Evaluation of the Magnesium Numeric Action Level

State of California General Permit for
Storm Water Discharges Associated with Industrial Activities
(Industrial General Permit)

California Stormwater Quality Association

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CASQA
CALIFORNIA STORMWATER
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Note to Reader

This Report was in the final stages of review and approval by the California Stormwater Quality Association (CASQA) when on March 2, 2020, the U.S. Environmental Protection Agency (EPA) noticed in the Federal Register (Volume 85, No. 41, pages 12288-12295) that it had issued a draft of the federal Multi-Sector General Permit (MSGP) for public review and comment. The proposed MSGP would update the 2015 MSGP. The MSGP applies only to Native American tribal lands in California; however, the State Water Resources Control Board (State Water Board) relied heavily on the 2008 MSGP for the development of the California Industrial General Permit (IGP). The annual Numeric Action Levels (NALs) in the IGP are derived from and function similarly to the MSGP benchmark values. Among other changes in the March 2, 2020 release, EPA proposes to remove the magnesium benchmark.

The Federal Register notice includes a proposed 2020 MSGP Fact Sheet that includes the following:

> *The 2015 MSGP required subsector K1 to monitor for magnesium and included a benchmark value of 0.064 mg/L. The NRC [Ed. National Research Council] study recommended that EPA remove the magnesium benchmark from the 2020 MSGP since it is a "natural component of surface and groundwater and does not appear to be toxic to a majority of aquatic organisms at concentrations likely to be encountered in most waters" (NAS, 41). Significant evidence does not exist to indicate adverse impacts of aquatic organism and EPA does not provide an aquatic life criterion for magnesium. Magnesium concentrations present in stormwater are not anticipated to be toxic to most aquatic organisms6. EPA could not find any information to support continuing to require this benchmark parameter and therefore proposes to remove magnesium as a benchmark parameter in the 2020 MSGP.*
>
> ***Request for Comment 17:** EPA requests comment or any information related to the acute effects of magnesium on aquatic organisms that would warrant retaining a magnesium benchmark in the 2020 MSGP.*

In response to this request, CASQA plans to submit comments, including this Report, to EPA.

Disclaimer

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Evaluation of the Magnesium Numeric Action Level in the State of California General Permit for Storm Water Discharges Associated with Industrial Activities (Industrial General Permit)

Introduction

The State of California General Permit for Storm Water Discharges Associated with Industrial Activities (IGP)[1] includes a Numeric Action Level (NAL) for magnesium. The basis for the NAL is the U.S. Environmental Protection Agency (EPA) Multi-Sector General Permit (MSGP)[2] benchmark for magnesium, 0.064 milligrams per liter (mg/L).

The purpose of this Report is to provide technical information and recommendations to support the State Water Board's decision-making regarding the magnesium NAL in the IGP.

Therefore, this Report:

- Describes the basis of the MSGP benchmark and IGP NAL;
- Identifies sources of magnesium, including industrial activities and materials, soil, and rainfall;
- Compares magnesium concentrations in industrial stormwater to those in surface water and groundwater;
- Describes the current regulatory framework for magnesium (existing water quality objectives and 303(d) listings);
- Summarizes recent findings by the National Academies of Sciences, Engineering, and Medicine (National Academies) as related to magnesium in stormwater;
- Identifies the impacts of exceeding the magnesium NAL for IGP permittees; and
- Presents conclusions and provides a recommendation regarding the inclusion of a magnesium NAL in the IGP.

Basis for the MSGP Benchmark and IGP NAL

EPA established parameter benchmark values as part of the *Final National Pollutant Discharge Elimination System Storm Water Multi-Sector General Permit for Industrial Activities* dated September 29, 1995 (1995 MSGP). According to the 1995 MSGP (Federal Register, Volume 60, No. 189, pages 50824-50825), the benchmarks were developed as "the pollutant concentrations above which EPA determined represents a level of concern. The level of concern is a concentration at which a storm water discharge could potentially impair, or contribute to impairing water quality or affect human health from ingestion of water or fish."

For many parameters, the benchmark values were based on acute freshwater criteria recommended by EPA in the National Recommended Water Quality Criteria for the protection of aquatic life and human health. Where acute aquatic life freshwater criteria had not been established, benchmark values were based on several other sources. For certain parameters, if the water quality criteria was less than the method detection limit, the benchmark value was

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[1] *National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Industrial Activities* dated April 1, 2014, prepared by the California State Water Resources Control Board.

[2] *National Pollutant Discharge Elimination System (NPDES) Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP)* effective on June 4, 2015, prepared by EPA.

based on a numerical adjustment, calculated as 3.18 times the method detection limit.[3] This approach was utilized to establish benchmarks for 12 parameters, including magnesium. For magnesium, the resulting calculated benchmark value was 0.064 mg/L. Of note, and as described in the Regulatory Framework section of this document, EPA's National Recommended Water Quality Criteria does not establish acute or chronic criteria, in freshwater or saltwater, for magnesium.

In the *National Pollutant Discharge Elimination System (NPDES) Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity* effective September 29, 2008 (2008 MSGP), EPA reevaluated benchmark values. Of the 12 parameters with benchmarks previously calculated using the 3.18 times the method detection limit approach, seven parameter benchmarks were revised based upon new water quality criteria values, and seven parameter benchmarks were removed in their entirety. This 2008 MSGP update therefore left magnesium as the only remaining parameter with a benchmark developed using the 3.18 times the method detection limit approach.

In 2014, the California State Water Board adopted the EPA benchmarks from the 2008 MSGP as part of the IGP to serve as NALs, including the magnesium benchmark value of 0.064 mg/L. As described in the IGP, NALs are designed to provide feedback on industrial sources of pollutants as part of a multiple-objective performance measurement system.

Sources of Magnesium

Magnesium may be present at facilities due to former and/or current industrial activities. The 1995 MSGP described industrial sources of magnesium associated with chemicals used to boil wood chips for the paper manufacturing industry, magnesite magnesium carbonate associated with clay products manufacturing, magnesium as one of several soluble metals that can be sourced from raw materials corrosion at primary metals and scrap recycling facilities, and magnesium oxide in coal ash at steam electric power generating facilities. Further, the 1995 MSGP established required benchmark stormwater monitoring for magnesium at hazardous waste treatment, storage, or disposal facilities.

Magnesium is one of the most prevalent minerals in natural soil and was listed as a mineral with the eighth highest average soil concentration in the conterminous United States by the U.S. Geological Survey[4] at 9,000 milligrams per kilogram (mg/kg), with a range of 50 to over 100,000 mg/kg. The report *Background Concentrations of Trace and Major Elements in California Soils*,[5] which described magnesium as a "major" soil element along with seven other elements with 0.1% or greater average abundance in the earth's crust, presented magnesium concentrations in soil at 50 locations throughout California with an average concentration of 9,923 mg/kg (approximately 1%) and a range of 1,456 to 32,378 mg/kg.

Magnesium particulate matter present in the atmosphere, whether from mineral or anthropogenic sources, has the potential to deposit on the ground surface at industrial facilities where it accumulates before being mobilized and discharged during storm events. In addition, rainfall contains magnesium even before contacting the ground surface or other materials at industrial facilities. The National Atmospheric Deposition Program (NADP) currently monitors the deposition of acids, nutrients, and base cations in precipitation at 263 sites primarily throughout North America. The NADP annual reports for the period of 2015 through 2017[6] showed magnesium concentrations in rainfall at 10

[3] 1995 MSGP.

[4] *Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States* dated 1984, prepared by the U.S. Geological Survey.

[5] *Background Concentrations of Trace and Major Elements in California Soils* dated March 1996, prepared by the Kearney Foundation of Soil Science, University of California Division of Agriculture and Natural Resources.

[6] NADP annual data summaries available at http://nadp.slh.wisc.edu/lib/dataReports.aspx, last accessed on February 20, 2019.

stations in California ranging from 0.004 to 0.068 mg/L, with concentrations commonly exceeding 0.020 mg/L and one out of the 28 reported concentrations exceeding the 0.064 mg/L NAL. Most of the elevated magnesium concentrations in rainfall were measured at the monitoring stations closest to urban areas where IGP facilities are concentrated.

Rain was also sampled by the Lawrence Livermore National Laboratory in Livermore, California as part of a Level 2 Exceedance Response Action (ERA) Natural Background Technical Report (as required by the IGP; see Impact of Exceeding Magnesium NAL for more detail). The results of magnesium concentrations in four samples collected between March 2017 and March 2018 ranged from 0.047 to 0.090 mg/L,[7] with one of the four concentrations exceeding the 0.064 mg/L NAL.

With contributions from non-industrial sources such as natural background soil, atmospheric deposition, and rainfall, there is a strong possibility that the concentration of magnesium in stormwater will exceed the NAL without industrial contributions.

Concentrations of Magnesium in Industrial Stormwater, Surface Water, and Groundwater

INDUSTRIAL STORMWATER

Magnesium industrial stormwater discharge data were downloaded from the Stormwater Multiple Application and Report Tracking System (SMARTS) for the period of July 1, 2015 through January 30, 2019[8] to correspond to the period of time in which reporting to SMARTS has been required under the current IGP. The magnesium data were then processed to remove non-detect results when the method detection limit or the reporting limit, in the absence of a method detection limit, were higher than the NAL and the ability to assess compliance with the NAL was not possible. Additionally, readily identifiable outlier concentrations that were not supported with uploaded laboratory reports, and that could be identified as non-discharge samples such as equipment blanks and internal facility samples, were also removed. Further, some outlier values were observed to be entered incorrectly due to unit errors and were corrected based on a review of uploaded laboratory reports. The data set included the parameter "Total Magnesium" and, to a lesser extent, "Total Recoverable Magnesium" and "Dissolved Magnesium." The IGP requires metals to be analyzed and reported as total metals; therefore, no attempt was made to verify whether the dissolved values were actually dissolved magnesium or entered incorrectly as dissolved instead of total magnesium.

After processing the SMARTS data, the resulting data set included a total of 1,414 qualifying storm event magnesium sample data points with a magnesium concentration range of 0.042 to 1,310 mg/L. Only two verifiable stormwater discharge samples, supported by an uploaded laboratory report, were reported with magnesium concentrations less than the NAL, corresponding to a NAL exceedance rate of 99.9%. With 99.9% of reported California stormwater samples over the past four stormwater seasons showing an exceedance of the NAL for magnesium, either there is a widespread magnesium pollution problem, or, the NAL is too low and does not provide useful or meaningful feedback on industrial sources of magnesium in stormwater.

Box and whisker plots of these industrial stormwater data are presented in Figure 1.

[7] *Results of Magnesium in Rain Water Sampling* dated September 2018, prepared by the Lawrence Livermore National Laboratory, as attached to *Industrial General Permit Exceedance Response Level 2, Natural Background Technical Report, Site 300, Corral Hollow Road, Tracy, CA 95377* dated December 2018, prepared by the Lawrence Livermore National Laboratory.

[8] SMARTS data available at https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.xhtml, last accessed on January 30, 2019.

SURFACE WATER AND GROUNDWATER

To evaluate the NAL to concentrations of magnesium observed in the environment, California surface water (i.e., receiving waters such as streams and lakes) and groundwater data from the National Water Quality Monitoring Council's Water Quality Portal[9] were downloaded for the period August 2015 through November 2018. The data were collected from water sources throughout the state in both urban and non-urban settings.

For surface water, 1,117 magnesium samples were collected at 192 locations throughout California, mostly as the dissolved fraction in water. The range of reported concentrations was 0.04 to 177 mg/L, with only 1.5% of reported samples less than the NAL and 98.5% exceeding the NAL.

For groundwater, 1,668 dissolved magnesium samples were collected at 1,147 locations throughout California. The range of concentrations was 0.019 to 2,480 mg/L, with only 0.6% of reported samples less than the NAL and 99.4% exceeding the NAL.

Box and whisker plots for these California surface water and groundwater data are included on Figure 1.

COMPARISON OF CONCENTRATIONS OF MAGNESIUM IN INDUSTRIAL STORMWATER, SURFACE WATER, AND GROUNDWATER

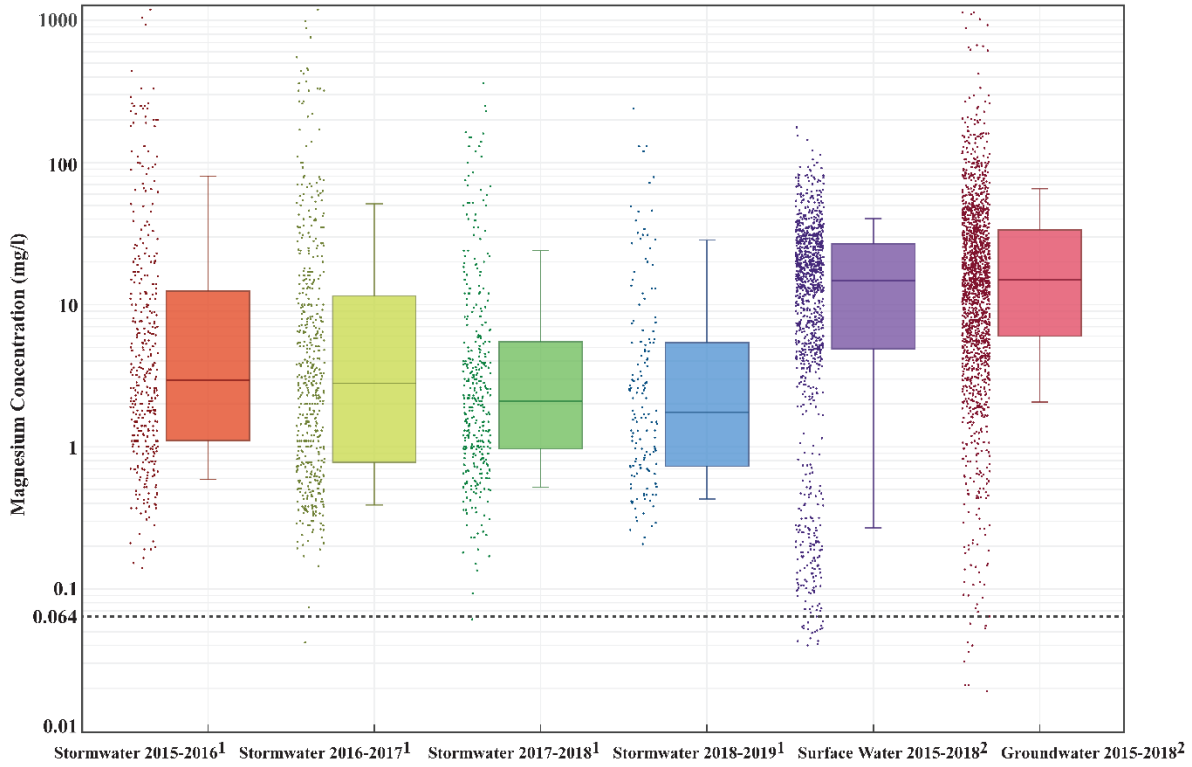
Figure 1 presents magnesium box and whisker plots for the data described above for industrial stormwater, surface water, and groundwater. The boxes show the 25th, 50th (median), and 75th percentiles of the data, with whiskers at the 10th and 90th percentile values. Scatter plots showing the actual magnesium data points are plotted adjacent to the box and whisker plots. A horizontal dashed line for the 0.064 mg/L NAL is shown for comparison.

As shown on Figure 1, the interquartile range and median concentrations for magnesium in stormwater are less than the interquartile range and median concentrations in surface water and groundwater throughout California. Figure 1 also shows that the magnesium NAL is orders of magnitude below typical magnesium concentrations found in California industrial stormwater, surface water, and groundwater.

Although the maximum magnesium concentrations for industrial stormwater are similar to the highest concentrations reported for groundwater (Figure 1) and likely are associated with industrial activities, the data trends described above show that the bulk of magnesium concentrations in industrial stormwater are actually less than typical concentrations in surface water and groundwater.

[9] National Water Quality Monitoring Council Water Quality Portal database available at https://www.waterqualitydata.us/, last accessed on February 4, 2019.

Figure 1. Magnesium Concentrations in California Stormwater, Surface Water, and Groundwater



----- Numeric action level of 0.064 mg/l

[1]Stormwater data provided by the California State Water Resources Control Board Stormwater Multiple Application and Report Tracking System database, https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.xhtml

[2]Surface and groundwater data provided by the National Water Quality Monitoring Council Water Quality Portal, https://www.waterqualitydata.us/.

Current Regulatory Framework for Magnesium

WATER QUALITY STANDARDS: AQUATIC LIFE

As noted previously, EPA has not established acute or chronic criteria for magnesium for the protection of aquatic life. Accordingly, the California Toxics Rule, promulgated by EPA in 2000 for waters in California, also does not include criteria for magnesium.[10]

WATER QUALITY STANDARDS: HUMAN HEALTH

Neither EPA nor the State Water Board have established surface water standards for magnesium for the protection of human health.

As a point of reference, and not as a direct comparison to the appropriateness or applicability to surface water regulation, EPA has not established a maximum contaminant level (MCL) nor a secondary maximum contaminant level (SCMCL) for magnesium through the Safe Drinking Water Act. MCLs are established to protect the public against consumption of drinking water contaminants that present a risk to human health. An MCL is the maximum

[10] The California Toxics Rule, or CTR, established identical criteria to the EPA's recommended Clean Water Act section 304(a) criteria for the same pollutants published in December 1998.

allowable amount of a contaminant in drinking water which is delivered to the consumer.[11] SMCLs are established as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. These contaminants are not considered to present a risk to human health at the SMCL.[12]

303(D) LISTINGS IN CALIFORNIA

The Final 2014 and 2016 California Integrated Report (Clean Water Act Section 303(d) and 305(b) Report) does not identify any magnesium listings in the State of California.[13] Therefore, magnesium has not been identified as a pollutant in California's surface waters that impairs beneficial uses.

OTHER POTENTIAL GUIDELINES / SCREENING VALUES

EPA Region 3 Biological Technical Assistance Group used a screening value for the evaluation of sampling data at Superfund sites. A freshwater screening value of 82 mg/L was selected for magnesium.[14] The 82 mg/L value was determined as the lowest chronic exposure value for daphnids as part of a study to analyze toxicological benchmarks for screening chemicals for aquatic ecological effects.[15] While screening values are significantly different in their purpose from establishing water quality objectives, as a point of reference, this screening value is three orders of magnitude greater than the magnesium NAL.

National Academies of Sciences, Engineering, and Medicine Report on the MSGP

The National Academies reviewed the MSGP to study certain aspects of the industrial stormwater program, with an emphasis on monitoring requirements and retention standards. In its report *Improving the Next-Generation EPA Multi-Sector General Permit for Industrial Stormwater Discharges*, the National Academies made the following statements regarding benchmarks and magnesium:

> *Benchmarks should be based on the latest toxicity criteria designed to protect aquatic ecosystems from adverse impacts from short-term or intermittent exposures, which to date have generally been acute criteria. . . .* (pages 4 and 54)

> *Magnesium is a natural component of surface and groundwater and does not appear to be toxic to a majority of aquatic organisms at concentrations likely to be encountered in most waters, with reported LC50 values ranging from 780 to more than 20,000 mg/L (van Dam et al., 2010). No EPA aquatic life criterion is provided for magnesium. Nevertheless, total magnesium is listed in the MSGP as a benchmark monitoring requirement for Sector K (hazardous waste treatment, storage, or disposal facilities), with a threshold concentration of 0.064 mg/L as a benchmark. Data submitted under the 2015 MSGP show that all samples reported for Sector K exceeded the benchmark, and 83 percent of the samples exceeded eight times the benchmark. It is unclear why magnesium is a required benchmark for this sector, given the lack of toxicity at concentrations likely to be observed in industrial stormwater discharges. Therefore, the committee recommends that magnesium be removed as a benchmark monitoring requirement. . . .*(page 43)

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[11] https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals

[12] Ibid.

[13] The California State Water Resources Control Board *Final 2014 and 2016 California Integrated Report (Clean Water Act Section 303(d) List/305(b) Report)* last updated April 11, 2018, available at https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014_2016.shtml and last accessed on February 20, 2019.

[14] *EPA Region III BTAG, Freshwater Screening Benchmarks* dated July 2006, prepared by EPA.

[15] *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision* dated June 1996, prepared by the Risk Assessment Program, Health Sciences Research Division for the U.S. Department of Energy.

> *Based on little evidence of adverse effects to aquatic organisms at common levels, suspend or remove the benchmarks for magnesium and iron; benchmarks for these metals can be reinstated if/when acute aquatic life criteria are established or benchmarks are developed based on chronic effects from intermittent exposure* (pages 4 and 55).[16]

EPA plans to use the results of this study to inform its proposed revisions to the MSGP, which are anticipated in 2020. [*Ed. EPA noticed proposed revisions to the MSGP on March 2, 2020, including the removal of the magnesium benchmark.[17]]*

Impact of Exceeding the Magnesium NAL for Industrial Permittees

IGP REQUIREMENTS FOR NAL EXCEEDANCES

The IGP includes a NAL for magnesium and there are specific actions that must be followed by industrial permittees that are unable to meet the NAL value. The following section provides context with respect to the process established in the IGP to address a NAL exceedance and the associated level of effort and resources industrial permittees must expend to address the magnesium NAL.

The IGP requires permittees whose facilities exceed a NAL on an annual average basis to conduct ERAs. After the first year of exceeding an NAL, permittees enter into Level 1 ERA status and must utilize a qualified industrial stormwater practitioner (QISP) to conduct an evaluation of the pollutants that led to the NAL exceedance and train facility personnel, implement additional best management practices (BMPs), and submit a Level 1 ERA Report prepared by the QISP.

After a second year of exceeding the same NAL parameter, permittees enter into Level 2 ERA status and must submit a Level 2 ERA Action Plan prepared by a QISP. The Level 2 ERA Action Plan is required to describe plans to implement BMPs to meet the NAL or an intention to conduct and submit a natural background or non-industrial pollutant source demonstration report.

Prior to the end of the third year (or 1 year after submitting the Level 2 ERA Action Plan), permittees must submit a Level 2 ERA Technical Report prepared by a QISP. The Technical Report must present one of the following technical demonstrations:

- Industrial Activity BMPs Demonstration describing BMPs implemented to address the NAL exceedance;
- Non-Industrial Pollutant Source Demonstration describing that the NAL exceedance is attributable solely to the presence of non-industrial sources such as run-on from adjacent properties, aerial deposition from man-made sources, or as generated by on-site non-industrial sources; or
- Natural Background Pollutant Source Demonstration describing that the NAL exceedance is attributable solely to the presence of the pollutant in natural background concentrations that have not been disturbed by industrial activities.

[16] *Improving the EPA Multi-Sector General Permit for Industrial Stormwater Discharges* dated 2019, prepared by the National Academies.

[17] Notice; request for public comment. *National Pollutant Discharge Elimination System (NPDES) 2020 Issuance of the Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity*. Environmental Protection Agency (EPA). Federal Register, Volume 85, No. 41, pages 12288-12295.

BMP EFFECTIVENESS AND COST

The primary question at hand is the applicability and necessity of establishing an NAL for magnesium. Cost information is presented to provide context for the implications of exceeding the magnesium NAL.

Due to the soluble nature of magnesium, conventional BMPs will not remove typical levels of magnesium in stormwater to a concentration of 0.064 mg/L or lower. Advanced treatment is necessary and typically would involve a multi-stage process to remove suspended solid material followed by treatment to reduce soluble magnesium concentrations. According to an experienced stormwater treatment vendor, a standard installation for solids removal using chemical treatment, clarification, and filtration would cost approximately $250,000 to $450,000 for a 4-acre site with a treatment flow rate of 300 gallons per minute. Once the solids have been removed, the most likely option to achieve the magnesium NAL would be to implement reverse osmosis treatment. For the same 300-gallon-per-minute flow rate, a reverse osmosis system would cost approximately $300,000 to $600,000 and there would still be no guarantee of meeting the NAL. Additionally, a reverse osmosis system would generate a significant amount (up to 50% of the treated water volume) of concentrated reject wastewater that requires disposal, leading to high ongoing operation and maintenance costs.[18] Further, there would be additional costs to install updated drainage conveyance and pumping systems to capture stormwater and pump it to a central treatment system. Ion exchange media is another potential option for removing magnesium from stormwater. It may not be as likely to meet the NAL as reverse osmosis, but if the influent water chemistry supports the use of ion exchange, the installation costs, according to the stormwater treatment vendor, would be approximately half of the costs for the reverse osmosis system, with lower operation and maintenance costs.

If the implemented BMPs achieve compliance with the effluent limitations of the IGP, including Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to reduce or prevent pollutants in stormwater discharges and authorized non-stormwater discharges in a manner that reflects best industry practice considering technological availability and economic practicability and achievability, and the NAL cannot be achieved, then the Industrial Activity BMP Demonstration must include an additional evaluation. The evaluation must describe any additional BMPs that would reduce or prevent NAL exceedances, estimated costs of additional BMPs evaluated, and an analysis describing the basis for the selection of BMPs implemented in lieu of the additional BMPs evaluated but not implemented.

Hiring a QISP; conducting evaluations; preparing and submitting ERA reports; conducting treatability, natural background, and/or non-industrial pollutant source studies; designing and installing treatment systems; operating and maintaining BMPs and treatment systems; and constructing facility upgrades, are all significant costs to address stormwater that exceeds NALs. Directing financial resources to address magnesium NAL exceedances also has the potential to divert funding away from additional BMPs or other measures that could have much greater water quality benefits.

LEGAL LIABILITY

Regardless of how well a facility is able to complete the ERA process, a significant number of facilities in California have been subject to Clean Water Act third-party lawsuits. Exceeding NALs is often one of the claims that third-party organizations make regarding inadequate implementation of BMPs and non-compliance with the IGP. If a facility is involved with defending itself against a lawsuit or an intent to file suit, there can be significant costs associated with legal fees, consultants, and settlements.

[18] Email regarding Magnesium Treatment dated February 11, 2019 to Mr. Matt Hillyard of Farallon Consulting, L.L.C.

Conclusions and Recommendations

CONCLUSIONS

Based on the information provided above, the following conclusions can be made:

- Magnesium is a common mineral in soil, often found in concentrations exceeding 1%;
- Magnesium is present in rainfall at concentrations that may approach or exceed the NAL;
- With non-industrial sources of magnesium such as natural background concentrations in soil, aerial deposition, and rainfall, there is a high likelihood that magnesium in stormwater runoff will exceed the magnesium NAL without industrial contributions;
- Concentrations of magnesium in industrial stormwater generally are lower than concentrations measured in surface water and groundwater;
- Exceedance of a NAL by 99.9% of the stormwater sample results does not meet the IGP objective of providing feedback on industrial sources of pollutants;
- The magnesium NAL is not based on published water quality criteria;
- There is a lack of acute or chronic aquatic toxicity criteria that support the magnesium NAL;
- The concentration of magnesium in drinking water is not limited by EPA maximum contaminant level requirements;
- There are no current listings for magnesium on the California statewide Clean Water Act Section 303(d) list of impaired waters; and
- There are significant potential costs for corrective actions and legal liability associated with an exceedance of the magnesium NAL; however, these corrective actions have not been shown to provide environmental or human health benefits.

RECOMMENDATIONS

CASQA agrees with the National Academies' MSGP benchmark assessment and recommends that the State Water Board remove the magnesium NAL until sufficient information related to the acute effects of magnesium on aquatic organisms warrant the inclusion of a magnesium benchmark in the MSGP or a NAL in the IGP.