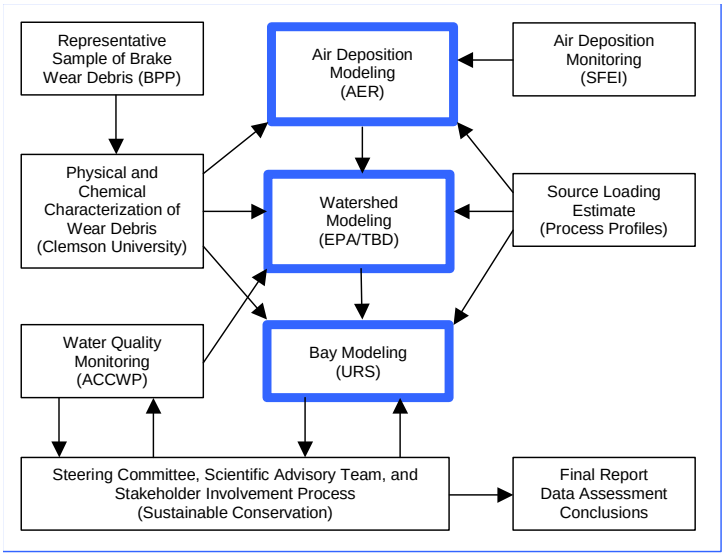
Brake Pad Partnership Update *Fall 2006*

The Brake Pad Partnership is a multistakeholder effort to understand the impacts on the environment that may arise from brake pad wear debris generated in the use of passenger vehicles. Manufacturers, regulators, stormwater management agencies, and environmentalists are working together to understand the impacts that may arise from brake pad wear debris generated by passenger vehicles on the environment. BPP efforts are aimed at developing an approach for evaluating potential impacts of copper from brake pads affecting water quality in the South San Francisco Bay as an example. Brake pad manufacturers have committed to adding this evaluation approach to their existing practices for designing products that are safe for the environment while still meeting the performance requirements demanded of these important safety-related products.

BPP Technical Studies Update



The Brake Pad Partnership (BPP) is conducting a set of interlinked laboratory, environmental monitoring, and environmental modeling studies to understand the fate and transport of copper from automobile brake pad wear debris in the environment. The figure on the left illustrates the relationships among the studies.

At the core of the Partnership's effort are three environmental modeling studies:

- Air Deposition Modeling—to predict the deposition rate for brake pad wear debris that is initially airborne.
- Watershed Modeling—to estimate how much of the copper released from brake and nonbrake sources washes into surface waters and the storm drainage system and eventually reaches the waters of the San Francisco Bay.
- Bay Modeling—to determine whether and, if so, to what extent copper from brake pad wear debris affects short- and long-term concentrations of copper in the bay.

In support of these modeling efforts, the Partnership has conducted additional studies to develop accurate input data for the models. Air deposition monitoring provided data necessary for comparison with the modeled results as a part of the air deposition model evaluation. Stormwater monitoring data were collected to help calibrate and validate the watershed modeling. In addition, the Partnership conducted physical and chemical characterization analyses of brake pad wear debris.

Since the last BPP Update in Spring of 2005, the Partnership has completed its work on air deposition and water quality monitoring, chemical characterization of a representative sample of nonairborne brake pad wear debris, and estimating the amount of copper released to the watershed from brake and nonbrake sources. Significant progress has been made in all three modeling efforts as well. In addition, a stakeholder conference was held in June 2005 during which overviews of all the technical efforts were presented.

The BPP has also met some important challenges in its work. In late 2005, as a result of the technical peer review process on the draft Watershed Modeling Work Plan, the BPP identified the need to better understand the land use and land cover data sets being used as inputs to the watershed deposition and air deposition models. The BPP conducted an intensive analysis of the available data sets to determine which ones would provide the most appropriate inputs for air deposition and watershed modeling efforts with respect to road surface area and directly-connected impervious surface area. The results of this assessment are now available on the BPP website and have been incorporated into the air deposition and watershed modeling efforts.

In early 2006, the BPP learned that it would need to revamp its plans for completing the watershed modeling. Originally, the U.S. Environmental Protection Agency (EPA) had agreed to perform the watershed modeling work for the Partnership as part of their BASINS model development for urban watersheds. However, due to personnel changes at the agency, EPA is no longer able to perform the watershed modeling but does provide technical advice for the modeling. As a result, Sustainable Conservation worked with the California Department of Transportation (Caltrans) to secure funding for the completion of the work by a technical contractor. The Caltrans support became available in November 2006, allowing us to proceed with the work.

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While the Steering Committee believes that meeting these challenges has ultimately strengthened the BPP's work, it has also produced delays. As a result, the technical studies are now scheduled for completion in late 2007. The Steering Committee members are ensuring that everything that can be done to streamline completion of the remaining technical studies without compromising their integrity is being pursued.

More detailed descriptions of recent BPP accomplishments are given below.

Estimates of Copper Loads to the Watershed Prepared

Estimates of releases of copper from both brake lining wear and nonbrake sources in the San Francisco watershed were finalized after review by the steering committee, technical experts, and stakeholders. Releases were estimated for each of 23 modeled subwatersheds within the greater watershed area, and include an estimate of the uncertainty. Airborne and roadway releases of copper from brake lining were estimated separately. Categories of nonbrake copper sources that were inventoried are architectural copper, copper in pesticides (which includes pesticides applied to land in urban areas, agricultural land applications, algaecide treatment of surface waters, pressure-treated wood preservatives, marine antifouling coatings, and pool, spa, and fountain algaecides), copper in fertilizers, copper releases from industrial facilities, and copper in domestic water discharged to storm drains. The reports describing these efforts are available on the BPP website at http://www.suscon.org/brakepad/pdfs/BrakeSourcesReportFinal01-30-06.pdf and http://www.suscon.org/brakepad/pdfs/NonBrakeSourcesReportFinal01-30-06.pdf

Air Deposition Monitoring Completed

Don Yee and Amy Franz at the San Francisco Estuary Institute (SFEI) completed their study of atmospheric deposition in Castro Valley. Bulk, dry, and precipitation deposition samples of copper and other trace metals and organic pollutants were collected at four sampling sites. Gaseous samples for a few of the sampling events were analyzed for benzene as well. After review by the BPP steering committee, independent experts, and stakeholders, the air deposition monitoring report was finalized and can be found on the BPP website at http://www.suscon.org/brakepad/pdfs/SFEI_CastroValleyAirDepositionStudyFINALReport23May05.pdf

Air Deposition Modeling for Castro Valley Completed

Betty Pun, Kristen Lohman, and Christian Siegnur of AER submitted their final report on air deposition modeling of brake pad wear debris after review by the steering committee, technical experts, and stakeholders. In this effort, a box model was used to simulate the regional background of copper and a detailed source-based disperson model was used to simulate local deposition rates. Resuspension of brake pad wear debris that was initially released to air and subsequently deposited on roadways was considered. The final report is available on the BPP website at http://www.suscon.org/brakepad/pdfs/AERairdepmodelingReportFinal07-27-06.pdf

Interested in Getting Involved in the Brake Pad Partnership?

For information on how to participate in the Brake Pad Partnership's (BPP) efforts, please subscribe to the BPP list-serve by sending a blank e-mail to BPP-list-serve-subscribe@topica.com. You will receive project updates, information on the availability of draft and final reports and the opportunity to provide your input, along with information on upcoming stakeholder events. Use of the BPP list-serve is reserved exclusively for disseminating and sharing information about the BPP.

Water Quality Monitoring Report Finalized

After review by a panel of stakeholders, steering committee members, and technical experts, the results of the 2003-2004 Castro Valley Creek Water Quality Monitoring Project were finalized. In this study, total copper and total suspended solids were measured in 54 time-weighted and 45 flow-weighted samples taken from Castro Valley Creek during nine storm events. The report for this project, which also provides tabulated stream flow data at the sample collection point and rainfall data from four rain gauges in Castro Valley, was prepared by the Alameda Countywide Clean Water Program and is available on the Partnership's website at http://www.suscon.org/brakepad/pdfs/BPP-WQSamplingResults_final_rtf.pdf

2005/2006 Accomplishments

Technical Studies

- Secured $100,000 in funding from Caltrans to pay for watershed modeling effort
- Identified potential replacement contractors for watershed modeling (replacing EPA's Office of Water)
- Conducted evaluation of land use/land cover data selection for watershed modeling
- Approved two work plans:
  - Bay Modeling
  - Release Estimates of Copper from Nonbrake Sources
- Finalized six reports:
  - Water Quality Monitoring
  - Air Deposition Monitoring
  - Release Estimates of Copper from Brake Pads
  - Release Estimates of Copper from Nonbrake Sources
  - Chemical Characterization of Nonairborne Brake Pad Wear Debris
  - Castro Valley Air Deposition Modeling

BPP Reports

- Brake Pad Partnership, January 2006, *Copper Use Monitoring Program Results for Model Years 1998–2004*

Stakeholder Involvement / Public Outreach and Communication

- Held Stakeholder Conference on June 22, 2005

Technical Work Product Review Status

Technical Work Product	Review Status
Air Deposition Modeling	
Work Plan	Finalized January 2004
Castro Valley Report	Finalized July 2006
Watershed Modeling	
Work Plan	Finalized November 2004
Report	Draft report due April 2007
Bay Modeling	
Work Plan	Finalized August 2006
Report	Draft report due September 2007
Characterization of Airborne Brake Pad Wear Debris	
Work Plan	Finalized May 2004
Report	Re-finalized January 2006
Chemical Characterization of Nonairborne Brake Pad Wear Debris	
Report	Finalized April 2006
Loading Estimate of Copper from Brake Pads	
Work Plan	Finalized May 2005
Report	Finalized January 2006
Loading Estimate of Copper from Nonbrake Sources	
Work Plan	Finalized May 2005
Report	Finalized January 2006
Water Quality Monitoring	
Report	Finalized April 2005
Air Deposition Monitoring	
Work Plan	Finalized January 2004
Report	Finalized May 2005
Project Management and Final Report	
Operations and Communications Plan	Finalized March 2004
Final Report	Draft report anticipated November 2007

Technical Consultants

Air Deposition Modeling
Atmospheric and Environmental Research, Inc.

Watershed Modeling
Aqua Terra and US EPA

Estimation of Copper Released from Brake and Nonbrake Sources
Process Profiles

Chemical and Physical Characterization of Brake Pad Wear Debris
Clemson University

Bay Modeling
URS Corporation

Air Deposition Monitoring
San Francisco Estuary Institute

Stormwater Monitoring
Alameda Countywide Clean Water Program

Project Contracting and Fiscal Management
San Francisco Estuary Project

Project Coordination and Technical Management
Sustainable Conservation

Analysis of Land Use/Land Cover Data

In 2005, it was brought to the attention of the partnership that a systematic analysis of land use and land cover data was necessary in order to arrive at appropriate data for land use and land cover, particularly with respect to estimating roadway surfaces and directly connected impervious surface area for the modeling efforts. Data sets on land use and land cover for two years from the USGS and one data set from ABAG vary in their level of completeness and temporal applicability. In addition, there is information on various aspects of land use and land cover from county assessor's data, the US Census Bureau TIGER database, ESRI's road database, and the Alameda County Road Database. A memo detailing the rationale behind selection of land use data sets for the various modeling efforts and for calculating the source load estimates was written by Sarah Connick and Connie Liao and is available on the BPP website at http://www.suscon.org/brakepad/pdfs/LandUseDataforModelsandEstimatesMemoFinal(02-01-06).pdf

Alexis Dufour and Terry Cooke of URS conducted an analysis of the data sets in order to compare estimates of total impervious area and to recommend a procedure for the BPP to estimate directly connected impervious area and the uncertainty in directly connected impervious area. They found that NLCD impervious layer estimates were systematically lower than local agency estimates, and they recommended the application of an empirical relationship (Alley and Veenhuis, 1983) to estimate directly connected impervious area. A memorandum detailing their analysis can be found on the BPP website at http://www.suscon.org/brakepad/pdfs/URSMemoTIA-DCIA-04-04-06.pdf

Bay Modeling Work Plan Completed

The BPP's bay modeling effort will be conducted by Terry Cooke and his colleagues at URS Corporation. After steering committee, stakeholder, and independent expert review, a finalized work plan for bay modeling has been developed. This work plan is available on the BPP website at http://www.suscon.org/brakepad/pdfs/Bay_Modeling_Workplan_Final_URS_09-01-06.pdf.

Chemical Characterization of Nonairborne Brake Pad Wear Debris Completed

Clemson University researchers Mark Schlautman and Ashley Haselden completed the chemical characterization of a representative sample of nonairborne brake pad wear debris. This debris was collected from the test apparatus and surrounding surfaces after being generated from a reasonably representative sample of brake lining material on a brake dynamometer. Total copper and iron content was determined, as well as the solubility and leaching potentials of copper and iron from the sample. The concentrations of copper and iron in nonairborne brake pad wear debris were found to be higher than for the airborne fraction. The researchers' findings were finalized after review by the BPP steering committee, independent experts, and stakeholders. A copy of their final report can be found on the BPP website at http://www.suscon.org/brakepad/pdfs/ChemicalCharacterizationofNonAirborneRepresentativeBPWDfinalReport(April2006).pdf

Model Year 2004 Copper Use Data Available

The Brake Manufacturers Council Product Environmental Committee reported data on the use of copper in 22 of the top 25 best selling vehicles for model year 2004. The data indicate that there was a slight decrease in copper used in vehicle brakes in comparison to the previous year, although copper use in 2004 was higher by about 60 percent than it was when the voluntary monitoring program began in 1998. This increase in copper is due mainly to the large number of vehicles that adopted copper containing pads to satisfy vehicle legal and comfort requirements rather than an increase in the percent copper in brake pads. The Copper Use Monitoring Program Results for Model Years 1998-2004 is available on the Partnership's website at http://www.suscon.org/brakepad/pdfs/FinalCuUMPReport01-11-06.pdf

Copper Regulations Impact Southern California

New copper TMDLs with aggressive compliance schedules have been put in place or are proposed for many water bodies in Southern California. As a result, water quality interests in Southern California have become keenly interested in potential sources of copper in stormwater. The BPP, particularly steering committee members Kelly Moran and Michael Endicott, along with BASMAA representatives, have been active in disseminating information about the status, goals, and accomplishments of the BPP project and its relevance to the needs of entities in Southern California. The BPP Steering Committee members are looking forward to working more closely with these Southern California interests.

Stakeholder Conference Held

A stakeholder conference was held on June 22, 2005. This well-attended conference was hosted by Pacific Gas and Electric Company in San Francisco. PowerPoint files for each of the presentations as well as the agenda can be viewed at http://www.suscon.org/brakepad/documents.asp. The next stakeholder conference will be held sometime in 2007.

Funding for this project has been provided in full or in part through an Agreement with the State Water Resources Control Board (SWRCB) pursuant to the Costa-Machado Water Act of 2000 (Proposition 13) and any amendments thereto for the implementation of California's Nonpoint Source Pollution Control Program. The contents of this document do not necessarily reflect the views and policies of the SWRCB, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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BPP Scientific Advisory Team

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Mark Schlautman, Clemson University, co-chair

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Estimating Copper Loadings to the Watershed

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