

SPAWAR Validates New Tool for Quantifying Copper and Zinc in Stormwater

WinSLAMM Use Supports Development of Control Practices to Reduce Metal Concentrations

A PROJECT SPONSORED by the Navy Environmental Sustainability Development to Integration (NESDI) program recently completed the development of a modeling tool to identify source areas of copper and zinc on Navy facilities. The simple spreadsheet tool and guidance document, available this spring from the Defense Technical Information (DTIC) website at www.dtic.mil, should be used when developing and implementing control practices to reduce metal concentrations in stormwater runoff.

tively high particle and metal concentrations. At Navy facilities, stormwater copper and zinc concentrations commonly exceed National Pollutant Discharge Elimination System (NPDES) permit benchmarks, creating the potential for Notices of Violation and civil lawsuits.

Identifying the relative magnitude of metal sources in a drainage is a first step in determining how to best mitigate them. The NESDI project demonstrated and validated an off-the-shelf

the University of Alabama, the originator of the WinSLAMM model.

Calibrating WinSLAMM

WinSLAMM, developed by PV & Associates, is a small-scale watershed hydrology modeling tool that has been applied to various industrial and municipal sites around the country. While widely used, the model requires the input of land-use specific data to optimize its predictive accuracy in quantifying stormwater conta-

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How Metals Form in Stormwater Runoff

Elevated metal concentrations in stormwater runoff are a serious issue in urban and industrial areas around the country. At Navy facilities, a high percentage of impervious surfaces, condensed industrial operations, and high vehicular traffic generally combine to generate runoff with rela-

stormwater model known as the Windows Source Loading and Management Model (WinSLAMM) to quantify relative metal source areas specifically for Navy facilities. The project was performed by the Energy and Environmental Sciences Group at the Space and Naval Warfare Systems Command, Systems Center Pacific in collaboration with Dr. Robert Pitt of

minant loading. The project effort therefore focused on gathering Navy facility-specific source and stormwater parameter data to calibrate, validate, and optimize the model for Navy use.

WinSLAMM was successfully calibrated for Navy facilities based on a comparison of over 300 datasets and detailed site characterizations from 19 separate drainage areas at 11 bases

across Navy Regions Southwest, Northwest, and Mid-Atlantic. Each drainage area was characterized by detailing land use specifics, stormwater management, practices and stormwater conveyance systems. The characterization was done using a combination of site visits, available Geographic Information System data, and aerial photos.

The calibrations were developed using land use data along with detailed regional historical rainfall and stormwater discharge data for each site. The final regional calibrations were evaluated by comparing the model results to the historical discharge datasets.

Part of this project included a leachate study, which measured the relative amount of copper and zinc that was generated from common materials when exposed to water, a surrogate to actual runoff. The materials leaching significant copper included hull paint, galvanized and brass metal, and treated wood products. The materials leaching significant zinc included items made of galvanized metal

including scaffolding, storm drain grates, stairs, building materials, and artificial turf. Charts listing these and other common sources are included in the final report.

Using the Model

It was determined that a simple-to-use spreadsheet tool would be the best method for time-pressed facility managers to implement the model. A spreadsheet tool was therefore developed from WinSLAMM that has all of the underlying calibration calculations for the three Navy regions.

Because variations in rainfall differ greatly from one geographical region to another, a spreadsheet was generated for each of the three Navy Regions where the calibration was performed. For example, the Navy Region Southwest calibration was based on San



Example of a street/parking area with an indirect connection to the storm drain conveyance system.

Diego area rainfall, which is generally characterized by intense, short duration storms with limited overall totals, and long dry periods. Rains in the San Diego area are characterized as being heavily seasonal with most of the rain occurring from the late fall to spring, and with a long dry period during the summer. Calibrations for regions Northwest and Mid-Atlantic were based on very different seasonal patterns. Navy installation environmental managers should follow the model that meshes most closely with the climate and rainfall patterns in their area.

Facility managers must perform a site characterization before the spreadsheet tool can be run. This is a crucial but potentially a time-consuming step to measure out the spatial extent of the site as defined by 53 pre-defined land use cate-

The leachate report evaluated various materials for their relative contributions of copper and zinc as a result of washoff.





This roughly 1000-square foot heavy laydown area contains roughly 75 percent galvanized materials. These statistics would be entered into the WinSLAMM spreadsheet tool to identify relative sources in a drainage area.

gories, and to list all materials present. Specific guidance is provided in the project report on how to best perform the site characterization, which includes walking the site and reviewing what structural materials are present, to what extent, and how they're connected to the storm conveyance system.

The project has created a simple tool that facility managers can use to identify where and relatively how much copper and zinc are generated throughout their drainages. The tool can be used when developing strategies to implement control practices to meet compliance.

The final report contains a table of the top 14 industrial source land uses for both copper and zinc across all three regions to provide a general overview of relative sources. The report appendices provide information on measured source strengths of many common materials found on Navy facilities, specific guidance with an example for conducting a site characterization, and the model calibration reports including candidate stormwater control practices with a measure of their potential effectiveness in each of the three Navy regions. The spreadsheet tool will be included as a CD with the hard copy of the final report and will also be available



Galvanized metal leaches significant amounts of both copper and zinc.

electronically. For a hard copy, contact the Principal Investigator at the information provided below. The report may also be downloaded from the NESDI program's web site at www.nesdi.navy.mil under project 455 (username and password required). 

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