AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
• ENVIRONMENTAL
• GEOTECHNICAL
• MATERIALS
• FORENSICS

April 10, 2014

Ms. Ginny Black
Minnesota Composting Council
11410 49th Place North
Plymouth, MN 55442

RE: Comments Regarding the Proposed MPCA Rules for SSOM Compost Sites
AET Project No. 02-02099

Dear Ms. Black:

As requested, American Engineering Testing, Inc. (AET) has completed our review of the MPCA proposed rules and SONAR for SSOM Compost Sites, the MPCA report titled Source Separated Compost Study Preliminary Summary and Data dated March 2014, and the statement of the National Waste & Recycling Association (NW&RA) presented at the hearing on March 24, 2014. You requested AET focus its review on the specific issues of compost contact water quality data, the permeability of a hard packed, all weather surface as described in the proposed rule, and comments on the NW&RA statement.

Our comments are organized into the following categories:

- **I. Compost Contact Water Data Evaluation**
- **II. Permeability of a Hard Packed, All-Weather Surface**
- **III. Impact of the Removal of Loam, Silt Loam, and Silt**
- **IV. Comments on the Testimony of James S. Aiken, PG on Behalf of National Waste & Recycling Association, March 24, 2014**

I. COMPOST CONTACT WATER DATA EVALUATION

We undertook an evaluation of compost contact water based on the data reported in the Minnesota Pollution Control Agency document "Source Separated Compost Study Preliminary Summary and Data" dated March 2014. The preliminary data reported in this study was generated at the University of Minnesota Arboretum's Organic Composting Demonstration compost facility (Arboretum) located in Chanhassen, Minnesota and operated by Specialized Environmental Technology (SET) in partnership with Carver County. The Arboretum's Organics Composting Demonstration Site was used to conduct a demonstration/research study to develop an understanding of the environmental implications of contact and storm water from source-separated organic material (SSOM) and yard waste. The demonstration\research study was funded through an Environmental Assistance Grant administered by the Minnesota Pollution Control Agency.

Appendix C, Table C1 of the Source Separated Compost Study Preliminary Summary and Data report contains the water quality results of the Test Cell Rain Simulation. The Test Cells were constructed of three different mixtures of organic materials in compost piles. A Purdue rain simulator was used to apply water to the Test Cells in sufficient quantities (essentially saturating the compost) to generate subsurface contact water that was collected, sampled, and analyzed.

The applicability of the contact water data from the Test Cell Rain Simulation to the actual contact water generated at a SSOM compost facility is highly questionable as compost piles generally are not saturated, would not have free flowing water moving vertically through the compost pile, and would not have a hydraulic head build up at the base of the compost pile.

Drinking Water Standards

Drinking water standards have been used throughout the demonstration/research project as a basis for comparison for contact water generated at the Arboretum compost facility. Federal Primary Drinking Water Standards include a limit on turbidity of 1 NTU, basically clear water. Turbidity is a measure of the cloudiness of water and is primarily due to suspended solids in the water. Removal of turbidity and suspended solids is necessary for aesthetics; people just do not want cloudy water coming out of the tap. Turbidity and suspended solids can also be associated with disease causing micro-organisms such as: viruses, parasites, and bacteria and can interfere with the effectiveness of disinfection processes. As a result, drinking water standards are based on sediment free water or water that has been filtered.

It is well documented that soils in Minnesota contain many elements including lead, arsenic, selenium, etc. These elements are naturally occurring and are present in the suspended solids that occur in water samples. When unfiltered water samples are analyzed, the presence of suspended solids will bias the sample results providing higher values.

Comparison of Contact Water Data to Drinking Water Standards

As noted above drinking water standards are based on water that has been filtered; removing the suspended solids and turbidity to 1 NTU. It is important to note that the contact water samples collected from the Test Cell rain simulation were not filtered prior to analysis. Thus, the contact water results are considered “total” contaminant measurements which include contaminants that are contained in suspended solids as well as contaminants dissolved in the water. As a result, it is misleading and not an accurate to compare unfiltered water sample data from the Arboretum compost facility Test Cells to drinking water standards derived from filtered water.

It is not appropriate to consider contaminants associated with sediment when evaluating ground water impacts because sediment in water moving through soil is easily and quickly removed by soil filtration and other attenuation processes. The appropriate practice for characterization of compost contact water is to filter the water samples prior to analysis in order to obtain a more representative chemical characterization of the water for comparison to drinking water standards or to the landfill leachate data presented at the March 24th hearing.

In order to provide an appropriate and meaningful evaluation of the data, we plotted the contaminant concentration and the total suspended solids concentration for the metals reported to exceed the drinking water standards, either US EPA Maximum Contaminant Level (MCL) or MDH Health Risk Limit (HRL), based on the subsurface results in Appendix C Table C1. These metals include: arsenic, barium, boron, cadmium, lead, mercury, and nickel. We then conducted linear regression statistical analysis of the data to determine the correlation between the metal concentration and the total suspended solids (TSS) concentration and the likely metal concentration in the water sample if the suspended solids were removed, filtered, as is standard practice prior to laboratory analysis. The results of the data comparison and statistical analysis are shown in the attached figures, one each for arsenic, barium, boron, cadmium, lead, mercury, and nickel.

The data evaluation shows a very strong correlation between metal concentration and TSS which indicates that the metals in the samples are associated with the suspended solids in the samples. The statistical analysis demonstrates that if the samples had been filtered prior to analysis the metals concentrations in the samples would have been less than drinking water standards in all cases with the exception of nickel.

The linear regression statistical analysis of the nickel results was highly influenced by two ‘outlier’ data points from the first (July) data set. These two data points had relatively high nickel concentrations and relatively low TSS concentrations. There could be a number of reasons why these two ‘outliers’ occurred. We recommend that the original data for these sample results be reviewed to determine if there is some obvious explanation, a data recording error, or other reason why these ‘outliers’ occurred. Excluding these two ‘outlier’ data points, the linear regression statistical analysis demonstrates that the nickel concentration in the samples would be less than drinking water standards based on filtered samples.

Our evaluation of the Appendix C Table C1 data noted a discrepancy in the results reported compared to the original draft report. This discrepancy was for the nickel concentration for the Pile 2 Subsurface 8/16/2013 sample. We reviewed the laboratory report for that sample and used the correct value, 1120 micrograms per liter, for the data evaluation.

Conclusion

The evaluation of the compost contact subsurface water sample data demonstrates that the metals in the samples are primarily due to the presence of sediment in the water samples. The water applied to the compost piles picked up sediment, basically small soil particles, as it moved through the pile and/or from the substrate below the pile. The use of unfiltered water sample results for evaluating ground water impacts and comparison to drinking water standards is not appropriate as the sediment is easily removed as the water moves through soil.

In addition, comparing the unfiltered water data from the Arboretum study to drinking water standards is not appropriate, as drinking water standards are based on water that has been filtered to remove suspended solids.

Finally, comparing the unfiltered water data from the Arboretum study to filtered landfill leachate data is not appropriate as it is not an equal comparison and results in misleading conclusions.

II. PERMEABILITY OF A HARD PACKED, ALL-WEATHER SURFACE

Subitem (6) of the SONAR states the minimum design of a composting facility must include a hard-packed, all-weather surface to minimize migration of materials and contact water into soils, surface water and groundwater. This type of surface corresponds to an 'Impervious Surface', as defined in the Minnesota Pollution Control Agency (MPCA) General Permit Authorization to Discharge Stormwater Associated with Construction Activity Under the National Pollutant Discharge Elimination System/State Disposal System, Permit No: MN R10001 (General NPDES/SDS Construction Stormwater Permit). According to the General NPDES/SDS Construction Stormwater Permit, an impervious surface is:

> "a constructed hard surface that either prevents or retards the entry of water into the soil and causes water to run off the surface in greater quantities and at increased rate of flow than prior to development. Examples include rooftops, sidewalks, patios, driveways, parking lots, storage areas, and concrete, asphalt and gravel roads."

The permit requires that the permanent stormwater management system of a site be designed based on the amount of added impervious surface, which includes hard-packed aggregate surfaces.

A typical hard-packed, all-weather aggregate surface used in Minnesota is a compacted layer of Class 5 or Class 6, as defined by the Minnesota Department of Transportation (MnDOT) "Standard Specifications for Construction." Research performed by MnDOT indicate laboratory hydraulic conductivity (permeability) values for samples of compacted Class 5 and Class 6 aggregate base from various locations in Minnesota range from approximately 2.6×10^{-4} centimeters per second (cm/s) (0.37 inches/hour) to 5.0×10^{-6} cm/s (0.007 inches/hour); this permeability data is published in the MnDOT report titled "Evaluation of a Field Permeameter to Measure Saturated Hydraulic Conductivity of Base/Subgrade Materials," which was published in 2001.

In our opinion a hard-packed surface of Class 5 or Class 6 having permeabilities below 3×10^{-4} cm/s (0.43 inches/hour) will minimize migration of materials and contact water into the subsurface and therefore meets the definition of an 'Impervious Surface' as defined by the MPCA stormwater permit. Moreover, it is our opinion a hard-packed surface of Class 5 or Class

6 will be an adequate impervious surface that retards infiltration and promotes natural attenuation for a SSOM compost operation. Based on the permeability data from the MnDOT study, the permeability of hard-packed Class 5 or Class 6 surfaces does not exceed the maximum permeability of a clay loam, sandy clay, sandy clay loam, and silty clay loam, as described in Table 2 of the SONAR.

III. IMPACT OF THE REMOVAL OF LOAM, SILT LOAM, AND SILT

Minnesota soils data were obtained by downloading the Minnesota *Soil Atlas* Geographic Information Systems (GIS) files. The *Soil Atlas* map series was developed by the Department of Soil, Water, and Climate of the University of Minnesota, in cooperation with the Natural Resources Conservation Service (previously Soil Conservation Service), U.S. Department of Agriculture, and the Minnesota Geological Survey. The data used in the Minnesota *Soil Atlas* are generalized and areas as small as one square mile may be viewed. A query of soil/material types was run to calculate the surface area of Minnesota soil/material types that would be "appropriately protective" as compost facility in-situ materials in the five feet below the ground surface.

Based on the soil type nomenclature used for the Minnesota *Soil Atlas*, material textures in the five feet below the ground surface, or a significant part of it, are categorized and labeled three different ways: "S" for sandy, "L" for loamy, and "C" for clayey. Based on the guidance proposed in the SONAR and the soil type nomenclature used in the Minnesota *Soil Atlas*, soils were evaluated for use as in-situ materials in the five feet below the ground surface of a compost facility. Furthermore, the following unique soil/material types were also determined to be unsuitable as compost facility in-situ materials: water, peat, rock, peat over sandy soils, non-acid peat, acid peat, alluvial soils, bog peat, mines and/or dumps, raised bogs, peat over loamy soils, marsh, and steep, stony, or rocky land.

Based on the soil/material types described in the proposed rule Subp. 9 B (8), only 7 percent of the surface area of Minnesota was determined to have soil/materials that would be suitable as compost facility in-situ materials in the five feet below the ground surface. If loamy soils are included, 68 percent of the surface area of Minnesota would be suitable as in-situ materials in the five feet below the ground surface at compost facilities.

IV. COMMENTS ON THE TESTIMONY OF JAMES S. AIKEN, PG ON BEHALF OF NATIONAL WASTE & RECYCLING ASSOCIATION, MARCH 24, 2014

AET reviewed the National Waste & Recycling Association (NW&RA) statement as presented by Mr. Jim Aiken with Barr Engineering at the MPCA hearing on March 24, 2014. It is AET's opinion that the foundation for NW&RA's statement is based on a flawed conceptual model and erroneous evaluation of the compost contact water data resulting in erroneous and highly biased conclusions.

NW&RA's statement utilizes an inaccurate conceptual model for a typical commercially operated SSOM compost pile as a basis for its opinion as to how contact water is generated and how it migrates from and within a pile of SSOM compost, as shown in Figure 1 attached to the NW&RA statement.

- Figure 1 and NW&RA's conceptual model and description are inaccurate and not representative of water movement into, out of, and within an engineered compost facility. Composting is an aerobic process which utilizes oxygen, nutrients *and water* to degrade the compost materials to less than 50% or less of the volume of the raw materials.
- NW&RA's conceptual model does not account for the rain water and contact water that is lost because it is consumed in the composting process or evaporates from the pile.
- NW&RA assumes all water immediately flows into and through the compost pile. It states: "As shown in the figure, rain falls on the pile, and the waste generates a chemical solution of leachate in which there are dissolved chemicals from whatever is in the waste material." It goes on to say "The leachate accumulates at the base of the waste and begins to move by gravity both into the ground and along the ground surface."
- Rain water will not immediately accumulate at the base of the compost pile; the rain water will be absorbed into the material, be utilized in the composting process, evaporate, and run off the surface of the material (as observed during the tests).

NW&RA utilized the results of the 2013 rain simulations where water was applied at a rate exceeding a Minnesota 100-year rain event as a basis for its analysis. Use of this data infers that the amount of water infiltrating the compost and collected would be typical and representative of water from a typical release model for a compost facility. The amount of water applied in the 2013 studies is not typical and in fact exceeded a 100-year rain fall event.

- The amount of simulated rain water that was applied was an extreme event and significantly and artificially inflated the amount of contact water likely to be observed under a more typical, realistic rain fall scenario.
- A 100-year rain event is the amount of precipitation that will fall over a 24-hour period with a probability of occurrence of once in 100 years. The range of precipitation for 100-year rain events throughout Minnesota is 4.8 - 6.2 inches of precipitation. Data collected from the July 12, 2013 rain simulation showed that 5 of the 8 rain gauges collected more than *5 inches of water that was applied over a 3 ½ hour period* and at one location 9.7 inches of water was applied during the same time period. This application of water to the test plots exceeded a 100-year rain event.

- The 2013 rain simulations are not representative of more typical rain fall events. Average *monthly* rain fall for Chanhassen, MN is 2.9 inches for April; 4.2 inches for July and 2.35 inches for October. During and between typical rainfall events, rain water will not immediately accumulate at the base of the compost pile. The rain water will be absorbed into the material; be utilized in the composting process, and evaporate. During dry periods between rain fall events, water will need to be applied to the compost to maintain the composting process.

NW&RA's comparison of compost contact water to MSW Leachate is flawed, contains numerous errors, and is inappropriate.

- NW&RA erroneously interpreted the compost contact water data used in its comparison. The fact is, the compost contact water data NW&RA relied on for its comparison was based on unfiltered samples and the results are 'total' constituents, including both dissolved and suspended components. Comparing water samples based on dissolved results to total results is not appropriate.
- NW&RA compared average MSW leachate data to individual compost contact water data. Any data comparison attempt should use the same basis for comparison. Using average data for one data set and individual sample results for the other data set is not appropriate.
- NW&RA erroneously included a surface water sample result in its comparison to MSW leachate. The surface water sample results had the highest concentrations of constituents in most cases. NW&RA either did not understand the data it used or erroneously compared unrelated data sets.

NW&RA makes some inappropriate and misleading statements. For example:

NW&RA Statement: "As shown on the table SSOM leachate contains numerous parameters that are associated with contaminated wastes. These include carcinogenic compounds like arsenic and benzene, as well as heavy metals arsenic, barium, cadmium, lead and perfluorocarbons."

AET Comment: This statement has a number of flaws. First, there is no data presented to support the statement that compost contact water contains benzene. We have no doubt that MSW leachate contains benzene. Perhaps NW&RA has confused the data sets. Second, the mere presence of metals in compost and compost contact water does not mean they are "associated with contaminated waste". It is well documented that metals occur naturally in the environment in soil, water, plants, etc. A soil sample collected from anywhere in the State of Minnesota would have concentrations of metals. Third, perfluorcarbons (PFCs) are ubiquitous in the environment. The Minnesota Department of Health comments regarding PFCs in the environment include:

> "Because PFCs are so stable, they may be found in soil, sediments, water or in other places. Studies indicate that some PFCs travel through soil and easily enter groundwater where they may move long distances. Some experts suggest that PFCs can also travel long distances in air, deposit on soil and leach into groundwater."

> "Studies show that nearly all people have some PFCs in their blood, regardless of age. The PFCs most commonly found in human blood are PFOS, PFOA, and PFHxS. People are exposed through food, water, or from using commercial products. Some PFCs stay in the human body for many years."

The PFCs detected in the compost contact water samples are well below drinking water standards and reported at the nanogram per liter (part per trillion) level. Stating or implying that PFCs at these concentrations are carcinogenic or toxic is unsupported and misleading.

NW&RA Statement: "It is unlikely that the concentrations reported in the MPCA's study would be significantly attenuated in the subsurface as is assumed in the proposed rules."

AET Comment: Soil has significant ability to attenuate contaminants that occur in water, especially metallic elements. The processes of filtration, ion exchange, chelation, fixation, etc. are effective at removing metallic elements from water as it passes through soil. Predicting the specific attenuation of dissolved metallic elements by soil is complex and dependent on many factors including; soil type, the specific element, ionic form, oxidation state, etc. However, attenuation of metallic elements associated with suspended solids is based on the simpler processes of sedimentation and filtration and is reliably predictable. Water filtration using sand as the filter medium is a technology that is commonly used to produce high quality water for many uses including drinking water.

Our evaluation of the compost contact water data demonstrates that nearly all of the metallic elements occur as suspended solids and would be effectively attenuated by the subsurface soils. It is our opinion that the suspended solids would be removed from the water after travelling no more than 2 to 3 feet through the soil and the metallic elements would be attenuated.

NW&RA Statement: "As indicated on the graphs, the MMSW leachate plots closer to the threshold for relatively clean groundwater, while SSOM leachate plots further from groundwater and has higher concentrations of each parameter than the MMSW leachate. The conclusion is obvious: SSOM leachate is worse than MMSW leachate for these parameters."

AET Comment: The conclusion may be obvious to NW&RA based on its erroneous comparison of the data, but the rest of the scientific community takes a more objective and realistic view. NW&RA completed an erroneous and inappropriate comparison of compost contact water to MSW leachate and states an outlandish conclusion that is not supported by the facts.

NW&RA Statement: "Figure 3 includes a graph showing an example of the mercury concentrations which are statistically higher than the concentrations found in the MSW leachate."

AET Comment: In addition to the errors the NW&RA made in their comparisons, Figure 3 contains the additional error of misstating the mercury concentration of MSW leachate based on their own data. The MSW leachate data included with the NW&RA statement includes 15 results for mercury. Thirteen of those results had a mercury concentration less than 0.0004 mg/l with the other two results less than 0.0002 mg/l. It is statistically impossible to obtain an average value of 0.0002 mg/l as shown in Figure 3 from these data. It would be interesting to know what sort of statistical analysis was run on these data to draw this conclusion.

We appreciate the opportunity to assist you in developing a sound scientific basis for the proposed rules.

If you have any comments or questions for us please contact Robert Kaiser at 651-659-1308 or rkaiser@amengtest.com.

Thank you

American Engineering Testing, Inc.

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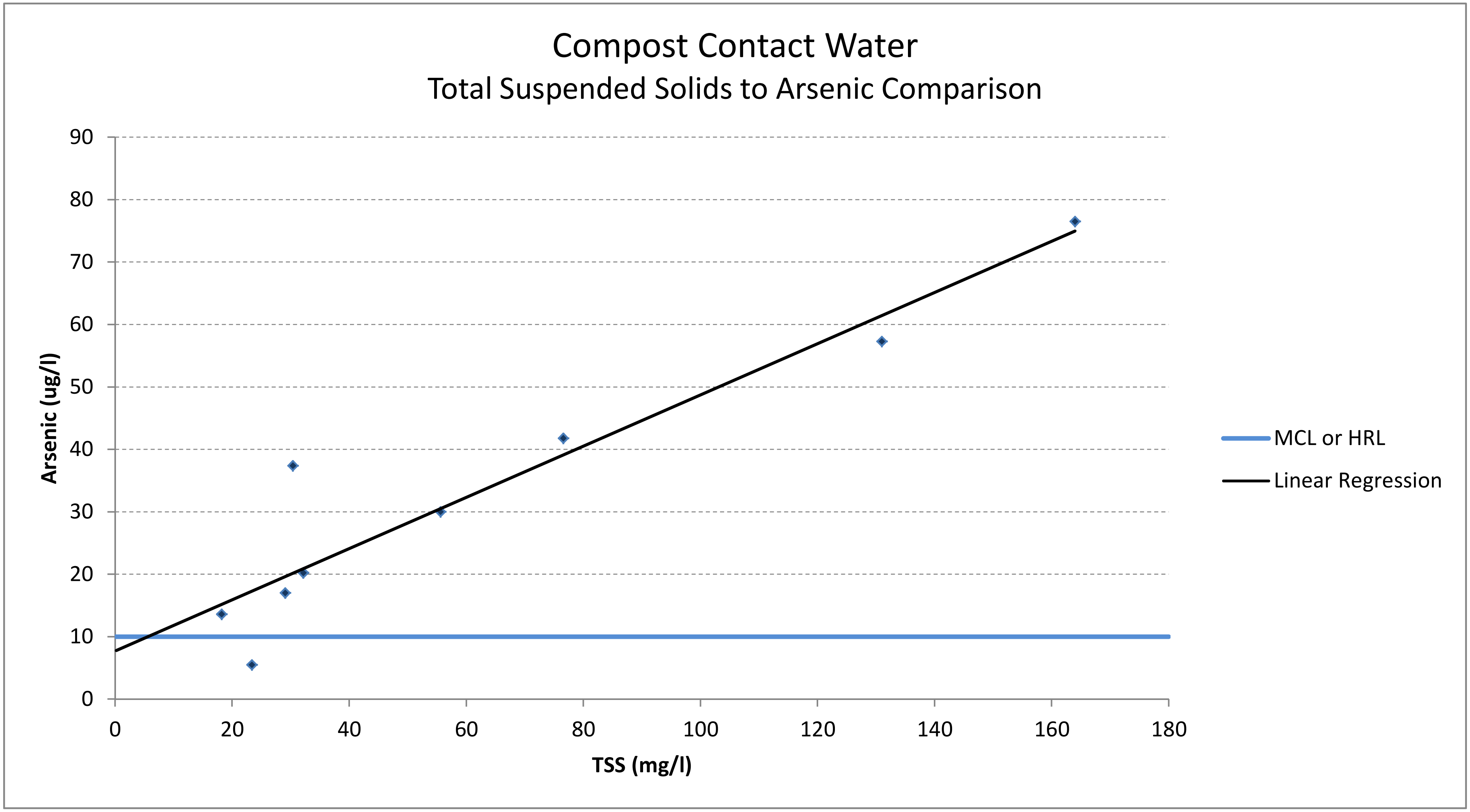
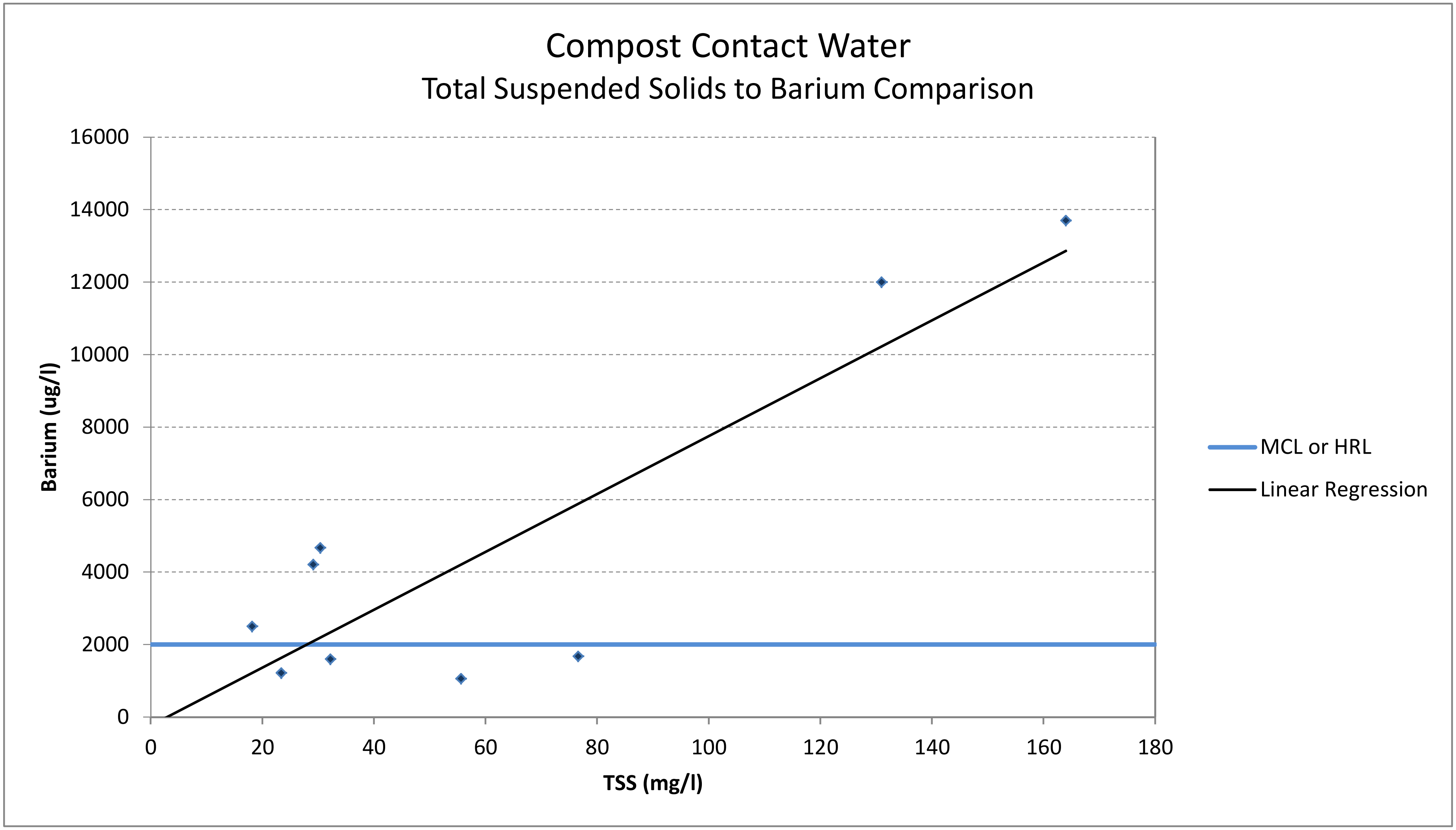
Attachments



Source: MPCA Source Separated Compost Study Preliminary Summary and Data, Appendix C, March 2014



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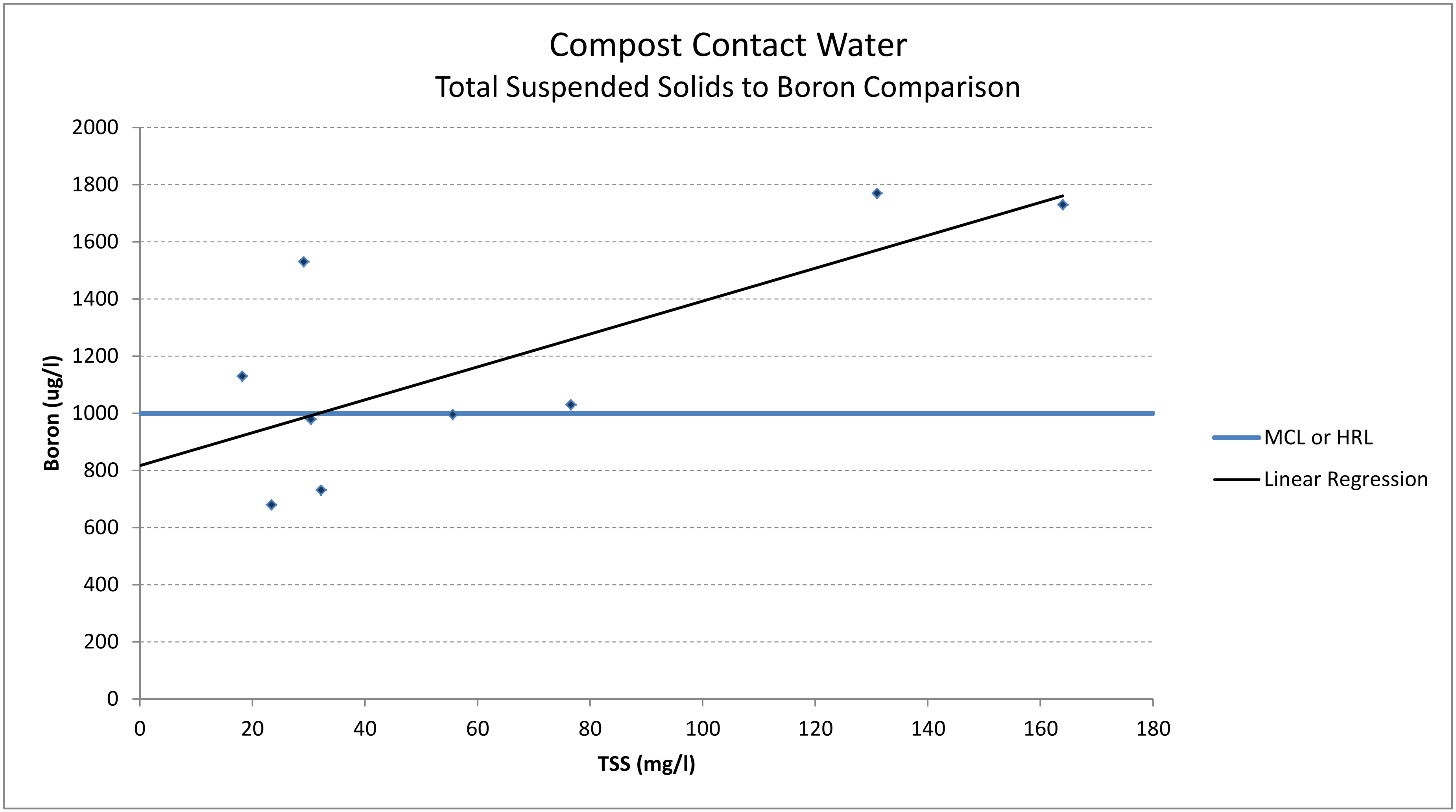

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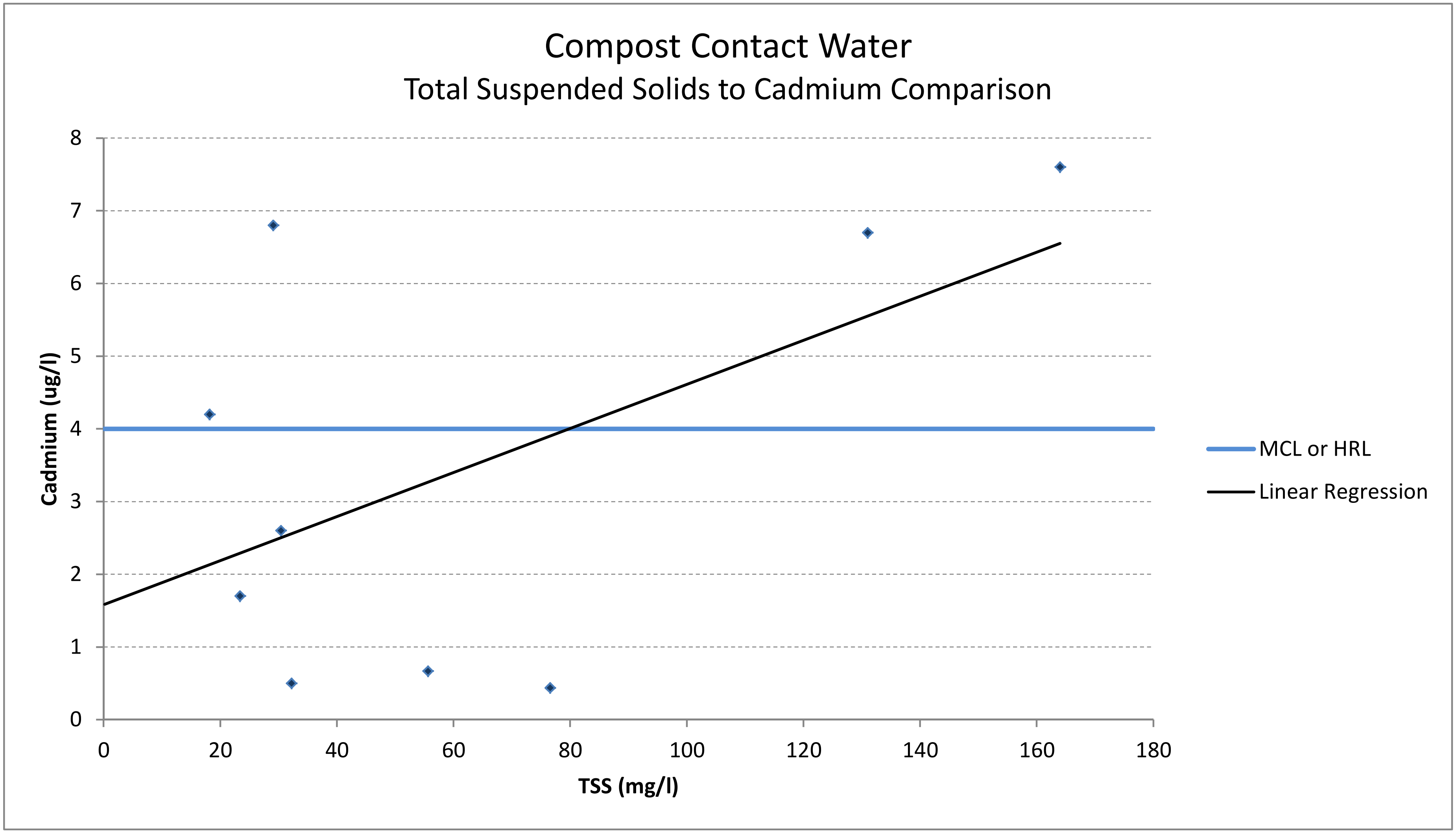

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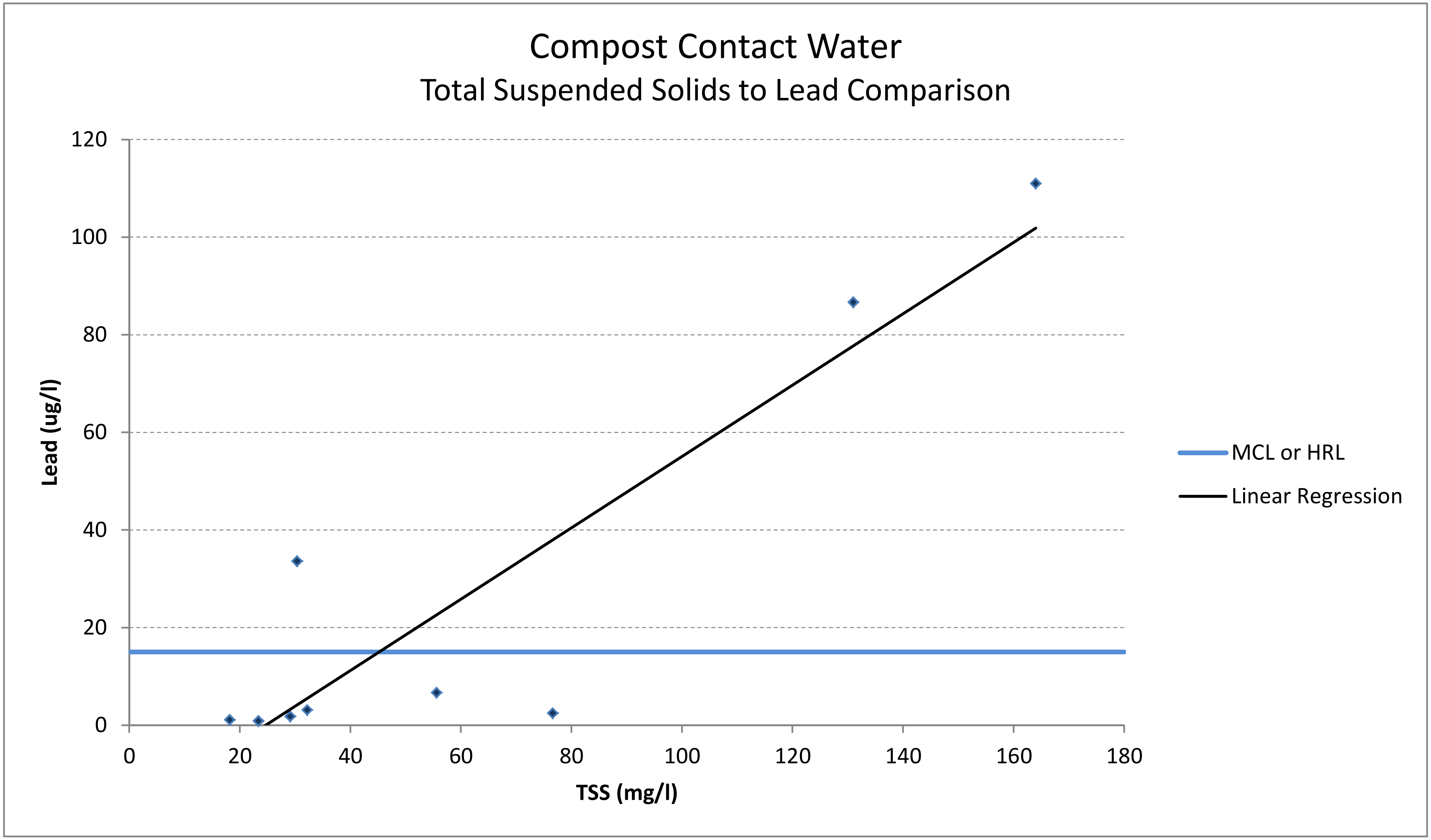

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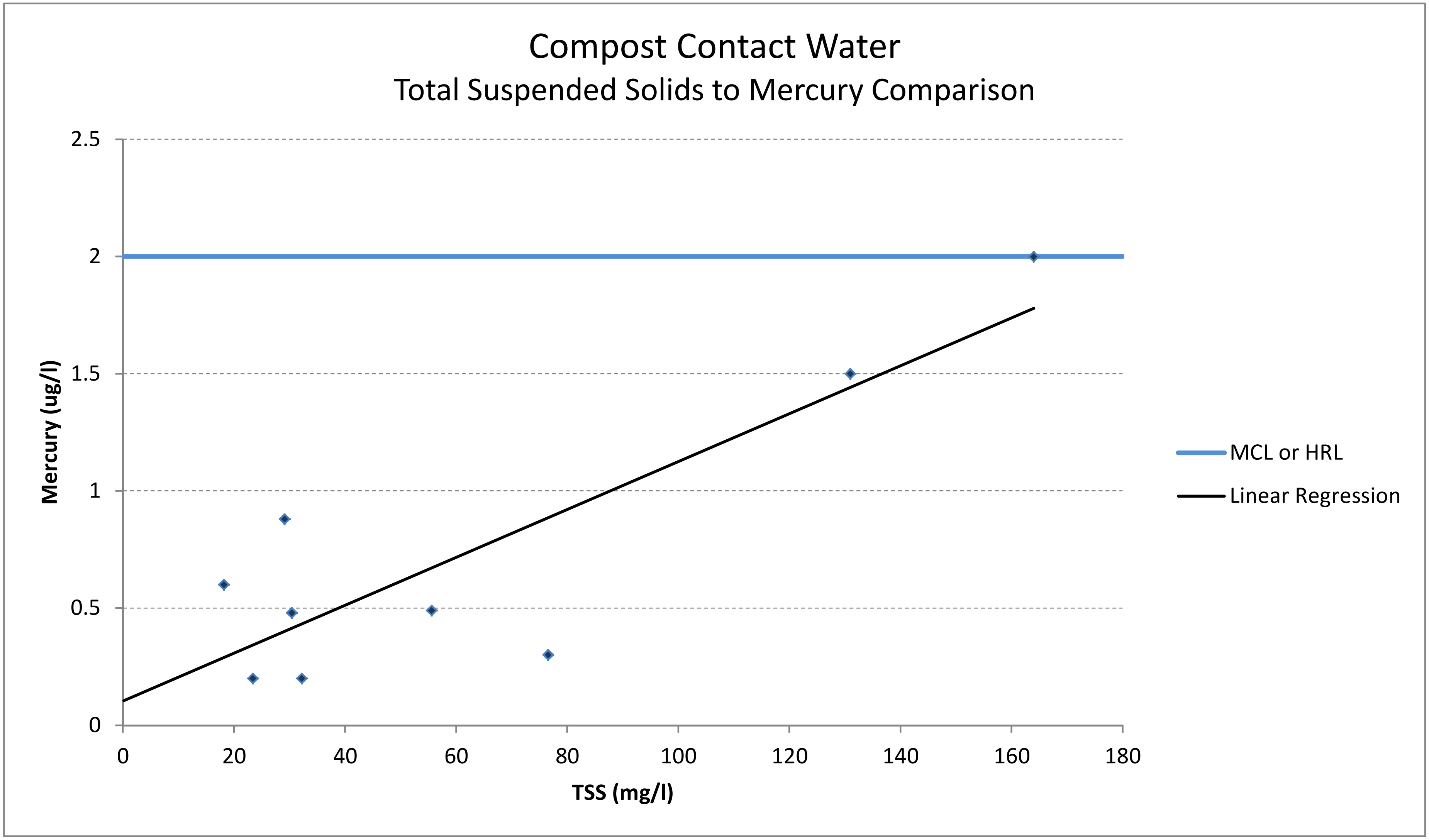

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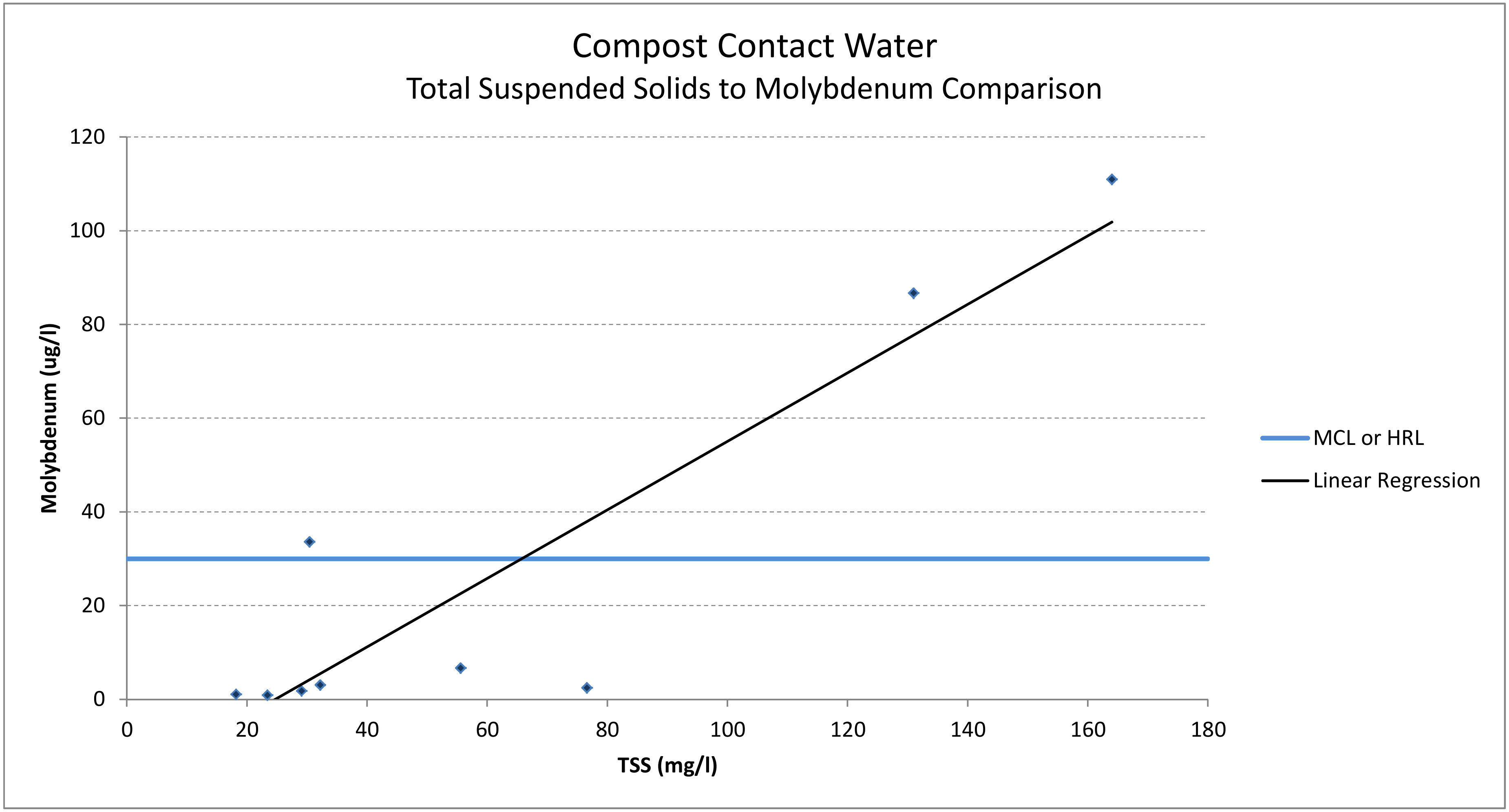

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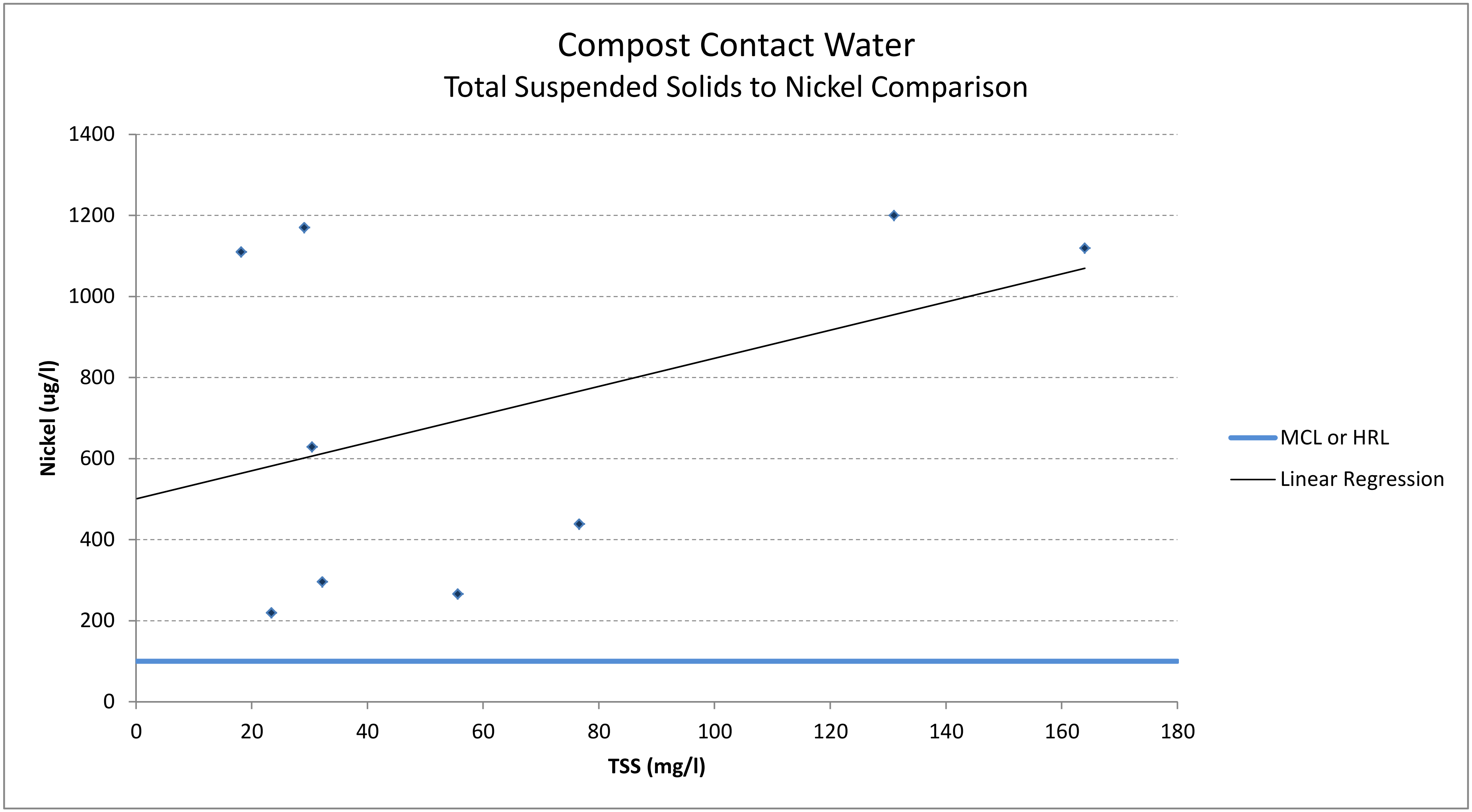

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