns with this Evaluation, summarized below:

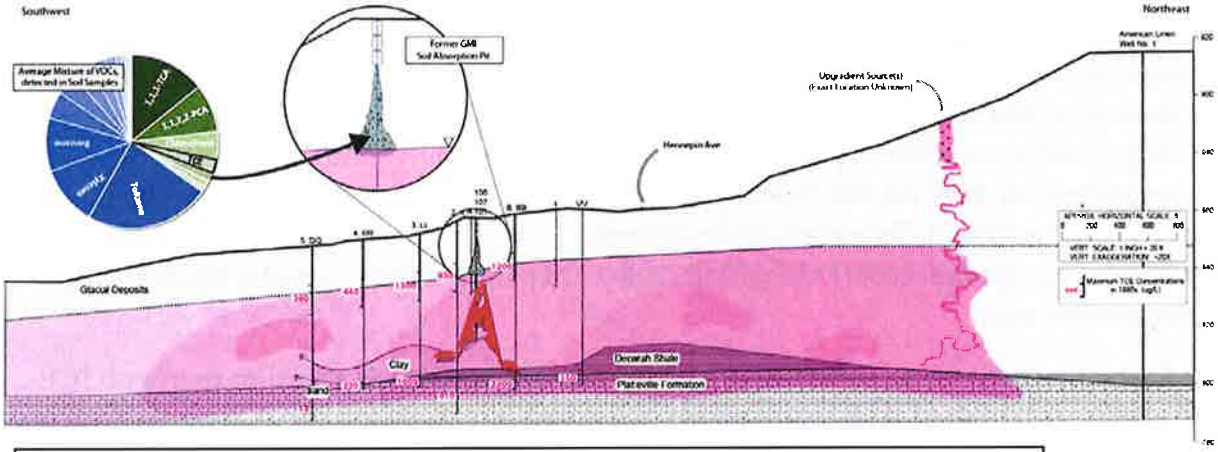
The timing of co-mingling of groundwater plumes from the General Mills/Henkel Site and up-gradient sources is questionable. The limited data discussed in the Evaluation do not indicate that groundwater plumes from the General Mills/Henkel Site and upgradient sources have always been comingled. The Vapor Intrusion investigation indicates additional sources may be present at the General Mills/Henkel property, potentially contributing additional COCs into the subsurface. Vapor intrusion evaluation/mitigation of the affected buildings and remaining downgradient receptors remains to be addressed. Generally, it appears that not all data were considered and certain data that did not support the Evaluation's conclusions were discounted.

The Evaluation claims that the General Mills source is predominately BTEX compounds and to a lesser extent chlorinated compounds such as TCE. The depositions/testimonies from former workers presented in the Evaluation are not sufficient to support this claim. The Evaluation presents selected data that attempt to show that TCE is relatively minor compared to the stated use of "petroleum based products, mineral spirits, benzene, toluene, xylene, ketones, etc." and that TCE was "not used often". The data cited in Table 3 give the average concentration of chlorinated solvents in General Mills source soil samples, but the report does not indicate which wells were included in that average. It appears that MW106, and potentially MW107, were not included, even though the report indicates that MW106 pulled source contaminants down into the groundwater during drilling. MW106 appeared to sample the pit-contents itself and it showed a higher percentage of TCE than the nearby soil samples. MW107 was also situated directly beneath or downgradient of the soil absorption pit (drywell) and the results indicated

97% of TCE. MW106 and MW107 appear to be the best indicators of the contents that were disposed of in the drywell. In Table 4, the Report discounts MW107 by stating that the well was "below the zone of affected soil (34-39 ft bgs)". The previous studies (1981 and 1983 RAP) had limited investigation of the vertical extent of the source at the drywell. The depth of the contamination beyond 26 ft was investigated at only three locations, two of which were sidegradient (Boring 101 and 102). MW107 is the only location that appears to account for the depth of the source as it is located potentially beneath the disposal site or potentially directly downgradient from the source. Concentrations were not enough to suggest TCE acted as a sinker, however, the ongoing daily to weekly disposal of contaminants (plus precipitation) would drive the source plume vertically downward. The Evaluation also appears not to consider the detections of Boring #2 and #3 which show TCE soil concentrations as high as 81,500 ug/kg at 26 ft depth and 110,000 ug/kg at 21 ft with soil concentrations generally increasing with depth. Benzene and Toluene were at a similar concentrations suggesting an equal ratio at least at the source.

In addition, the Evaluation uses a comparison of soil sample ratios to water ratios that is not appropriate. Table 3 and findings presented in support of the "fingerprint" ratio of BTEX/TCE compare soil sample ratios with water ratios. Both Benzene and TCE have chemical properties that determine fate and transport in soils versus water, such as adsorption rates to soils (carbon) and slightly different solubility rates, with Benzene being slightly greater than TCE. Comparing the concentrations from the two types of media is not appropriate. The comparison should take into account chemical differences (see for example https://pubs.usgs.gov/of/2006/1338/pdf/ofr2006-1338.pdf) as well as consider the degradation differences for each.

The Evaluation presents a conceptual site model that depicts GMI as a smaller source of TCE with greater quantities of BTEX compounds in the path of a much greater TCE plume from one or more unknown upgradient sources. This revision of the CSM may or may not be warranted and the ongoing investigation of upgradient sources may help clarify this. However, it is important to point out, that contrary to the Evaluation's claims, upgradient sources of TCE were identified in the early 1980 investigations. The 1983 Remedial Action Plan discussed the potential for two different sources of TCE. The data collected thus far and presented in the Vapor Intrusion Report on the MPCA website for General Mills certainly points to a number of sources and further adds to the findings of the 1983 report. The groundwater samples at well 301GS/GD are higher than any other groundwater sample result and this well is about 1700 ft northeast of the drywell at General Mills. The Evaluation's depiction of the CSM on Figures 1 and Figure 2 assume that they are correct that the BTEX compounds are the predominate mixture of the VOCs detected in the soil pit area. Again, this discounts the findings in MW106 or 107, Boring 2, and Boring 3. The wells had higher or nearly equal concentrations of TCE, and MW106 was a direct reflection of what was in the source as stated in the Evaluation's argument for discounting the results of MW106 (owing to the smearing during drilling). In Figure 1, the Evaluation shows how an upgradient source of TCE would sink and contaminate the aquifers, while the General Mills/Henkel Site source would float and not sink and would be a relatively smaller contribution of TCE. This figure could just as easily be drawn with contaminants from MW106, MW107, borings 2 and 3, and Piezometer A, to show TCE sinking similar to the upgradient unknown source depiction and potentially, portions of it collecting in the topographic low created by the sloping clay lens overlying the Decorah Shale. The drawing in red below shows a similar potential for TCE from the General Mills Henkel Site source to transport into the aquifers. The concentrations in the earlier reports (more representative) do not indicate DNAPL in the groundwater (dissolved phase) results. However, the constant daily to weekly adding of gallons of waste would further drive the plume deeper into the groundwater, particularly given that the "pit" was essentially a drywell that directly "injected" the waste 12 ft below ground surface, bypassing the swamp deposits that could have acted to reduce or retard the transport of TCE and hydrocarbons. The past data did not find DNAPL, but also had limited sampling at depth. The drawing below is simply another possibility based on the limited available data. The Evaluation makes similar assumptions for the unknown upgradient source. The concentrations upgradient are still not greater than the solubility of TCE at 1,100 mg/L, yet sources there are shown to sink by the Evaluation.



TCE at well 106: 7,200 µg/L

TCE at well 107: 1,300 µg/L

Piezometer A: 2,400 µg/L

Boring 2 (up to 26 ft bgs): 830 µg/L// soils: 14.3 – 97,290 ug/kg

We recognize that there are incomplete data at depth from the 1981 and 1983 studies within the disposal site area. Well 101 (ND), the only well to be sampled at depth (44 ft), appeared to be too far away and sidegradient from the disposal site. The contaminant footprint of this disposal area appears to be narrow. Had the investigation included drilling down further at MW106 or MW107, they may have found TCE and other COCs at depth. From the 1983 Report, Boring 102 was sampled at depth and had nondetects through the whole aquifer and was located southeast of the drywell pit. This could be evidence of a lack of comingled plume at that time in the glacial aquifer. Figure 11 in the 1983 document shows MW B as having 1,100 µg/L of TCE. However, if Boring 102 was completely nondetect and Boring 11 (upgradient of drywell disposal site, on other side of tin building was also nondetect, it shows the two plumes as of 1982 did not yet comingle. This contradicts the Evaluation's argument that the plumes have always been comingled in point 3.8.

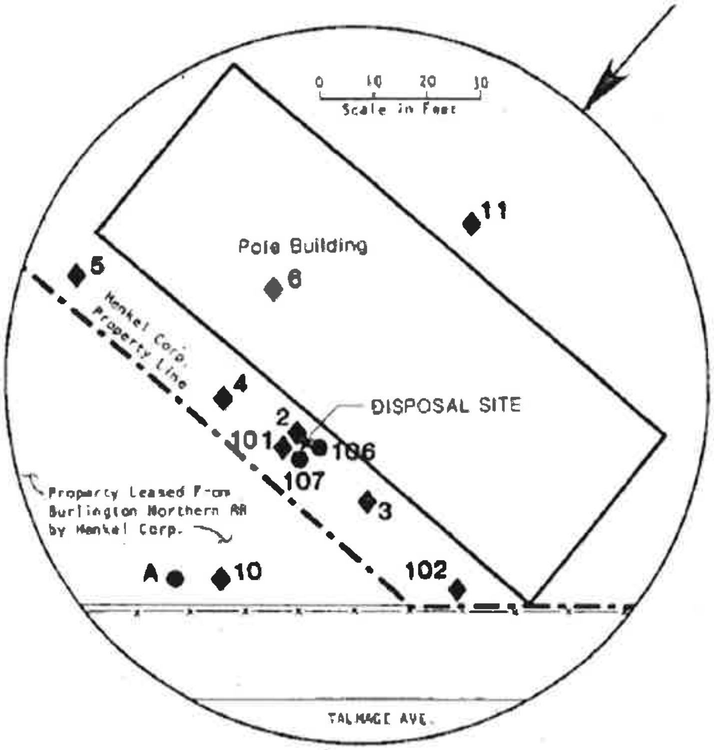


**Figure from 1981 Investigation. TCE detected mainly in 106 and 107, and A.**

The 1983 Site Characterization Study and Remedial Action Plan (RAP) appeared to investigate upgradient sources and contaminants within the three aquifers. The figures, data and text from the 1983 Site Characterization Study and RAP provide adequate information indicating that they investigated beyond the property of General Mills and did not presume that all of the TCE was from General Mills. Figure 11, 12, and 13 show TCE concentrations from each of the aquifers. Figure 11 showed TCE concentrations in the groundwater of the Glacial Drift Aquifer in µg/L. Location B @ 26 ft bgs detected 1,100 µg/L of TCE but is upgradient of the drywell/pit site. Even further upgradient, shallow well 6 had 1 µg/L TCE detected. Location B is still within the confines of the General Mills Property adjacent to Laboratory Building #3 (from 1981 General Mills Study of Subsurface Contamination) and recent information suggests that additional contaminants may be present in the subsurface. No soil samples were taken from this area. Nevertheless, the concentrations increase in the wells 106, 107 and follow a decreasing concentration path to the next downgradient wells of A, 2, 3, and 5. Figure 12 showed TCE concentrations from the Platteville Formation Carimona Member and BB (ugradient nested with B) had concentrations of 1600 µg/L of TCE. WW located further southeast of the site was higher at 2100 µg/L. These concentrations and patterns are similar to the plume delineation of the upgradient sources. It cannot be discerned whether the contaminants from General Mills transported vertically into the deeper Caromina aquifer at location II, but it remains a possibility.

Figure 2 in the Evaluation shows current conditions and states that all the chlorinated solvents have been cleaned up at the site. Sub slab Soil Vapor results (from 2014 and 2015 data) indicate that may not be the case. The concentrations are >2,000 ug/m3 at buildings northwest of the drywell pit with decreasing subslab concentrations surrounding those buildings. The results of both the past and recent groundwater and subslab data show that the concentrations decrease directly upgradient of the soil pit drywell area and increase downgradient. There appears to be ongoing contamination from the site.

The Evaluation does not provide adequate data in the glacial aquifer to support its claim that the pump and treat cleaned up all of General Mill's TCE. Barr's (2015) Vapor Intrusion Investigation Report provided a figure (21) showing trends of TCE. Recent concentrations in the groundwater at Well B, Well 2, and Well 109 show asymptotic conditions as of 2001, while pumping continued until 2010. Ongoing concentrations and apparent rebound may or may not be attributed to the comingling of plumes.

GW Flow Direction

From the groundwater flow directions depicted in the Barr (2015) Vapor Intrusion report on Figures 18 and 19, show that the flow direction from the drywell pit location would ultimately converge upon the plume originating from the upgradient source. The reasoning for this convergence is explained by the topography of the glacial drift (figure 17) where the drywell pit area is located in and near a low-lying area. It is debatable whether the plumes from General Mills and upgradient sources were comingled at the time of the earlier 1980 investigations. The data do not support those conclusions at least in the shallow water table portion of the glacial aquifer (samples from B and 11). Samples at depth from 101 and 102 also do not indicate a comingled plume in the deeper portions of the glacial aquifer as of 1982. It is likely and evident that the plume is comingled presently and it is not clear when this would have occurred.
Given the past data and present data showing the comingled plume in the glacial aquifer and potentially in the Platteville Fm. Carimona Member (location LL), it may not be possible to differentiate the sources of the TCE.

Sufficiency of Existing Soil Cleanup

According to a 2001 Shallow Soil Investigation (Barr, 2001), a soil concentration of 25,000 ug/kg of TCE was detected in the soil at GP-3 at 7-8 ft bgs. It appears the soil around the drywell was contaminated beyond the drywell pit. Close to the location of the drywell pit (GP1) there is considerable remaining soil concentrations of xylene, toluene and ethylbenzene. The Evaluation's claims of spatial variability and arguments in 3.9 appear insufficient. When plotting the concentrations from 2014-2015 on to the cross-sections available from the Barr 2015 Vapor Intrusion Report, it clearly showed a decrease in TCE in shallow and deep glacial aquifer just before the General Mills site, followed by increases in TCE concentrations in both the shallow and deep glacial aquifer.