

# Brake Pad Copper Reduction - Metrics for Tracking Progress

Technical Memo

California Stormwater Quality Association

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# MEMO

**TO:** CASQA **DATE:** December 1, 2014  
**FROM:** Kelly D. Moran, Ph.D. **PROJECT:** 79  
**SUBJECT:** Brake Pad Copper Reduction – Metrics for Tracking Progress

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To protect water quality, California law requires near elimination of copper in vehicle brake pads by 2025. Many California municipal urban runoff programs are relying on brake pad copper reduction as a piece of their plans to comply with requirements to reduce copper in urban runoff. This memorandum identifies quantitative metrics that can be used to track the pace of brake pad copper reduction and provides current and baseline values for each metric.

Based on data detailed below, it is apparent that brake pad copper reductions are underway—and are well ahead of regulatory deadlines. Average brake pad formulation copper content—currently 5.6%—has dropped about 30% since 2006. “Copper-free” (<0.5% copper) brake pad formulations have become widely available, comprising 41.2% of all available formulations. Most of the vehicle industry appears to be planning to transition to <0.5% copper brake pads prior to the first copper reduction compliance deadline in 2021.

## **Background**

Scientific studies indicate that dust generated by vehicle brakes is by far the most significant source of copper in urban watersheds. In California’s most urbanized watersheds, brake pad copper is estimated to comprise more than 60% of all copper in urban runoff.<sup>1</sup> A California law enacted in 2010, SB 346 (Kehoe) set in place a program that will nearly eliminate copper use in brake pads. SB 346 requires that brake pads sold in California contain no more than 5% copper by weight by 2021, and no more than 0.5% by 2025. The long implementation schedule in SB 346 was designed to provide time to develop new brake pad formulations and to effect a smooth transition by the vehicle industry to the lowest copper brake pads.

Following California’s model, the State of Washington also enacted restrictions on brake pad copper content in 2010 (Washington State 2010).<sup>2</sup> Washington’s law is similar to California’s, but provides a much narrower exemption for “aftermarket” brake pads that replace the “original equipment” brake pads sold with new vehicles. The narrow exemption effectively requires essentially all brake pads to meet SB 346 deadlines.

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<sup>1</sup> Donigian, A.S., B. R. Bicknell and E. Wolfram (2009). *Modeling the Contribution of Copper from Brake Wear Debris to the San Francisco Bay. Phase 2*. Prepared by AQUA TERRA Consultants for the Brake Pad Partnership.

<sup>2</sup> Washington State (2010). Washington Senate Bill 6557 (Senate Environment, Water & Energy Committee). Brake Friction Material. Statutes of 2010, Chapter 70.285 RCW.

Due to the importance of California's vehicle market and the interconnection of vehicle parts distribution systems throughout North America, brake pad manufacturers expect that it is unlikely that any manufacturer will produce California-specific or Washington-specific products. Instead, copper reduction will be integrated throughout the entire North American brake pad market.<sup>3</sup> U.S. EPA and the vehicle industry will likely soon be signing a "Copper-free Brake Initiative" Memorandum of Understanding to cement an industry commitment to nationwide brake pad copper reductions.

SB 346 compliance certification markings (brake pad and box markings) and chemical testing methods have been established by the automobile industry.<sup>4</sup> Washington State has adopted regulations specifying testing, marking, and reporting requirements.<sup>5</sup> California regulations specifying certification, testing, and marking requirements are in development.<sup>6</sup>

The brake pad testing and certification system is up and running, with NSF International serving as the sole certification organization. More than 4,500 brake friction materials have been certified, many of them with at lowest copper (<0.5%) level.

Brake pad copper reduction is already well underway, as demonstrated by the data below. The success and speed of the transition was plainly apparent at the October 2014 Society of Automotive Engineers Brake Colloquium, where many brake pad manufacturers touted their <0.5% copper products and several vehicle manufacturers shared their positive evaluation of the new products and detailed plans for an orderly transition of their entire North American vehicle lines—and most global production—to <0.5% copper by 2021.

Society of Automotive Engineers conference presentations, industry marketing materials, and informal communications with industry members indicate that most of the automotive industry is moving directly to <0.5% copper for the 2021 compliance deadline, thus avoiding a second cycle of reformulations.

### **Brake Pad Copper Reduction Tracking Metrics**

Publicly available data sources were reviewed to identify the best available quantitative metrics for tracking brake pad copper reductions. Because manufacturer sales data are proprietary, no public data set is available to calculate actual on-road brake copper content; however, two excellent quantitative metrics are available to track the pace of brake pad copper content reduction.

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<sup>3</sup> Motor and Equipment Manufacturers Association (MEMA) (2014). "Copper in Brake Friction" <http://www.aftermarketsuppliers.org/Councils/Brake-Manufacturers-Council-BMC/Copper-in-Brake-Friction> Accessed Nov. 7.

<sup>4</sup> Society of Automotive Engineers (SAE) (2011). *Measurement of Copper and Other Elements in Brake Friction Materials*. SAE Technical Standard J2975; Society of Automotive Engineers (SAE) (2012). *Friction Coefficient Identification and Environmental Marking System for Brake Linings*. SAE Technical Standard J866; Motor and Equipment Manufacturers Association (MEMA) (2012). 3-Stage Certification Logo.

<sup>5</sup> Washington Department of Ecology (2012). *Better Brakes Rule*. Chapter 173-901 Washington Administrative Code. Publication 12-04-027.

<sup>6</sup> California Department of Toxic Substances Control (2014). "Limiting Copper in Brake Pads" <http://www.dtsc.ca.gov/PollutionPrevention/BrakePads.cfm> Accessed Nov. 7.

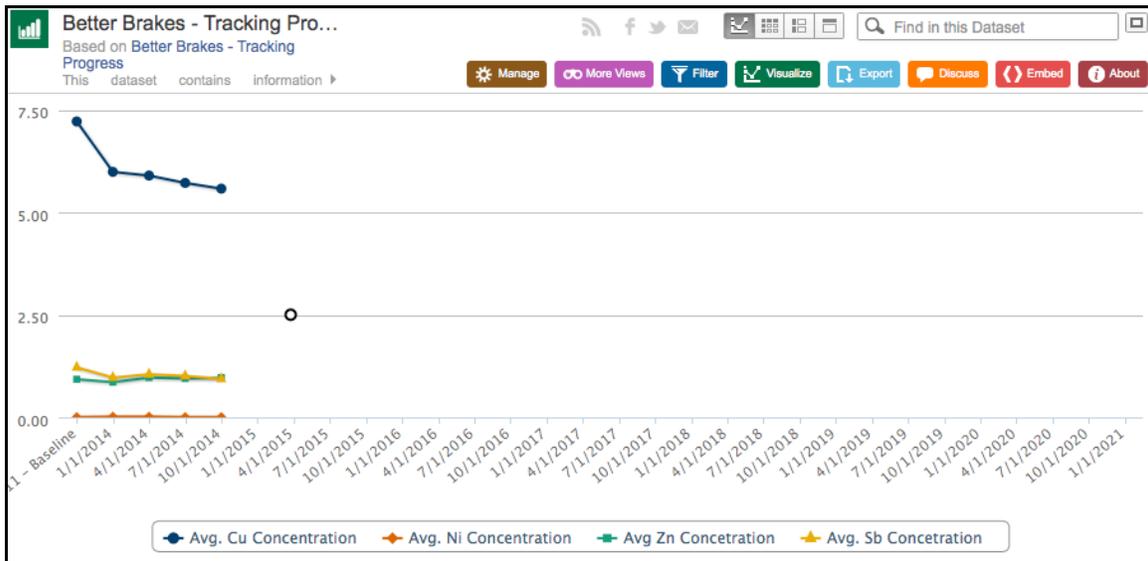
### Metric #1 - Washington Ecology Report of Industry-Wide Average Brake Pad Formulation Copper Content

Unlike California’s SB 346, Washington law requires manufacturers to provide Washington State Department of Ecology (“Ecology”) with periodic reports of brake pad copper, antimony, nickel, and zinc content.<sup>7</sup> This reporting is accomplished in conjunction with the brake pad formulation certification process. After certification, the brake pad certification organization (NSF International) provides Ecology with quarterly reports containing a summary of the chemical testing report for each certified brake pad formulation. The chemical testing report includes the formulation’s copper, antimony, nickel, and zinc content. The Washington process included a one-time “baseline” report of the copper, antimony, nickel, and zinc content in 2011 brake pad formulations.

Ecology uses the data it receives on each individual formulation to compute the industry-wide average copper, antimony, nickel, and zinc content for all certified brake pad formulations. Because manufacturers are not required to report sales data for each brake pad formulation, Ecology cannot calculate the true average on-road brake pad copper content. Consequently, the Ecology industry-wide average may not necessarily be the same as the true average on-road brake pad copper content.

Ecology has created a graph tracking the average certified brake pad formulation copper, antimony, nickel, and zinc (Figure 1). The graph shows the 2011 baseline values and data from quarterly reports, which started in January 2014. This graph is available on the Internet at [http://www.ecy.wa.gov/programs/hwtr/laws\\_rules/BBtracking.html](http://www.ecy.wa.gov/programs/hwtr/laws_rules/BBtracking.html)

**Figure 1. Washington Ecology Tracking Graphic for Average Copper, Antimony, Nickel, and Zinc Content of Certified Brake Pad Formulations**



Ecology intends to update the graph quarterly. Resources permitting, updates should be posted in each year in early February, May, August, and November.

<sup>7</sup> This provision, which was originally drafted by CASQA to support anticipated compliance reporting needs of its members, was omitted from the final version of SB 346 to avoid duplication with the Washington law (which had already been adopted) and to minimize costs for the state of California.

According to a representative industry analysis provided to the Brake Pad Partnership, in 2006 brake pads contained an estimated average of about 8% copper by weight.<sup>8</sup> Ecology data indicate that brake pad copper content dropped to about 7.2% in 2011, and has subsequently fallen to 5.6% (October 2014), a 30% reduction from the 2006 Brake Pad Partnership estimate.

#### Metric #2 – Fraction of Brake Pad Formulations with the “N” (<0.5% copper) Certification

The sole current brake pad certification organization, NSF International, maintains a public list of all brake pad formulations that have been certified as to their copper content (and other metals and asbestos). The list, which provides the specific certification level for each certified formulation, is available in the Internet at <http://info.nsf.org/Certified/autorp/listings.asp?standard=SAEJ2975>. This report is updated daily with new certifications. Brake pad formulations with <0.5% copper have the “N” certification.

As of November 7, 2014, NSF had certified 4,679 formulations, 1,931 (41.2%) of which have the “N” certification (the remainder have higher copper content). This is a substantial increase since 2006, when about 18% of original equipment and about one-third of replacement (“aftermarket”) brake pads were estimated to contain <0.5% copper.<sup>9</sup> Just in the short period since July 24, 2014, the number of “N” certified brake formulations has increased nearly 20%, and the fraction of “N” certified brake pads has increased from 39.2% to 41.2%.<sup>10</sup> Although the NSF website does not provide lists other than the current list, the trend can be tracked through periodic downloading of the NSF certification list.

At this time, no brake pad certification organization other than NSF International exists. Although additional certification organizations are not currently contemplated, there is a potential that the industry may use more than one certification organization. When this metric is updated, data from all certification organizations should be included.

#### **Summary**

Two quantitative metrics are available to track the pace of brake pad copper content reduction: (1) the Washington Ecology report of industry-wide average brake pad formulation copper content and (2) the fraction of brake pad formulations with the “N” (<0.5% copper) certification.

Currently, copper brake pad formulations meeting the lowest copper content standard (<0.5% copper) are widely available. Average brake pad formulation copper content (5.6%) has dropped about 30% since 2006. Most of the vehicle industry appears to be planning to transition to <0.5% copper brake pads prior to the first SB 346 copper reduction compliance deadline in 2021.

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<sup>8</sup> Brake Pad Partnership (BPP) (2008). *Copper Use Monitoring Program Results for Model Years 1998-2006*. Prepared by Sustainable Conservation for the Brake Pad Partnership Steering Committee.

<sup>9</sup> Phipps, M. (2008). “An Analysis of the 2006 Copper Monitoring Results.” Prepared for the Brake Pad Partnership; and Brake Pad Partnership (BPP) (1996-2012), and information shared with author at Brake Pad Partnership Steering Committee meetings.

<sup>10</sup> On July 24, 2014, 1,612 of 4,108 total formulations had the “N” certification.