State of California
Regional Water Quality Control Board
San Diego Region

EXECUTIVE OFFICER SUMMARY REPORT
September 13, 2006

ITEM: 8

SUBJECT: Status Report on the toxicity limitation established in the NDPES Permits for industrial storm water discharges to San Diego Bay from U.S. Navy facilities. The report will include a discussion of the U.S. Navy's May 2006 Report on Storm Water Toxicity Evaluation *(Michael McCann)*

PURPOSE: Receive a staff report assessing the U. S Navy's May 2006 report on industrial storm water discharges to San Diego Bay

PUBLIC NOTICE: The Agenda notice for the Sept. 13, 2006, Regional Board meeting serves as a public notice for this item.

DISCUSSION: On May 18, 2006 the U.S. Navy submitted a technical report on toxicity in industrial storm water discharges to San Diego Bay in response to a requirement established in the NDPES permit, Order No. R9-2002-002, for the Naval Base Point Loma (referred to as SUBASE). At the June 14 meeting the US Navy provided the Regional Board a presentation on the report and their recommendations for modifications of the toxicity limitation in the permit. As part of the agenda material for the June 14 meeting, the Regional Board was provided a copy of the report. Attached as Supporting Document No. 2 a copy of a summary of the Navy's report with their recommendations.

Specifically, the Discharge Specifications 4.a and 4.b of the NPDES permit read as follows:

"4.a For the SUBASE facility, effective 4 years after adoption of this Order, in 96-hour static or continuous flow bioassay (toxicity) test, undiluted storm water runoff associated with industrial activity shall not produce less than 90% survival, 50% of the time, and not less than 70% survival 10% of the time, using standard test species and protocol.

4.b During the 4-year period before the effective date of the toxicity limit set forth in *paragraph a.* of this *Specification*, the

US Navy shall conduct a study of the toxicity in storm water discharges from all areas of SUBASE at which industrial activities are undertaken and shall recommend a scientifically valid survival rate for acute exposure to discharges of storm water from industrial areas at SUBASE. The study may include a Toxicity Identification Evaluation (TIE), or a Toxicity Reduction Evaluation (TRE)."

September 11, 2006 marks the end of the 4-year period when the existing toxicity limit comes into effect and becomes enforceable. The US Navy is seeking a less stringent toxicity limitation based on the information provided in the report.

In 2002 during the process of the adoption of the existing order, the US Navy questioned the scientific bases of the toxicity limit established in the order. This toxicity limitation established in the order is the limit specified for toxicity in the State Board's Water Quality Control Policy for the Enclosed Bays and Estuaries of California, November 1995.

A technical review of the US Navy's report has been conducted by the Regional Board. In addition, technical assistance in the review of the report has been requested of the State Water Resources Control and the US Environmental Protection Agency. The results of their review have not yet been received.

The review of the Navy's report, Supporting Document No. 1, concludes that the Navy is very close to complying the existing toxicity limitation. With continued progress by the Navy to reduce the pollutant load in rain runoff from their industrial areas, the Navy is likely to achieve consistent compliance with the toxicity limitation.

Also, the Navy's recommended alternatives do not appear to be supported by the report. Toxicity in the storm water discharges clearly exists and should not be ignored. Toxicity in the discharge should not be discounted or considered less because the causative agents, namely copper and zinc, are diluted in bay water.

The Navy's report does not warrant significant changes to the permit's toxicity limitation. The report, however, identifies revisions to the permit that include the following:

1. Toxicity test results need to be statistically compared against control samples before declaring a sample as toxic.

2. The use of mussel *Mytilus galloprovincialis* should be considered as a substitute for one of the test species currently required for toxicity testing.

SUPPORTING DOCUMENTS:

1. Staff Report dated Sept. 1, 2006

2. Navy's Proposed Alternative Toxicity Requirements for Industrial Storm Water Discharges—A summary of the Navy's report

RECOMMENDATION(S): This is an informal item only.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

Subject: REVIEW OF US NAVY REPORT ON TOXICITY LIMITATION ESTABLISHED FOR INDUSTRIAL STORM WATER DISCHARGES TO SAN DIEGO BAY FROM US NAVY FACILITIES

Sept. 1, 2006

From: Michael McCann, James Smith, and Alan Monji

CONCLUSIONS FROM REVIEW OF THE REPORT

The industrial storm water discharges from the three Naval bases are not that far from complying with the current toxicity limitation in the Navy's three permits which require that:

> "For the [Naval Facility] facility, effective 4 years after the adoption of this Order, in a 96-hour static or continuous flow bioassay (toxicity) test, undiluted storm water runoff associated with the industrial activity shall not produce less than 90% survival 50% of the time, and not less than 70% survival, 10% of the time, using standard test species and protocol."

The Report shows (Table 43 of the Report) that 90 percent survival is achieved 42 percent of the time and that 70 percent survival is achieved 72 percent of the time in first flush samples when data from all four bases are pooled. These numbers are likely to improve if sample results are compared against valid control results, instead of against simple numeric criteria. These results may indicate that meeting permit conditions will prevent toxicity in San Diego Bay as very little toxicity has been observed in the receiving waters.

2. The two alternatives proposed in Navy's report are not supported by their report. Toxicity in the storm water discharges are evident and should not be ignored. Clearly, San Diego Bay is demonstrating significant negative impacts,

particularly in the bay sediments, from those pollutants from sources that are also contained in the Navy's discharge. Also, toxicity in the Navy's discharge should not be discounted because the causative agents are diluted in bay water.

RECOMMENDATIONS

1. The Report reveals areas that should be considered for revision of the permits that cover the industrial storm water discharges from the Naval bases:
   a. Toxicity test results need to be statistically compared against control samples before declaring a sample as toxic.
   b. The use of the mussel *Mytilus galloprovincialis* should be considered as a substitute for one of the test species currently required for toxicity testing.
   c. Further investigation into the ultimate fate of the storm water discharge pollutants (especially copper and zinc) should be prioritized for investigation.

2. The following activities by the Navy need to be considered to further understand the source and fate of pollutants from the naval bases and to ensure that storm water discharges are not toxic.
   a. Conduct further investigations into the ultimate fate and transport of copper and zinc released into San Diego Bay from the industrial discharges of the naval bases.
   b. Conduct Toxicity Identification Evaluations (TIE) to the next level to identify the sources of metals in the industrial storm water discharges.

The review's conclusions and recommendations by James Smith and Alan Monji are contained in the review document dated August 25 (Attachment No. 1).

BACKGROUND

On May 18, 2006 the U.S. Navy submitted a technical report on toxicity on industrial storm water discharges to San Diego Bay in response to a requirement

established in the NDPES permit, Order No. R9-2002-002, for the Naval Base Point Loma (referred to as SUBASE).

Specifically, the Discharge Specifications 4.a and 4.b of the NPDES permit read as follows:

"4.a For the SUBASE facility, effective 4 years after adoption of this Order, in 96-hour static or continuous flow bioassay (toxicity) test, undiluted storm water runoff associated with industrial activity shall not produce less than 90% survival, 50% of the time, and not less than 70% survival 10% of the time, using standard test species and protocol.

4.b During the 4-year period before the effective date of the toxicity limit set forth in *paragraph a.* of this *Specification*, the US Navy shall conduct a study of the toxicity in storm water discharges from all areas of SUBASE at which industrial activities are undertaken and shall recommend a scientifically valid survival rate for acute exposure to discharges of storm water from industrial areas at SUBASE. The study may include a Toxicity Identification Evaluation (TIE), or a Toxicity Reduction Evaluation (TRE)."

September 11, 2006 marks the end of the 4-year period when the existing toxicity limit comes into effect and becomes enforceable. The US Navy is seeking a less stringent toxicity limit based on the information provided in the report.

In 2002 during the process of the adoption of the existing order, the US Navy questioned the scientific basis of the toxicity limit established in the order. This toxicity limit established in the order is the limitation specified in the State Board's Water Quality Control Policy for the Enclosed Bays and Estuaries of California, November 1995.

Subsequent to the adoption of the NDPES permit for the SUBASE, the Regional Board adopted similar NPDES permits for the two other Navy facilities in San Diego Bay—Naval Base San Diego and Coronado Amphibious Base. All three permits have established the same toxicity limitation for industrial storm water. The permit expiration dates for the three permits are as follows: SUBASE Sept. 11, 2007; Naval Base San Diego Nov. 13, 2007; Amphibious Base Coronado May 14, 2008.

During the 4 year period of the Navy's study, the Navy appeared twice before the Regional Board to provide a status of the study. On March 9, 2005 the Regional Board heard a status report. Then at the June 14, 2006 meeting, the US Navy provided the Regional Board a presentation on the final report and recommendations for modifications of the toxicity limitation. As part of the agenda material for the June 14 meeting, the Regional Board was provided a copy of the report.

In June 2004 the Regional Board provided written comments (Attachment No. 2) to the Navy on the proposed technical approach to evaluate storm water toxicity.

Attachment No. 3 is copy of an Executive Officer Item dated July 14, 2004.

In February 2004 the Navy submitted questions to the State Water Resources Control Board about this Regional Board's establishment of the toxicity limit the three Navy permits. At the request of Mr. Tom Howard of the State Board, responses to these questions were provided in memo dated March 9, 2006 (Attachment No. 4). The Navy also received a copy of this memo.

This review concludes that the Navy is close to fully complying with the toxicity limitation in the three permits. And, there is a good chance that the Navy, provided it continues to take steps to reduce pollutants in their industrial storm water discharges, can fully and consistently comply with the toxicity limitation.

In addition, the Navy has done some promising work with a filter-adsorption system to reduce the pollutant load in storm water runoff. Attachment No. 5 is copy of an article highlighting the Navy's work in 2005.

Attachment Nos. 1, 2, 3, and 4

Linda S. Adams
Secretary for Environmental Protection

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(619) 467-2952 • Fax (619) 571-6972
http://www.waterboards.ca.gov/sandiego

TO: John H. Robertus
Executive Officer

FROM: Jimmy Smith and Alan Monji
Environmental Scientists

DATE: August 25, 2006

SUBJECT: REVIEW OF SPAWAR'S TECHNICAL REPORT NO. 1938, *STORM WATER TOXICITY EVALUATION CONDUCTED AT NAVAL STATION SAN DIEGO, NAVAL SUBMARINE BASE SAN DIEGO, NAVAL AMPHIBIOUS BASE CORONADO, AND NAVAL AIR STATION NORTH ISLAND*

A. Summary

SPAWAR Technical Report No. 1938 (Report) presents the results of an evaluation of toxicity and pollutant concentrations in both storm water discharges and in the receiving waters of San Diego Bay. Toxicity Identification Evaluations (TIEs) were performed on storm water discharges and the spatial extent of the discharge plumes were mapped for San Diego Bay. Sufficient sampling occurred to capture the full range of discharge type and magnitude expected to be released from the four bases. This included a wide range of storm flows, number of dry days between rain events, watershed sizes, and types of industrial activities. Appropriate scientific methods were employed throughout the investigation such that the results appear reliable.

Storm water discharges frequently exhibited toxicity to test species. The TIEs indicated that copper, zinc, and surfactants could be the principal pollutants causing toxicity, and concentrations of copper and zinc often exceeded the performance goals of the applicable permit. Surface receiving waters showed very little toxicity, had low concentrations of pollutants and were quickly able to assimilate storm water discharges. These results indicate that toxicity and pollutant concentration in storm water discharges are not reliable indicators of toxicity in San Diego Bay receiving waters.

The Report reveals areas that should be revised in the permits that cover the industrial storm water discharges from the four naval bases.

1. Toxicity test results must be statistically compared against control samples before declaring a sample as toxic.
2. The use of the mussel *Mytilus galloprovincialis* should be considered as a substitute for one of the test species currently required for toxicity testing.
3. Further investigation into the ultimate fate of the storm water discharge pollutants (especially copper and zinc) should be prioritized for investigation.

The Report indicates very little toxicity in San Diego Bay receiving waters while the Navy is already close to meeting their permit toxicity requirements. The changes above would strengthen permit language that may already be adequately protecting San Diego Bay waters from toxic conditions. The Report's cover letter puts forth two alternative monitoring plans, neither of which is supported in this review for the following reasons. Toxicity in storm water is evident and should not be ignored. San Diego Bay is already demonstrating negative impacts from pollutants contained in the Navy's discharge as evidenced by the efforts to clean up sediment at the Mouth of Chollas Creek and at the shipyards and by the Total Maximum Daily Load developed for Shelter Island Yacht Basin (RWQCB, 2005).

B. Issues

Laboratory control samples exhibit variability that is inherent to the nature of toxicity tests. Condition of test subjects, handling techniques, and the test environment can all deleteriously affect the test endpoint. This leads to control samples often exhibiting less than 100 percent survivability or normal development. The conditions which caused the reduction are most likely common to all test samples. Therefore, test samples must be compared against the results of the valid control samples when

determining toxicity. These statistical comparisons should consider minimum significant differences (MSD) when interpreting test results. Caution must be exercised when using MSD to interpret toxicity testing results. If there is large variability in control and sample testing performance, a large MSD could be produced that results in a low endpoint before a sample is considered toxic (Philips, et. al., 2001). This could allow for toxic conditions to not be identified as such.

The Report indicates that the test species *Atherinops affinis* (topsmelt) and *Americamysis bahia* (mysid) behave similarly when exposed to both storm water discharges and receiving waters. It may be appropriate to substitute *Mytilus galloprovincialis* (mussel) for one of the currently required species. *M. galloprovincialis* is indigenous to San Diego Bay and exhibits greater toxicity sensitivity to both discharge effluent and to receiving waters. Use of this test will require the selection of the proper threshold for determining that a control sample is acceptable. The Report considered 70 percent normal development as an acceptable control, which is consistent with American Society for Testing and Materials bivalve protocol while the United States Environmental Protection Agency West Coast methods sets the acceptability threshold at 90 percent normal shell development and a MSD of less than 25 percent.

The Report clearly shows that substantial amounts of copper, zinc, Polynuclear Aromatic Hydrocarbons (PAHs), pesticides, Polychlorinated Biphenyls (PCBs) are being released into San Diego Bay from the naval bases' industrial storm water discharges, but fails to conclusively state the ultimate fate of these pollutants discharged to the water column of the Bay. Complexation with dissolved organic carbon and dilution are alluded to as reasons that receiving waters do not display toxicity. Further studies need to be conducted to further elucidate this pathway. Areas of San Diego Bay have already been identified as having water column copper concentrations high enough to negatively impact beneficial uses (RWQCB, 2005). The benthic communities of San

Diego Bay have also been negatively impacted, and initial TIEs conducted for sediment at the mouth of Chollas Creek have indicated that organics and pesticides are the likely causative agents (SCCWRP and U.S. Navy, 2005).

C. Conclusion

The naval bases are not that far from complying with the current language in the respective permits which require that

> "For the [Naval Facility] facility, effective 4 years after the adoption of this Order, in a 96-hour static or continuous flow bioassay (toxicity) test, undiluted storm water runoff associated with the industrial activity shall not produce less than 90% survival 50% of the time, and not less than 70% survival, 10% of the time, using standard test species and protocol."

The Report shows (Table 43 of the Report) that 90 percent survival is achieved 42 percent of the time and that 70 percent survival is achieved 72 percent of the time in first flush samples when data from all four bases is pooled. These numbers are likely to improve if sample results are compared against valid control results, instead of against simple numeric criteria. These results may indicate that meeting permit conditions will prevent toxicity in San Diego Bay as very little toxicity has been observed in the receiving waters.

D. Recommendations

The following activities are necessary to further understand the source and fate of pollutants from the naval bases and to ensure that storm water discharges are not toxic.

1. Conduct further investigations into the ultimate fate and transport of copper and zinc released into San Diego Bay from the industrial discharges of the naval bases.
2. Conduct TIEs to the next level to identify sources of metals.

References

Phillips, B.M., John W. Hunt, Brian S. Anderson, H. Max Puckett, Russell Fairey, Craig J. Wilson, and Ron Tjeerdema, 2001. *Statistical Significance of Sediment Toxicity Test Results: Threshold Values Derived by the Detectable Significance Approach.* Environmental Toxicology and Chemistry, Vol. 20, No. 2, pp. 371-3733. February 2001.

RWQCB, 2005. *Total Maximum Daily Load for Dissolved Copper In Shelter Island Yacht Basin, San Diego Bay,* California Regional Water Quality Control Board, San Diego Region, October, 2005.

SCCWRP and U.S. Navy, 2005. *Sediment Assessment Study for the Mouths of Chollas and Paleta Creek, San Diego, Phase 1 Report.* Southern California Coastal Water Research Project, Westminster, CA and Space and Naval Warfare Systems Center, U.S. Navy, San Diego, CA. May 2005.

California Regional Water Quality Control Board
San Diego Region

Terry Tamminen
Secretary for Environmental Protection

9174 Sky Park Court, Suite 100, San Diego, California 92123-4340
(858) 467-2952 • Fax (858) 571-6972
http://www.swrcb.ca.gov/rwqcb9

Arnold Schwarzenegger
Governor

June 10, 2004

Mr. Rob Chichester, Deputy Asst. Chief of Staff
Environmental Department, N45RW RC
U.S. Navy
33000 Nixie Way-Bldg. 50, Suite 326
San Diego, CA 92147-5110

In reply refer to:
IC: 03-538.01: richp

Dear Mr. Chichester:

SUBJECT: COMMENTS REGARDING PROPOSED TECHNICAL APPROACH TO EVALUATE STORM WATER TOXICITY

The Regional Board has received your *Proposed Technical Approach to Evaluate Storm Water Toxicity* (proposed study) dated September 24, 2003. In the proposed study, the Navy will conduct an interim toxicity monitoring study of industrial storm water discharges and toxicity from its facilities. The proposed study is being conducted pursuant to *Discharge Specifications, B.4.b., Order No. R9-2002-0002, NPDES Permit No. CA0109363, Waste Discharge Requirements for U.S. Navy, Naval Base Point Loma Complex, San Diego County.* We have the following comments regarding the proposed study:

1. As proposed, the study will not provide sufficient information to us for the consideration of modifications to the toxicity limitation in your National Pollutant Discharge Elimination System (NPDES) permits.

2. The proposed study should include a review of the statistical reliability of the current toxicity standard and any proposed toxicity standard. The review should describe the reliability of current toxicity standard and test methods, and the proposed toxicity standard and test methods. The current toxicity limitation applies to *undiluted* industrial storm water discharges.

3. The study should examine the reliability of toxicity standards for the undiluted industrial storm water discharges as currently required and for the proposed toxicity standard that may be developed.

4. The study should identify a toxicity testing method and a toxicity survival rate for undiluted industrial storm water discharges from locations that implement *best available technology economically achievable* (BAT) for toxic and non-conventional pollutants, and *best conventional pollutant control technology* (BCT) for conventional pollutants and that protects the Beneficial Uses of San Diego Bay while examining the reliability of the current toxicity standard and the reliability of any proposed standard.

5. The study should identify the BAT and BCT activities implemented at the source of the industrial storm water discharges and compare the toxicity standard to discharges that do not implement BAT and BCT activities.

We understand the proposed study as submitted will include three sections: 1) a field study to evaluate the toxic impact of storm water on San Diego Bay; 2) a laboratory study to evaluate the causative agents of toxicity; and 3) a deployed laboratory study that will provide a link between the standard field and laboratory work. Additionally, two ancillary tasks will also be included in the proposed study: 1) an attempt at identifying the source of the causative agent of toxicity for control and mitigation purposes and 2) an evaluation of contaminant flux to the sediments in the form of particles.

The three outfall locations and associated Bay surface water sampling locations appear to be representative of typical activities located at the Naval Base Point Loma. As indicated in the proposed study, the Navy should sample two storm events each year from each of the three outfalls and Bay water sampling location. Because of the late starting date of the proposed study, the Regional Board is concerned that the proposed study may not have a sufficient number of data sets for toxicity and for chemical analysis to be statistically defensible. We recommend that you review this matter and, if necessary, increase the frequency of the sampling and analysis to achieve at least 15 sampling analyses prior to completing the proposed study.

The proposed field study should include a complete description of the discharge volume, location and characteristics of each outfall and receiving water sampling location. The description should include specific details identifying and describing the BAT and BCT activities being implemented in the catchment basin producing the discharge.

The Navy's final recommendation regarding an alternative toxicity specification should be submitted to the Regional Board by January 11, 2006, eight months prior to the date for compliance with the toxicity specification in Order No. R9-2002-0002. The Regional Board recommends the Navy have a peer review of the toxicity study. You should develop, and submit for our consideration, a *peer review workplan.* This workplan would, at a minimum, describe your proposal for the members of the peer review panel, the purpose of the peer review and the review time frame. The peer review report should be included with your final toxicity study report.

If the Navy considers that the proposed study will fulfill the toxicity specifications for the Naval Base San Diego, Order No. R9-2002-0169, and Naval Base Coronado, Order No. 2003-0008, the proposed study should include an analysis or rationale regarding the applicability of a recommended toxicity study for the portion of San Diego Bay that receives the storm water discharges from these two Naval Bases. Otherwise, the Navy should propose a separate study for each of the Naval Bases.

The proposed study will fulfill the storm water monitoring requirements for *Monitoring for Toxicity at SUBASE*, Monitoring and Reporting Program (MRP) No. R9-2002-0002 (page M-10). Pursuant to the MRP, an annual report for the toxicity study must be submitted by August 1 each year. In the meantime, the Navy is required to monitor for toxicity at the Naval Base San Diego and the Naval Base Coronado pursuant to Order No. R9-2002-0169 and Order No. R9-2003-0008 respectively.

We have also reviewed the comment letter to the Navy from Debra L. Denton, Environmental Scientist, of the United States Environmental Protection Agency (USEPA), dated December 8, 2003 regarding the proposed study. We agree with the USEPA comments and urge the Navy to include the USEPA recommendations in your study, or provide a detailed explanation why the actions recommended by the USEPA are not included in the study.

Order No. R9-2002-0002 was adopted on September 11, 2002. After September 11, 2006, the Navy is required to comply with *Discharge Specification B.4.a,* a discharge specification of 90% survival, 50% of the time, for its discharges of industrial storm water. The storm water discharge monitoring data for the Graving Dock facility has indicated that discharges of industrial storm water can comply with the toxicity specification is in its permit.

The heading portion of this letter includes a Regional Board code number after "In reply refer to:" In order to assist us in the processing of your correspondence please include this code number in the heading or subject line portion of all correspondence and reports to the Regional Board.

If you have any questions regarding the above, please contact Mr. Paul J. Richter of my staff at (858) 627-3929 or by e-mail at richp@rb9.swrcb.ca.gov.

Respectfully,

JOHN H. ROBERTUS
Executive Officer
San Diego Regional Water Quality Control Board

JHR:mpm:jrp:pjr

cc: Terry Oda, Chief
USEPA, Region IX

Debra L. Denton Ph.D., Environmental Scientist
USEPA Region IX

Mr. David Merk
SD Unified Port District

U.S. Navy Toxicity Study *(Paul J. Richter)*

The NPDES permit for the *U.S. Navy, Naval Base Point Loma Complex, San Diego County (Order No. R9-2002-0002),* adopted on September 11, 2002, requires that industrial stormwater discharges achieve a toxicity survival rate of *90% survival, 50% of the time and not less than 70% survival, 10% of the time*. The toxicity limitation becomes an enforceable effluent limitation four years after adoption (September 11, 2006). During the first four years the limitation is a performance goal. The Order also allows the U.S. Navy to conduct a toxicity study on industrial storm water dischargers during the four years and to recommend an alternative toxicity limitation based on the results of the study. Subsequent NPDES permits adopted for the other U.S. Naval Base Complexes in the San Diego Region (including *Naval Base Coronado* and *Naval Base San Diego*) also have an identical toxicity limitation for stormwater.

During the hearing to adopt tentative Order No. R9-2002-0002, the Regional Board questioned the basis for and the validity of the stormwater toxicity limitation (i.e. *90% survival, 50% of the time*) contained in the tentative Order. The Regional Board added a provision to the Order that requires the U.S. Navy to conduct a study of the toxicity in storm water discharges from all areas of *Naval Base Point Loma Complex* where industrial activities take place and recommend a scientifically valid survival rate for acute exposure to discharges of storm water from industrial areas at the complex. Subsequent NPDES permits adopted for U.S. Naval Base Complexes in the San Diego Region also included the toxicity study requirement. Also, the renewal permits adopted for the three major shipyards (NASSCO, Continental Maritime, and Southwest Marine) operating in San Diego Bay included recommendations for the shipyards to participate in the Navy toxicity study.

By letter dated September 24, 2003 the Navy submitted a proposed study titled *Proposed Technical Approach to Evaluate Storm Water Toxicity*. In the proposed study, the Navy explained that it would conduct toxicity monitoring of industrial storm water discharges and the receiving waters near its facilities. By letter dated December 8, 2003 the U.S. EPA provided comments on the proposed study. The U.S. EPA's comments included: 1) the Navy needs to state the study objective clearly; 2) the need for a Quality Assurance Project Plan; 3) clarification of appropriate test methods and species; 4) use of a State certified laboratory; and 5) the necessity to include the basis for evaluation of data, statistical analysis, use of storm hydrographs, and modeling of the storm water discharges into the Bay.

By letter dated June 10, 2004, the Regional Board informed the U.S. Navy that the proposed study will not provide sufficient information for the consideration of modifications to the toxicity limitations in the NPDES permits. The Regional Board letter states that the study should include additional information regarding 1) the statistical reliability of the current and proposed toxicity standards, 2) the toxicity standard for discharges from locations that implement *best available technology economically achievable* (BAT) for toxic and non-conventional pollutants, and *best conventional pollutant control technology* (BCT) for conventional pollutants for undiluted industrial stormwater discharges. The letter also requires a final report on the U.S. Navy toxicity study to be submitted to the Regional Board no later than January 11, 2006. As of June 28, 2004, the Regional board has not received a response to the June 10, 2004 letter from the Navy.

During the hearing on September 11, 2002, the Regional Board questioned whether or not the toxicity limitation was achievable. The toxicity survival rate of *90% survival, 50% of the time and not less than 70% survival, 10% of the time* is an achievable effluent limitation. The U.S. Navy conducts toxicity monitoring at its Graving Dock facility. A review of the results of

stormwater toxicity monitoring conducted at the U.S. Navy's Graving Dock facility during the April 2000 through February 2003 period indicated that the discharges of industrial storm water complied with the toxicity limitation during that period. A review of Regional Board compliance records shows that no violations of the toxicity limitations have been noted since February 2003.

California Regional Water Quality Contr

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Attachment No. 4

TO: Tom Howard
Chief Deputy Director
State Water Resources Control Board

FROM: Michael McCann
Supervising Water Resource Control Engineer
SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD

DATE: March 9, 2006

SUBJECT: STORMWATER TOXICITY LIMITATION—US NAVY AND SAN DIEGO BAY

This is in response to your request for information on questions raised by the US Navy in an email to you dated February 2, 2006 from Mr. Randal Friedman, US Navy, Navy Region Southwest.

Specifically, the Navy has requested the San Diego Regional Board provide scientific analysis and studies supporting the current performance standard toxicity established in the 3 NPDES permits for the Navy's stormwater discharges to San Diego Bay. The Navy refers to the standard as, "90% survival, 50% of the time and 70% survival, 10% of the time".

The toxicity standard of concern is the toxicity limitation established in The Water Quality Control Policy for the Enclosed Bays and Estuaries of California as adopted by Resolution No. 95-84 on November 16, 1995 (EBEP). Specifically, Footnote No. 3 to the opening paragraph of Chapter I reads as follows:

"Undiluted wastewaters covered under this exception provision shall not produce less than 90 percent survival, 50 percent of the time, and not less than 70 percent survival, 10 percent of the time of a standard test species in 96-hour static or continuous flow bioassay test using undiluted waste. Maintenance of these levels of survival shall not by themselves constitute sufficient evidence that the discharge satisfies the criteria of enhancing the quality of the receiving water above that which occur in the absence of the discharge. Full and uninterrupted protection for the beneficial uses of the receiving water must be maintained. A Regional Board may require physical, chemical, bioassay, and bacteriological assessment of treated wastewater quality prior to authorizing release to the bay or estuary of concern."

This is consistent with, and the appropriate way to implement, the Basin Plan water quality objective for toxicity that states "All wastes shall be maintained free from toxic substances in concentrations that are toxic to or produce detrimental physiological responses in human, plant, animal, or aquatic life..." The CWA sec. 101(a)(3) declares "that it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited." By complying with the industrial discharge specifications for toxicity established in the EBEP, the discharges of industrial storm water will be protective of the receiving water quality.

On Sept. 11, 2002 the San Diego Regional Board adopted a NPDES permit to the US Navy for discharges of stormwater to San Diego Bay from its Navy Base Point Loma. Storm water runoff from industrial areas is considered industrial process water. Therefore, in accordance with the EBEP, specifically Footnote No. 3, the permit establishes a performance standard for toxicity for the base's stormwater water discharges. The permit specifies that this performance standard would become an enforceable effluent limitation on Sept. 11, 2006. The Board had initially considered the EBEP toxicity limit as an enforceable effluent limitation, but the US Navy objected and argued before the Board that the specific toxicity limitation was too stringent to meet and not scientifically based. The US Navy requested sufficient time to review the limitation and, if possible, to develop sufficient data to support an alternative, scientifically based, toxicity limitation. In response to the Navy's request, the Board established the toxicity limit as an nonenforceable performance standard until Sept. 11, 2006 when the standard would become an enforceable effluent limitation.

It is important to point out that Order No. R9-2002-0002, the order serving as the NPDES permit, has a finding, Finding No. 3, that references the EBEP. In addition, the Fact Sheet to the order also references the EBEP.

Subsequent to the Board's adoption of the NPDES permit for Navy Base Point Loma, the Board adopted NPDES permits to two other Navy Base facilities adjacent to San Diego Bay—Navy Base San Diego and Navy Base Coronado. These permits also establish the same toxicity performance standard with a 4-year time period before the performance standard becomes an enforceable effluent limitation.

The toxicity limit from the EBEP should not have come as a surprise to the Navy in 2002 with the adoption of the permit for Navy Base Point Loma. On August 12, 1998, the Regional Board adopted a NPDES permit, Order No. 98-53, to the US Navy for its Graving Dock facility adjacent to San Diego Bay. This order established the same toxicity performance standard as the US Navy Point Loma permit and specified that the standard would become an enforceable effluent limitation in 2000. The US Navy has complied with the permit by terminating stormwater discharges to San Diego Bay.

Since the Sept. 11, 2002, the US Navy is supposed to have been working on developing information to support an alternate toxicity effluent limitation. It is not apparent at this time what progress the Navy has achieved in developing sufficient information to support an alternative toxicity limit. The US Navy has contacted us recently that they intend to meet with Board staff to provide the information they have developed. It is our expectation that the Navy will also provide a plan and schedule for complying with the enforceable toxicity effluent limitation by Sept. 11, 2006.

The Navy is not the first discharger required to meet this EBEP toxicity limitation. Since 1999, the three major shipyards in San Diego Bay—NASSCO, Continental Maritime, and BAE (formerly Southwest Marine)—have been required to meet this same toxicity limitation for stormwater discharges to San Diego Bay. The shipyards have complied with their NPDES permits by configuring their exposed work areas to prevent stormwater discharges to the bay. The Navy may have to take the same approach in complying with their NPDES permits.

The specific toxicity limitation was established for the EBEP when it was first adopted by the State Board in 1974. I am not aware of any challenges received by the State Board regarding this long-standing toxicity limit. Also, I am not aware of all the information that formed the basis for the toxicity limit in the 1974 EBEP. I recently learned from State Board staff that the following two reports may have been used to partially support the 1974 EBEP toxicity limit:

1. A 1972 study titled "A Study of Toxicity and Biostimulation in San Francisco Bay-Delta Waters. Volume III. Acute Toxicity of Discharged Wastes".
2. Kaiser Engineers, Inc. 1969. San Francisco Bay-Delta Water Quality Control Program.

The Water Quality Control Plan for the Enclosed Bays and Estuaries of California as adopted by Resolution No. 95-84 on the November 16, 1995 specifies the following:

Chapter 1:

It is the policy of the State Board that the discharge of municipal wastewaters and industrial process waters[2] (exclusive of cooling water discharges) to enclosed bays and estuaries, other than San Francisco Bay-Delta system, shall be phased out as the earliest practicable date. Exceptions to this provision may be granted by a Regional Board only when the Regional Board finds that the wastewater in question would consistently be treated and discharged in such a manner that it would enhance the quality of receiving waters above that which would occur in the absence of the discharge[3].

Footnote No. 2: For the purpose of this policy, treated ballast waters and innocuous nonmunicipal wastewater such as clear brines, wastewater, and pool drains are not necessarily considered industrial process wastes, and may be allowed by the Regional Boards under discharge requirements that provide protection to the beneficial uses of the receiving water.

Footnote No. 3: Undiluted wastewaters covered under this exception provision shall not produce less than 90 percent survival, 50 percent of the time, and not less than 70 percent survival, 10 percent of the time of a standard test species in 96-hour static or continuous flow bioassay test using undiluted waste. Maintenance of these levels of survival shall not by themselves constitute sufficient evidence that the discharge satisfies the criteria of enhancing the quality of the receiving water above that which occur in the absence of the discharge. Full and uninterrupted protection for the beneficial uses of the receiving water must be maintained. A Regional Board may require physical, chemical, bioassay, and bacteriological assessment of treated wastewater quality prior to authorizing release to the bay or estuary of concern.

Discharge Specifications B. 4.a and b of Order No. R9-2002-0002 reads as follows:

4a. For the SUBASE facility, effective 4 years after the adoption of this order, in a 96-hour static or continuous flow bioassay (toxicity) test, undiluted storm water runoff associated with industrial activity shall not produce less than 90 % survival, 50 % of the time, and not less than 70 percent survival 10 % of the time, using standard test species and protocol.

4b. During the 4-year period before the effective date of the toxicity limit set forth in *paragraph a* of this specification, the U.S. Navy shall conduct a study of the toxicity in storm water discharges from all areas of the SUBASE at which industrial activities are undertaken and shall recommend a scientifically valid survival rate for acute exposure to discharges of storm water from industrial areas at SUBASE. The study may include a Toxicity Identification Evaluation (TIE), or a Toxicity Reduction Evaluation (TRE).

Treatment of Storm Water Runoff from Military Industrial Activities

NFESC Demonstrates Advanced Storm Water Runoff Treatment System

Engineers from the Naval Facilities Engineering Service Center (NFESC) have developed and are demonstrating an innovative filter-adsorption system that reduces the concentration of metals, hydrocarbons, suspended solids, and other pollutants in storm water runoff at the Navy Regional Recycling Center (NRRC) in San Diego, CA.

Storm water runoff associated with industrial operations at Navy installations typically has elevated metals content, a moderate suspended solids and organic content, and a low nutrient and bacterial content. The metals in storm water runoff can be attributed to outdoor metal working processes such as cutting and grinding, storage of metal objects outdoors, and use of metal bearing materials such as corrosion inhibiting and anti-fouling paints. Organic compounds in storm water runoff are often due to leaks of motor oil, hydraulic fluid, and antifreeze. Sediment is usually deposited on the watershed by wind or erosion. Dust generated by industrial processes is another source of fine particles.

In many cases, storm water runoff from Navy industrial sites is not easily treated by current commercial off-the-shelf (COTS) technology. Most of the COTS storm water treatment technology is designed for municipal applications such as trash, nutrient, and sediment removal. Additionally, most storm water treatment technology requires large areas of land for detention basins and similar structures. Space is often at a premium at many Navy sites, especially waterfront locations.

Storm water runoff from Navy industrial sites is a significant problem. The Navy is under increasing pressure from regulators and local communities to reduce the amount of pollutants discharged with storm water into harbors, bays, lakes, and streams. In San Diego, a California Regional Water Quality Control Board (CRWQCB) Order requires the Navy to:

1. Terminate (keep from entering the storm drain system) the first 1/4 inch of runoff,
2. Pass a 96-hour acute toxicity bioassay test, and
3. Reduce the concentration of copper in runoff from certain high risk areas to less than 63 micrograms per liter (µg/L) and reduce the concentration of zinc to less than 117 grams per liter (g/L).

The goals of this particular project were to demonstrate a storm water runoff treatment technology that:

1. Will allow the Navy to meet all storm water discharge requirements,
2. Is low cost and easy to install,
3. Requires little land area, and
4. Is inexpensive to maintain.

Several commercial storm water treatment technologies were tested by NFESC in the laboratory and in field demonstrations at NRRC to determine if they could reduce copper and zinc concentrations to meet the CRWQBC requirements. None of the systems could meet the CRWQCB requirements when the influent metals concentrations were high.

NFESC has developed and tested a storm water runoff treatment system that meets the above stated goals. The storm water treatment technology developed at NFESC is similar to a sand filter. However, instead of using sand as the filter medium, polluted storm water is treated by flowing the runoff through a bed of specially selected materials. NFESC identified several industrial commodities that remove copper, zinc, lead, cadmium, and other metals to very low concentrations. The chemical process used is adsorption—the adhesion of ions or molecules to the surface of a material.

The filter-adsorption media selected for demonstration is a layer of gravel over a layer of bone char over a layer of activated alumina. (Note: Bone char is a black, granular solid obtained by calcining cattle bones. Through the calcining process crushed bone is cooked in an oxygen deficient atmosphere, leaving carbon and tri-calcium phosphate as the residue.) The gravel layer is a coarse filter. The bone char and activated alumina remove metals both by straining and adsorption.

A 1/20 scale model of the planned treatment system was built and used to gather field test data.

The model is shown in Figure 1. The unit uses battery-powered motors to pump runoff water from a collection sump to temporary storage tanks. Water from the storage tanks is then pumped to the treatment system. Automatic water samplers collect grab and composite samples of process influent and effluent for chemical analyses. (Note: A grab sample is collected at one point in time and represents an instantaneous value of the parameter of interest. A composite sample is collected over a period of time and represents an average, or composite, value of the parameter.)

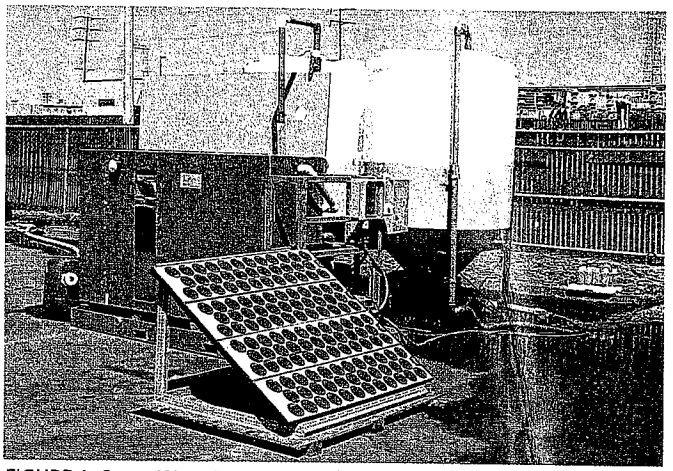

FIGURE 1: Storm Water Treatment Technology Test Stand.

Field testing was performed at NRRC San Diego with the assistance of NRRC personnel. Typical results of field-testing are presented in Table 1. Results show that the treatment system reduced all of the metals listed in Table 1 to below permitted limits. In addition, effluent from the treatment system passes the required 96-hour acute toxicity test.

TABLE 1: Metals Removal Effectiveness Results

Parameter	Influent (µg/L)	Effluent* (µg/L)	Permitted Limit (µg/L)
Aluminum	330–860	ND–100	750
Cadmium	ND–12	ND	15.9
Chromium	ND–18	ND	20
Copper	1,900–4,700	ND–21	64
Iron	3,000–8,200	ND–170	1,000
Lead	150–360	ND	82
Zinc	680–1,700	ND–41	117

** ND means below the practical detection limit. U.S. Environmental Protection Agency Method 200.7 used in all cases.*

Figure 2 illustrates the difference between the influent and effluent storm water runoff.

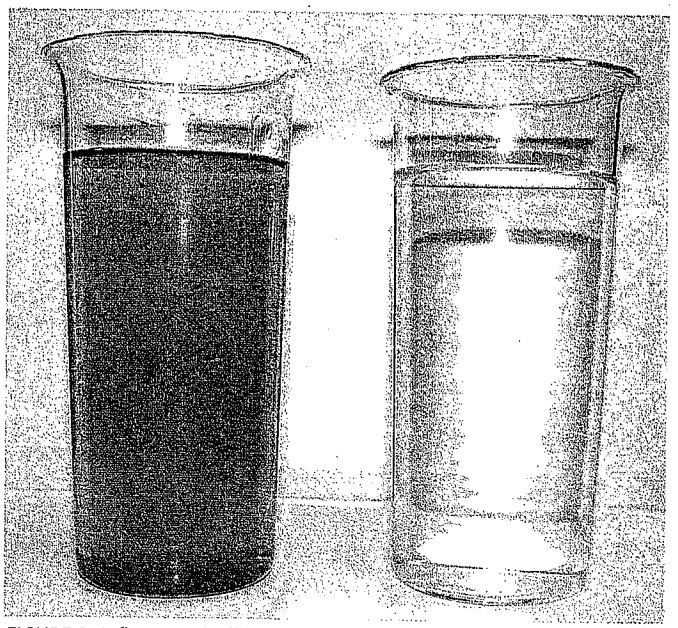

FIGURE 2: Influent and Effluent from Treatment System.

While the selection of filter-adsorption materials focused on the removal of specific dissolved metals, there are limited data that indicate the filter-adsorption materials can also significantly reduce the concentration of organic material. In field tests, the filter-adsorption process reduced oil and grease and total petroleum hydrocarbon to non-detectable concentrations. However, the influent concentrations of these compounds were low during the field tests. It remains to be determined how well the process works for higher hydrocarbon concentrations.

Funding was obtained from the Environmental Security Technology Certification Program (ESTCP) for a large-scale demonstration of filter-adsorption technology. ESTCP is the Department of Defense's (DoD) environmental technology demonstration and validation program. Its goal is to identify, demonstrate, and transfer technologies that address DoD's highest priority environmental requirements. The program promotes innovative, cost-effective environmental technologies through demonstrations at DoD facilities and sites.

The site of the ESTCP demonstration is NRRC San Diego. The previous method of complying with the CRWQCB order at the NRRC is shown in Figure 3. The first 1/4-inch of rain was pumped from a sump into large tanks. The contents of the tanks were periodically transferred to a sanitary sewer.

FIGURE 3: Termination and Removal of Storm Water Runoff.

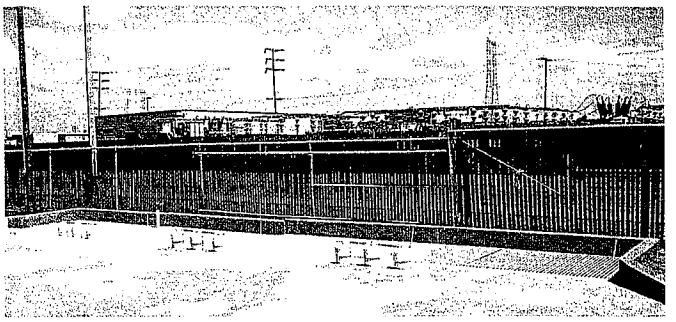

FIGURE 5: Installation at NRRC.

NRRC and Commander Naval Region Southwest personnel worked with NFESC to develop a system that will remove pollutants to below permitted values, use little land area, and be easy to maintain. A sketch of the cross section of the filter-adsorption treatment system is shown in Figure 4. The system consists of a pre-cast concrete trench filled with layers of filter adsorption media. A network of perforated plastic pipes at the bottom of the trench collects the treated water and conducts it to the main discharge pipe. The discharge pipe leads to an existing storm drain vault. The treatment system is located in a landscaped area between the edge of a parking lot and the property line fence. The parking lot serves as a temporary pond area when the water runoff rate exceeds design capacity.

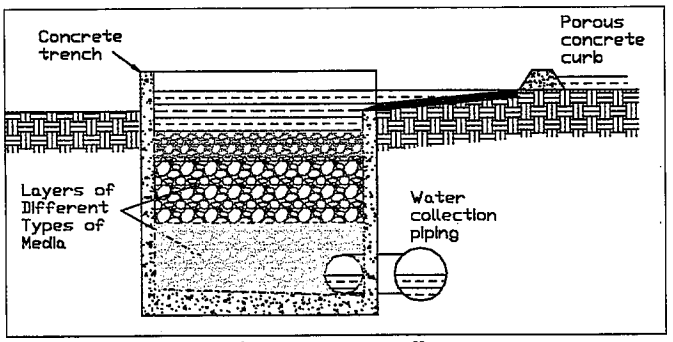

FIGURE 4: Cross-section of Storm Water Runoff Treatment System.

The installation will treat storm water runoff from approximately four impervious acres. The demonstration installation is designed to treat a peak runoff rate of 250 gallons per minute. This capacity will treat all of the runoff from over 90 percent of the storms. An image of the installation is shown in Figure 5.

Commander Naval Region Southwest personnel worked with the CRWQCB San Diego Region to amend the National Pollutant Discharge Elimination System permit for Naval Base San Diego to "allow the Navy to use treatment technologies for storm water runoff as an alternative to the current requirement of diverting the first 1/4 inch of runoff from high-risk areas at the Naval Base San Diego." This permit modification was made to allow demonstration of the filter trench technology.

The media beds are expected to last a minimum of 15 years before needing to be replaced. Routine maintenance is expected to consist of removing and replacing the top inch of gravel on the bed every three to five years. The inlet grating is covered with rubber mats during the dry season. The expended media is expected to pass the California Toxicity Characteristic Leachate Procedure.

The demonstration unit cost approximately $80,000. The unit cost is $20,000 per acre of watershed. This cost is about one-third that of commercially available technologies marketed to remove metals from storm water runoff.

The demonstration treatment system is fully instrumented to collect samples of process influent and effluent for chemical analysis and samples of effluent for bioassay tests. Data on rainfall, process throughput, and other variables are also collected. Testing began with the start of the California rainy season in the fall of 2005. The results will be analyzed and reported in accordance with the Technology Acceptance Reciprocity Partnership, a protocol for storm water best management practice demonstrations endorsed by California, Massachusetts, Maryland, New Jersey, Pennsylvania, and Virginia. ⚓

CONTACT

Gary Anguiano
Naval Facilities Engineering Service Center
805-982-1302
DSN: 551-1302
gary.anguiano@navy.mil

If you would like to share your pollution prevention success stories, or would like additional information on the Navy's technology transfer program, contact Andrew Drucker at 805-982-1108, DSN: 551-1108 and andrew.drucker@navy.mil.

Navy's Proposed Alternative Toxicity Requirements for Industrial Storm Water Discharges

BACKGROUND

Storm water toxicity requirements are included in three industrial storm water NPDES permits imposed on three Navy Facilities on San Diego Bay. Permit CA0109363 applies to US Naval Base Point Loma and specifically refers to the areas of industrial storm water runoff from US Naval Submarine Base. Permit CA0109169 applies to the industrial storm water runoff from US Naval Base San Diego. Permit CA0109185 applies to the industrial storm water runoff from Naval Base Coronado and specifically to the Naval Amphibious Base and Naval Air Station North Island. The permit toxicity requirements were as follows, using the term "*Naval Facility*" in place of specific names Submarine Base, Naval Station, Naval Amphibious Base, and Naval Air Station North Island mentioned in each permit:

1. "For the [*Naval Facility]* facility, effective 4 years after the adoption of this Order, in a 96-hour static or continuous flow bioassay (toxicity) test, undiluted storm water runoff associated with industrial activity shall not produce less than 90% survival 50% of the time, and not less than 70% survival, 10% of the time, using standard test species and protocol."

2. "During the 4-year period before the effective date of the toxicity limit set forth in paragraph a of this Specification, the U.S. Navy shall conduct a study of the toxicity in storm water discharges from all areas of [*Naval Facility*] which industrial activities are undertaken and shall recommend a scientifically valid survival rate for acute exposure to discharges of storm water from industrial areas at [Naval Facility]. The study may include a Toxicity Identification Evaluation (TIE), or a Toxicity Reduction Evaluation (TRE)."

Based upon discussion with the San Diego Regional Water Quality Control Board (SD RWQCB) Staff and dialogue with SD RWQCB members during permit adoption, the toxicity requirement in the permit was derived from the Water Quality Control Plan for the San Diego Basin (9), 1994 and is stated in the permits as follows:

> "The Basin Plan water quality objective for toxicity states that "*All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life...*" The CWA Sec 101(a)(3) declares "*that it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited.*" By complying with the industrial storm water discharge specifications for toxicity in this Order, the discharges of industrial storm water will be non-toxic. The receiving waters are not expected to become toxic from the industrial storm water discharge."

The permit requirements were therefore designed to ensure compliance with the Clean Water Act and Basin Plan goal narratives of maintaining San Diego Bay free of toxic impacts.

The specific toxicity requirements of "90% survival, 50% of the time, and 70% survival, 10% of the time" were derived from the State's Water Quality Control Policy for the Enclosed Bays and Estuaries of California, 1974 (Policy). The rationale and derivation of these specific limitations for storm water is unknown, but are not based on any known scientific evaluation of storm water toxicity. Furthermore, the Policy explicitly stated that these requirements did not apply to land runoff. During the permitting process the Navy suggested and the Regional Board agreed that a scientific study of storm water toxicity would be appropriate in setting a toxicity threshold, and in agreement with Basin Plan policy:

> *"Water quality objectives must be based upon sound scientific water quality criteria needed to protect the most sensitive of the beneficial uses which have been designated for a water body."*

During the permit hearing the Navy expressed concern that; the decision to use a specific storm water toxicity requirement of 90% survival 50% of the time was not based on scientific data, that the toxicity requirement was overly stringent for protecting water quality criteria, and that based upon the experience of other permit holders the only effective BAT/BCT for meeting this toxicity requirement was to capture all storm water runoff and discharge it to the sanitary sewer.

PURPOSE OF ALTERNATIVE TOXICITY STUDY

Commander Navy Region Southwest funded a scientific study of storm water toxicity that was conducted between 2002 and 2005 by the Environmental and Applied Systems Branch of the Space and Naval Warfare Systems Center, San Diego. The final report of this study, entitled: "*Storm Water Toxicity Evaluation Conducted at: Naval Station San Diego, Naval Submarine Base, San Diego Naval Amphibious Base, Coronado, and Naval Air Station, North Island, December 2005*" forms the basis for the alternative toxicity recommendations in this paper.

The goal of the toxicity study was to develop a robust dataset of storm water and receiving water toxicity that can be used to support a scientifically-based acute toxicity threshold for industrial storm water discharges from Navy Facilities. The technical approach used three simultaneous measurement components to evaluate industrial storm water toxicity and impacts to San Diego Bay waters. The three components included:

1. Toxicity and chemistry measurements in storm water (end-of-pipe)
2. Toxicity and chemistry measurements in receiving waters
3. Storm water plume mapping

WHOLE EFFLUENT TOXICITY (WET) TESTING LIMITATIONS

The toxicity requirement in the permit is based on the principles of Whole Effluent Toxicity (WET) testing. "WET is a useful parameter for assessing and protecting against impacts upon water quality and designated uses caused by the aggregate toxic effect of the discharge of pollutants" (EPA, 1991). EPA guidance, test protocols, and the

evaluation of toxicity focus almost exclusively on continuous industrial waste discharges once they have mixed with the receiving environment, usually a fresh water system. In fact the guidance states "...there is a less likely chance for receiving water impacts to be observed in saltwater systems as predicted by toxicity tests." because of larger and more complex mixing. By measuring toxicity at the end-of-pipe the current permit does not consider interaction with the receiving environment when establishing toxicity compliance. Furthermore, the latest draft (2004) of EPA's WET Implementation Guidance does not contain guidance on its use for evaluating episodic and ephemeral discharges such as storm water. On March 24, 2005 Department of Defense submitted comments on EPA's *"Draft National Whole Effluent Toxicity Implementation Guidance Under the National Pollutant Discharge Elimination System"* requesting EPA provide guidance on storm water WET testing. Currently, there is a void of information on how to best implement WET testing to evaluate the potential for adverse impacts from storm water discharges on receiving waters. Also not taken into consideration by the permit is the fact that, test organism exposure periods are 96 hours in length. Rain events that these tests are designed to simulate are typically 24 hours or less in length. Because of the differences between:

1. the rapid assimilation of storm water and its affects on organisms in the actual receiving water compared to affects on organisms in 100% effluent conditions and
2. the duration of rain events and receiving water organism exposure compared to test organism exposure duration in the laboratory [96-hours]

using end of pipe storm water results with a 90% acute toxicity survival limit is an overly conservative requirement for protection of a large marine receiving water. However, certain basic principals should be applied when developing a toxicity requirement, regardless of the type of discharge. These principles are discussed later in this paper.

WET TEST METHODS VARIABILITY

The toxicity requirement in the permits is based on Whole Effluent Toxicity (WET) testing. WET testing was identified by the EPA as "a useful parameter for assessing and protecting against impacts upon water quality and designated uses caused by the aggregate toxic effects of the discharge of pollutants" (EPA's Technical Support Document for Water Quality-based Toxics Control, EPA, 1991). On the basis of results obtained in EPA's Complex Effluent Toxicity Testing Program and other reviewed studies (cited in EPA, 1991), the EPA concluded that the control of toxicity is a valid approach for protecting ambient water quality and receiving water impact. They also concluded that "impact from toxics would only be suspected where effluent concentrations after dilution are at or above toxicity effect concentrations". WET testing has been applied to mixing of continuous industrial discharges with receiving waters, but does not provide direction on its application for short exposure discharges such as those produced by storm water. The current permits do not consider if storm water effluent concentrations after dilution are at or above toxicity effect concentrations.

The permit requirement is based on short-term or acute toxicity testing. Acute WET tests use standardized protocols to evaluate short-term toxicity by exposing test organisms for 96-h or less and measuring lethality as the endpoint. There are also tests designed to evaluate chronic toxicity which is typically defined as a longer term test in which sublethal effects such as fertilization, growth, or reproduction are measured on very sensitive life stages of test organisms (e.g., embryos). In WET tests, a chosen test species is exposed to an effluent sample (often at various levels of dilution) within a test

chamber for a specified duration. At the end of the exposure period, the test effect (lethality, development, etc.) is evaluated and compared to results in a control sample to determine if the effluent was toxic or not. The current permits do not consider comparisons to control samples as a means of establishing what a sample is toxic or not toxic.

There are a variety of quality assurance/quality control (QA/QC) measures applied to WET methods to minimize test method variability and ensure that the tests produce meaningful results. These apply to effluent sampling and handling, test organism source and condition, test conditions, instrument calibration, replication, the use of reference toxicants, recordkeeping, and data evaluations. Test method variability is a key component when evaluating toxicity data and declaring the result as toxic or non-toxic. Guidance on method variability and the use of minimum significant difference (MSD) was developed by EPA in 2000 (EPA, 2000). The MSD represents the smallest difference that can be distinguished between the response of the control organisms and the response of the organisms exposed to the effluent. As such, the MSD is a minimum detection limit for toxicity tests. The current permit requirement does not consider test method variability.

"Aquatic toxicity tests are laboratory experiments that measure the biological effect (e.g., growth, survival, and reproduction) of effluents or receiving waters on aquatic organisms. In aquatic toxicity tests, organisms of a particular species are held in test chambers and exposed to different concentrations of an aqueous sample, for example, a reference toxicant, an effluent, or a receiving water, and observations are made at predetermined exposure periods. At the end of the test, the responses of test organisms are used to estimate the effects of the toxicant or effluent." (EPA, 2000).

As with any measurement process, WET test methods have a degree of variability arising from a number of factors. These include the number of test organisms, the number of treatment replicates, randomization techniques, the source and health of the test organisms, the type of food used, laboratory environmental conditions, dilution water quality, and potentially, the experience of the analyst performing the test. A measure of test method variability from all these factors is the minimum significant difference (MSD). The MSD represents the smallest difference that can be distinguished between the response of the control organisms and the response of the organisms exposed to the aqueous sample. The difference between control mean and treatment mean, expressed as a percentage is the percent MSD or PMSD. The MSD provides an indication of within-test variability and test method sensitivity and can be compared to the method detection used in chemical analyses.

EPA guidance recommends States implement the upper (90^{th} percentile) and lower (10^{th} percentile) PMSD bounds to achieve an acceptable level of test sensitivity and minimize within-test variability. There is an overwhelming acknowledgement of the importance of test method variability in evaluating toxicity results in the literature. However, WET test variability is not addressed in the current NPDES permit language, either in the form of test acceptability criteria or from a standpoint of determining significant differences from controls. The 90% requirement in the current permit language exceeds EPA's lower boundary for PMSD and has no statistical power to identify actual toxic effects in the effluent, let alone in the receiving environment. The 90% requirement in the treatment is equivalent to the test protocols that allow 90% survival in the controls. Even using the PMSD upper bound, the EPA found that only about 50% of labs were able to detect a

25% difference from control. This suggests that there is very little likelihood that toxicity labs could detect the <10% statistical difference from control that is inherent in the permit requirement (controls are allowed to vary from 90 to 100% survival). Therefore, whatever toxicity threshold is applied in the permit, it should account for WET variability and consideration of the PMSD.

CONSIDERATIONS IN PERMIT CHANGES

Anti-degradation

Federal Anti-degradation Policy "prohibits any action that would lower water quality below that necessary to maintain and protect existing uses...". The implementation of any of the proposed alternative toxicity requirements described below would not result in anti-degradation because in all cases the requirement would be used to identify when a discharge has an unacceptable toxic impact in the receiving water and therefore indirectly that an existing beneficial use can not be attained.

Anti-Backsliding:

The general prohibition of the Anti-backsliding policy (Section 1) states that "...a permit may not be renewed, reissued, or modified to contain effluent limitations which are less stringent than the comparable effluent limitations in the previous permit...". However, there are exceptions allowed to this policy under Section B if a permit with respect to Section 1 applies may be renewed, reissued, or modified to contain a less stringent effluent limitation applicable to a pollutant if-

> (B) (i) information is available which was not available at the time of permit issuance (other than revised regulations, guidance, or test methods) and which would have justified the application of a less stringent effluent limitation at the time of permit issuance;...

It is clear that the Navy study provides critical information that was not available at the time of permit issuance. This is re-enforced by the fact that the permit offered the Navy 4 years to conduct a study and recommend a scientifically valid survival rate. Any change in the permit would therefore be allowed under this policy.

RECOMMENDED SCIENTIFICALLY VALID SURVIVAL RATES:

The Navy study (executive summary attached) provides one of the most extensive datasets on storm water runoff conducted. Using multiple lines of evidence, the data showed that while first-flush storm water can be acutely toxic, there was no relationship between toxicity measured in storm water (end-of-pipe) and toxicity measured in the receiving water. To ensure that an acute toxicity threshold for storm water discharges will accurately identify and be protective of water quality impacts in the receiving environment, the proposed Navy alternatives include:

- The use of appropriate EPA WET test methods and data evaluation when declaring a test result as toxic

- Acknowledgement of WET method variability and the minimum significant difference that laboratory testing can provide in declaring a toxic result
- Consideration of realistic exposure conditions when using WET testing to infer toxicity in the receiving water

Alternative 1. Measure Toxic Effect Directly in Receiving Waters.

The most basic result of the Navy Study was that toxicity measured at the end-of-pipe did not correspond to toxicity in the receiving environment. This is the basis for the two proposed alternatives. For this alternative it is proposed that toxicity be measured in the receiving water. Samples should be collected from the surface 2' of bay water within 5' feet of an outfall discharge pipe during a storm event. Samples can be collected from shore using a pre-cleaned bucket or pumping system. The same time frame of collecting the sample during the first hour of flow could still be applied.

In addition to taking a sample in the receiving water, a sensitive toxicity endpoint should be used based upon the pollutants found to be causing toxicity in the end of pipe samples. Based on this it is recommended that the mussel embryo-larval development test (highly sensitive to copper) be used.

The standard acute toxicity test protocols (topsmelt or mysid survival) in the permit utilize 96-hour test durations though shorter durations are allowed. Exposure duration measured in the bay was on the order of tens of minutes (Special Floating Bioassay Laboratory Study) and always less than 24 hours. It is recommended that a 48-hour bioassay endpoint be used to match this duration and maintain a greater than two-fold "safety factor" in the exposure duration.

The data should be subject to all test acceptability criteria including consideration of PMSD. Results should be considered toxic when the bay / storm water sample's normal development is statistically different from controls (e.g. Scripps seawater). The minimum statistical difference should be identified on the basis of a PMSD level pre-determined by the Regional Board. The 90^{th} percentile PMSD based on the Navy study (n=148) was 24% different from controls. The outcome of using this toxicity requirement is that 90% of laboratories would be able to declare the test result as toxic.

Proposal: Measure toxicity directly in receiving water samples collected during storm events using one of the most sensitive toxicity endpoints available, a 48-hour test duration, and declaring a result as toxic if it fails to meet the 90^{th} percentile PMSD value of 24% different from control.

Alternative 2. Measure Toxic Effect in the Effluent Adjusted To Match Receiving Water Exposure.

A second alternative to receiving water sampling would be end-of-pipe sampling adjusted to match the exposure conditions found in the receiving environment. It was observed that a typical minimum dilution level measured immediately outside outfalls ranged between 7 and 20. It is recommended here that a 25% effluent concentration be tested to match this dilution and maintain a greater than two-fold "safety factor" of the exposure magnitude. Marine organisms listed in the 2001 Ocean Plan for acute toxicity testing would be used for this alternative.

The standard acute toxicity test protocols (topsmelt or mysid survival) in the permit utilize 96-hour test durations though shorter durations are allowed. Exposure duration measured in the bay was on the order of tens of minutes (Special Floating Bioassay Laboratory Study) and always less than 24 hours. It is recommended that a 48-hour bioassay endpoint be used to match this duration and maintain a greater than two-fold "safety factor" in the exposure duration

The data should be subject to all test acceptability criteria including PMSD. Results should be considered toxic when the bay / storm water sample's normal development is statistically different from controls (e.g. Scripps seawater). The minimum statistical difference should be identified on the basis of a PMSD level pre-determined by the Regional Board. The 90th percentile PMSD based on the Navy study (n=148) was 24% different from controls. The outcome of using this toxicity requirement is that the Regional Board will be able to clearly identify when there is a toxic impact in San Diego Bay waters from these discharges.

Proposal: End-of-pipe storm water samples adjusted for receiving water exposure conditions that include a 25% effluent concentration, a 48-hour test duration, 2001 ocean plan toxicity test organisms, and declaring a result as toxic if it fails to meet the 90th percentile PMSD value of 24% different from control.

EPA, 1991. *Technical support document for water quality-based toxics control.* USEPA, OW, EPA/505/2-90-001, PB91-127415, March 1991.

EPA, 2000. U*nderstanding and accounting for method variability in whole effluent toxicity applications under the national pollutant discharge elimination system program.* USEPA, OWM, EPA 833-R-00-003, June 2000.

EPA, 2004. *National Whole Effluent Toxicity (WET) Implementation Guidance Under the NPDES Program*, United States Office of Wastewater EPA 832-B-04-003 Environmental Protection Management, EPA 832-B-04-003, DRAFT November 2004.

State of California
Regional Water Quality Control Board
San Diego Region

SUPPLEMENTAL
EXECUTIVE OFFICER SUMMARY REPORT
September 13, 2006

ITEM: 8

SUBJECT: Status Report on the toxicity limitation established in the NDPES Permits for industrial storm water discharges to San Diego Bay from U.S. Navy facilities. The report will include a discussion of the U.S. Navy's May 2006 Report on Storm Water Toxicity Evaluation *(Michael McCann)*

PURPOSE: Receive a staff report assessing the U. S Navy's May 2006 report on industrial storm water discharges to San Diego Bay

PUBLIC NOTICE: The Agenda notice for the Sept. 13, 2006, Regional Board meeting serves as a public notice for this item.

DISCUSSION: On May 18, 2006 the U.S. Navy submitted a technical report on toxicity in industrial storm water discharges to San Diego Bay in response to a requirement established in the NDPES permit, Order No. R9-2002-002, for the Naval Base Point Loma (referred to as SUBASE). At the June 14 meeting the US Navy provided the Regional Board a presentation on the report and their recommendations for modifications of the toxicity limitation in the permit. As part of the agenda material for the June 14 meeting, the Regional Board was provided a copy of the report. Attached as Supporting Document No. 2 is a copy of a summary of the Navy's report with their recommendations.

Specifically, the Discharge Specifications 4.a and 4.b of the NPDES permit read as follows:

"4.a For the SUBASE facility, effective 4 years after adoption of this Order, in 96-hour static or continuous flow bioassay (toxicity) test, undiluted storm water runoff associated with industrial activity shall not produce less than 90% survival, 50% of the time, and not less than 70% survival 10% of the time, using standard test species and protocol.

4.b During the 4-year period before the effective date of the toxicity limit set forth in *paragraph a.* of this *Specification*, the US Navy shall conduct a study of the toxicity in storm water discharges from all areas of SUBASE at which industrial activities are undertaken and shall recommend a scientifically valid survival rate for acute exposure to discharges of storm water from industrial areas at SUBASE. The study may include a Toxicity Identification Evaluation (TIE), or a Toxicity Reduction Evaluation (TRE)."

September 11, 2006 marks the end of the 4-year period when the existing toxicity limit comes into effect and becomes enforceable. The US Navy is seeking a less stringent toxicity limitation based on the information provided in the report.

In 2002 during the process of the adoption of the existing order, the US Navy questioned the scientific bases of the toxicity limit established in the order. This toxicity limitation established in the order is the limit specified for toxicity in the State Board's Water Quality Control Policy for the Enclosed Bays and Estuaries of California, November 1995.

A technical review of the US Navy's report has been conducted by the Regional Board. In addition, technical assistance in the review of the report has been requested of the State Water Resources Control Board (SWRCB) and the US Environmental Protection Agency. Only the SWRCB review has been received (Supporting Document No. 3).

The review of the Navy's report, Supporting Document No. 1, concludes that the Navy is very close to complying with the existing toxicity limitation. With continued progress by the Navy to reduce the pollutant load in rain runoff from their industrial areas, the Navy is likely to achieve consistent compliance with the toxicity limitation.

Also, the Navy's recommended alternatives do not appear to be supported by the report. Toxicity in the storm water discharges clearly exists and should not be ignored. Toxicity in the discharge should not be discounted or considered less because the causative agents, namely copper and zinc, are diluted in bay water.

The Navy's report does not warrant significant changes to the permit's toxicity limitation. The report, however, identifies revisions to the permit that include the following:

1. Toxicity test results need to be statistically compared against control samples before declaring a sample as toxic.

2. The use of mussel *Mytilus galloprovincialis* should be considered as a substitute for one of the test species currently required for toxicity testing.

SUPPORTING DOCUMENTS:

1. Staff Report dated Sept. 1, 2006

2. Navy's Proposed Alternative Toxicity Requirements for Industrial Storm Water Discharges—A summary of the Navy's report

3. Preliminary Comments by the SWRCB on Storm Water Toxicity at San Diego Naval Facilities

RECOMMENDATION(S): This is an informational item only.

PRELIMINARY
Comments on Storm Water Toxicity at San Diego Naval Facilities

September 5, 2006

Steven G. Saiz
State Water Resources Control Board
Division of Water Quality
Sacramento, CA

I was asked to review a report of storm water runoff at Navy facilities situated in the San Diego Bay titled, *Storm Water Toxicity Evaluation Conducted at Naval Station San Diego, Naval Submarine Base San Diego, Naval Amphibious Base Coronado, and Naval Air Station North Island.* In addition, I reviewed the *Navy's Proposed Alternative Toxicity Requirements for Industrial Storm Water Discharges* report. These comments were in response to a request of the Regional Board senior staff, while I was temporarily assigned to the Regional Board for this project.

The Navy is to be commended for the extensive sampling effort shown by the toxicity report.

Acute toxicity language in NPDES permits for the Navy facilities is currently as follows:

> In a 96-hour static or continuous flow bioassay (toxicity) test, undiluted storm water runoff associated with industrial activity shall not produce less than 90% survival 50% of the time, and not less than 70% survival, 10% of the time, using standard test species and protocol.

My comments are summarized below. I regret that my comments are brief. I will, however, continue to offer my assistance after your September 2006 Board Meeting.

1. The expression of acute toxicity as <90% survival, 50 % of the time and <70% survival 10% of the time is derived from the 1974 State Water Quality Control Policy for the Enclosed Bays and Estuaries of California. Much progress has been made since 1974 in the development of toxicity testing and metrics to express both acute and chronic toxicity. For example, the 2005 Ocean Plan establishes toxicity water quality objectives using "toxicity units." The Ocean Plan acute toxicity objective is 0.3 toxicity units and the chronic toxicity objective is 1.0 toxicity units.

2. Since the San Diego Region Basin Plan adopted the acute toxicity language from the 1974 Statewide Policy, I suggest that Regional Water Board staff consider updating the Basin Plan using a newer metric such as toxicity units.

3. Assessing compliance with <90% survival, 50 % of the time and <70% survival 10% of the time is problematic. The "percent if the time" portions of the language imply the 50th and tenth data percentiles, respectively. These percentiles in turn require a sizable data set in order to produce quantile plots (such as Figures 60-62 in the toxicity document), especially for the tenth percentile. In addition, the time frame for compliance is not specified in the language.

4. The <90% survival, 50 % of the time and <70% survival 10% of the time permit language is an absolute standard that does not compare survival results to the associated control response. I endorse a t-testing type approach that contrasts the test site to an appropriate control site.

5. The Navy offered two alternative acute toxicity language proposals. While some of the recommended concepts are welcomed additions (use of EPA WET methods, acknowledgement of variability by specifying a minimum significant difference), both alternatives are unacceptable because they fail to measure toxicity using undiluted storm water. Measuring toxicity in receiving waters is a desirable adjunct measurement, but it should not be a surrogate for end-of-pipe storm water toxicity measurements.

6. Both of the alternative toxicity language proposals would, in effect, be granting the Navy facilities a *de facto* dilution credit at all of their storm water discharges. In contrast, a discharger should demonstrate that dilution credit is appropriate for a specific outfall.

7. The toxicity report demonstrated the ephemeral nature of storm water inputs into the saline waters of San Diego Bay. Because the toxic effects of storm water may be short-lived, staff should consider omitting acute toxicity testing altogether. Following guidance from the Ocean Plan, a *chronic* toxicity test requirement may be more appropriate for end-of-pipe discharges with little or no dilution. Many of the short-term chronic toxicity test species listed in Appendix III of the Ocean Plan would be appropriate for the San Diego Bay.

8. The Navy identified copper, zinc, and possibly surfactants as being responsible for toxicity in storm water. A suitable course of action should be inserted into the permit to identify and reduce the sources of these toxicants.

I appreciate the opportunity to comment on these documents and to assist the Regional Board staff. Please contact me if you have questions at (916) 341-5582 or by email at ssaiz@waterboards.ca.gov.