COMMONWEALTH of VIRGINIA

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December 22, 2010

MEMORANDUM

TO: The Honorable Robert F. McDonnell

The Honorable Harvey B. Morgan, Chair
House Committee on Agriculture, Chesapeake and Natural Resources

The Honorable Patricia S. Ticer, Chair
Senate Committee on Agriculture, Conservation and Natural Resources

FROM: David K. Paylor

SUBJECT: Toxics Reduction in State Waters Report for 2010

Pursuant to VA. CODE ANN. § 62.1-44.17:3, the Virginia Department of Environmental Quality ("DEQ") forwards the attached 2010 Annual Report for Toxics Reduction in State Waters. The report describes DEQ's toxics reduction program and summarizes the activities completed in 2010, including monitoring state waters for the presence of toxics and implementing remedial measures to reduce and eliminate toxics. Should you have any questions concerning this report or wish to request a hard-copy, please contact Jeff Reynolds, Water Resource Policy Manager, DEQ Office of Policy, at (804)698-4376. The report is also available on the DEQ website at: http://www.deq.virginia.gov/regulations/reports/html.

2010 Report on Toxics Reduction in State Waters

The complete set of Tables, Folders with Figures, and Appendices associated with this report, as well as the text document, are available on the WebPages of the Department of Environmental Quality at http://www.deq.virginia.gov/watermonitoring/.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

JANUARY 1, 2011

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Table of Contents

TABLE OF CONTENTS 3

LIST OF TABLES 5

LIST OF FIGURES: FOLDERS 3 THROUGH 6 6

LIST OF APPENDICES 9

GLOSSARY OF ACRONYMS, ABBREVIATIONS AND TECHNICAL TERMS 10

EXECUTIVE SUMMARY 13

FOREWORD 17

1.0 INTRODUCTION 18

1.1 THE REPORT: TOXICS REDUCTION IN STATE WATERS 18
1.2 FUNCTIONAL DEFINITIONS: TOXICITY, WATER QUALITY CRITERIA, AND WATER QUALITY STANDARDS 18
1.2.1 Defining "Toxicity": *18*
1.2.2 Federal Water Quality Criteria: *19*
1.2.3 State Water Quality Standards - WQS: *20*
1.3 Federal Reporting Requirements *20*

2.0 ACTIVITIES DIRECTED TOWARD TOXICS REDUCTION 21

2.1 PREVENTION 21
2.2 MONITORING AND ASSESSMENT 21
2.3 REMEDIATION 22
2.4 ANALYSIS OF TOXICS FROM AMBIENT WATERS 22

3.0 TOXICS-RELATED RESULTS – SFY2010 23

3.1 PREVENTION 23
3.1.1 Reduction of Toxics by Pollution Prevention *23*
3.1.2 Reduction of Toxics from Permitted Discharges and Compliance Monitoring of Permitted Facilities *25*
3.1.3 Reduction of Toxics by Environmental Education *26*
3.1.4 Virginia Toxics Release Inventory *26*
3.2 MONITORING OF TOXICS IN AMBIENT WATERS – SFY2010 27
3.2.1 Surface Waters and Sediments *27*
3.2.1.1 Dissolved Metals in Surface Waters 28
3.2.1.2 Total Metals in Surface Waters 28
3.2.1.3 Total Metals in Sediments 29
3.2.1.4 Dissolved Pesticides and Other Organic Contaminants 29
3.2.1.5 Pesticides and Other Organics in Sediment 29
3.2.1.5.1 Chlorinated Pesticides in Freshwater Sediment 29
3.2.1.5.2 Phosphorylated Pesticides in Freshwater Sediment 29
3.2.1.5.3 Herbicides in Freshwater Sediment 30
3.2.1.5.4 Polycyclic Aromatic Hydrocarbons (PAHs) in Freshwater Sediment 30
3.2.1.5.5 Semi-volatile Organics in Freshwater Sediment 30
3.2.1.5.6 Polychlorinated Biphenyls (PCBs) in Freshwater Sediment 30
3.2.1.5.7 Organics in Estuarine Sediment 30
3.2.1.5.8 Polycyclic Aromatic Hydrocarbons (PAHs) in the Water Column 30
3.2.2 Fish Tissue Contamination *31*
3.2.3 Biological Monitoring *31*
3.2.3.1 Freshwater Benthic Monitoring 31
3.2.3.2 Estuarine Benthic Monitoring 32
3.2.4 Special Studies Related to Toxics *32*
3.2.4.1 Regional Special Studies Involving Toxics 32
3.2.4.2 Probabilistic Near-Shore Oceanic Survey 33
3.2.5 Other Program Specific Studies *33*
3.2.5.1 The Chesapeake Bay Program 33

3.2.5.1.1 Toxics Reduction and Prevention Strategy 33
3.2.5.1.2 Toxics 2000 Strategy 33
3.2.5.1.3 CURRENT TOXICS-RELATED ACTIVITIES 34
3.2.5.2 The Elizabeth River Program 34
3.3 THE CALENDAR YEAR 2011 WATER QUALITY MONITORING PLAN2010 35

4.0 ASSESSMENT OF TOXICS IN AMBIENT WATERS: 35

4.1 THE 305(B)/303(D) WATER QUALITY INTEGRATED ASSESSMENT REPORT 35
4.1.1 The 305(b) Water Quality Assessment 35
4.1.2 The 303(d) Impaired Waters List 36
4.1.3 Delisted, previously impaired segments 37
4.2 Most Recent Virginia Department of Health Fishing Restrictions and Health Advisories 38

5.0 REMEDIATION OF TOXICS IN AMBIENT WATERS: 38

6.0 SUMMARY AND CONCLUSIONS 40

6.1 POLLUTION PREVENTION 40
6.1.1 Virginia Pollutant Discharge Elimination System (VPDES) 40
6.1.2 Office of Pollution Prevention 40
6.1.3 Environmental Education 41
6.1.4 Toxics Release Inventory 41
6.2 MONITORING - WATER QUALITY MONITORING PROGRAMS 41
6.3 ASSESSMENT, REMEDIATION, AND THE CONTINUED REDUCTION OF TOXICS 42
6.3.1 Assessed Impairments – The 2010 305(b)/303(d) Water Quality Integrated Assessment Report 42
6.3.2 Remediation / Reduction 42
6.3.3 Continued Commitment 43

7.0 REFERENCES 43

All Tables, Folders, Figures and Appendices referred to in the text are available as "Read Only" files on DEQ's WebPages (http://www.deq.virginia.gov/watermonitoring/tox.html). Data users may download them as they are and then rename them if editing or reformatting is desired. All are also available on CD together with this text. Direct your requests to Don Smith at (804) 698-4429 or Donald.Smith@deq.virginia.gov.

List of Tables

* *

Introduction to Tables and Folders - Analyte Lists and Program Codes for Tables and Folders

Table 1	**DCLS Toxics Parameter Group Codes and Prices - SFY10**
Table 2	**Ambient Toxics Samples and Costs - SFY10**
Table 3	**Water Clean Dissolved Metals - All Basins - SFY10**
Table 4	**Water Clean Total Metals - All Basins - SFY10**
Table 5a	**Sediment Metals - All Basins - SFY10**
Table 5b	**Sediment Metals - Estuarine ProbMon - SFY10**
Table 6a	**Sediment Organo-chlorine Pesticides - All Basins - SFY10**
Table 6b1	**Sediment Organo-phosphorus Pesticides - Grp1 - All Basins - SFY10**
Table 6b2	**Sediment Organo-phosphorus Pesticides - Grp2 - All Basins - SFY10**
Table 6c	**Sediment Herbicides All Basins - SFY10**
Table 6d1	**Sediment PAHs - Grp1 - All Basins - SFY10**
Table 6d2	**Sediment PAHs - Grp2 - All Basins - SFY10**
Table 6e	**Sediment Semi-Volatiles All Basins - SFY10**
Table 6f	**Sediment PCBs All Basins - SFY10**
Table 6g	**Sediment Organics Estuarine ProbMon - SFY10**
Table 6h	**Water PAHs All Basins - SFY10.xls**
Table 7	**Fish Tissue Pesticides Analysis Results - WQMA 2009 (Rec'd 2010)**

List of Figures: Folders 3 through 6

The numbering of figure-containing **Folders** corresponds to the numbers of the associated **Tables 3 through 6**, which contain the complete results for the ambient monitoring of toxic materials from the past state fiscal year. The Microsoft Excel® workbooks that contain the graphs of historical toxics concentrations also include worksheets with descriptive statistical summaries of historical data arranged as follows:

(1) Historical data arranged by state fiscal year for all toxic parameters in the class;
(2) Historical data arranged by toxic parameter for years 1997 through the present.

Note: Because of restrictions for naming electronic folders and files, the names of some folders and files stored on disk may not appear exactly the same as those listed below.

Introduction to Tables and Folders - Analyte Lists and Program Codes for Tables and Folders

Folder 3 - Historical Dissolved Clean Metals - All Basins

Historical Dissolved Metals - (1) Potomac-Shenandoah Basin SFY10
Historical Dissolved Metals - (2) James Basin SFY109
Historical Dissolved Metals - (3) Rappahannock Basin SFY10
Historical Dissolved Metals - (4) Roanoke Basin SFY10
Historical Dissolved Metals - (5) Chowan-Dismal Swamp Basin SFY10
Historical Dissolved Metals - (6) Tennessee-Big Sandy Basins SFY10
Historical Dissolved Metals - (7) Chesapeake Bay and Coastal Basins SFY10
Historical Dissolved Metals - (8) York Basin SFY10
Historical Dissolved Metals - (9) New Basin SFY10

Folder 4 - Historical Total Metals - Water - All Basins

Historical Total Metals in Water Column - (1) Potomac-Shenandoah Basin SFY10
Historical Total Metals in Water Column - (2) James Basin SFY10
Historical Total Metals in Water Column - (3) Rappahannock Basin SFY10
Historical Total Metals in Water Column - (4) Roanoke Basin SFY10
Historical Total Metals in Water Column - (5) Chowan/Dismal Swamp Basin SFY10
Historical Total Metals in Water Column - (6) Tennessee - Big Sandy Basin SFY10
Historical Total Metals in Water Column - (7) Small Ches. Bay & Coastal Basins SFY10
Historical Total Metals in Water Column - (8) York Basin SFY10
Historical Total Metals in Water Column - (9) New Basin SFY10

Folder 5 - Historical Metals - Sediment - All Basins

Historical Sediment Metals - (1) Potomac-Shenandoah Basin SFY10
Historical Sediment Metals - (2) James Basin SFY10
Historical Sediment Metals - (3) Rappahannock Basin SFY10
Historical Sediment Metals - (4) Roanoke Basin SFY10
Historical Sediment Metals - (5) Chowan-Dismal Swamp Basin SFY10
Historical Sediment Metals - (6) Tennessee-Big Sandy Basin SFY10
Historical Sediment Metals - (7) Small Chesapeake Bay & Coastal Basins SFY10
Historical Sediment Metals - (8) York Basin SFY10
Historical Sediment Metals - (9) New Basin SFY10

Folder 6a - Historical Organo-Chlorine Pesticides - Sediment - All Basins

Historical Sediment OC Pesticides - (1) Potomac-Shenandoah SFY10
Historical Sediment OC Pesticides - (2) James SFY10
Historical Sediment OC Pesticides - (3) Rappahannock SFY10
Historical Sediment OC Pesticides - (4) Roanoke SFY10
Historical Sediment OC Pesticides - (5) Chowan SFY10
Historical Sediment OC Pesticides - (6) Tennessee-Big Sandy SFY10
Historical Sediment OC Pesticides - (7) Small Chesapeake & Coastal SFY10
Historical Sediment OC Pesticides - (8) York SFY10
Historical Sediment OC Pesticides - (9) New SFY10

Folder 6b - Historical Organo-Phosphorus Pesticides - Sediment - All Basins

Historical Sediment OP Pesticides-1 - (1) Potomac-Shenandoah SFY10
Historical Sediment OP Pesticides-2 - (1) Potomac-Shenandoah SFY10
Historical Sediment OP Pesticides-1 - (2) James SFY10
Historical Sediment OP Pesticides-2 - (2) James SFY10
Historical Sediment OP Pesticides-1 - (3) Rappahannock SFY10
Historical Sediment OP Pesticides-2 - (3) Rappahannock SFY10
Historical Sediment OP Pesticides-1 - (4) Roanoke SFY10
Historical Sediment OP Pesticides-2 - (4) Roanoke SFY10
Historical Sediment OP Pesticides-1 - (5) Chowan SFY10
Historical Sediment OP Pesticides-2 - (5) Chowan SFY10
Historical Sediment OP Pesticides-1 - (6) Tennessee-Big Sandy SFY10
Historical Sediment OP Pesticides-2 - (6) Tennessee-Big Sandy SFY10
Historical Sediment OP Pesticides-1 - (7) Small Chesapeake & Coastal SFY10
Historical Sediment OP Pesticides-2 - (7) Small Chesapeake & Coastal SFY10
Historical Sediment OP Pesticides-1 - (8) York SFY10
Historical Sediment OP Pesticides-2 - (8) York SFY10
Historical Sediment OP Pesticides-1 - (9) New SFY10
Historical Sediment OP Pesticides-2 - (9) New SFY10

Folder 6c – Historical Herbicides – Sediment – All Basins

Historical Sediment Herbicides - (1) Potomac-Shenandoah SFY10
Historical Sediment Herbicides - (2) James SFY10
Historical Sediment Herbicides - (3) Rappahannock SFY10
Historical Sediment Herbicides - (4) Roanoke SFY10
Historical Sediment Herbicides - (5) Chowan SFY10
Historical Sediment Herbicides - (6) Tennessee-Big Sandy SFY10
Historical Sediment Herbicides - (7) Small Chesapeake & Coastal SFY10
Historical Sediment Herbicides - (8) York SFY10
Historical Sediment Herbicides - (9) New SFY10

Folder 6d – Historical PAHs - Sediment – All Basins

Historical Sediment PAHs - (1) Potomac-Shenandoah SFY10
Historical Sediment PAHs - (2) James SFY10
Historical Sediment PAHs - (3) Rappahannock SFY10
Historical Sediment PAHs - (4) Roanoke SFY10
Historical Sediment PAHs - (5) Chowan SFY10
Historical Sediment PAHs - (6) Tennessee-Big Sandy SFY10
Historical Sediment PAHs - (7) Small Chesapeake-Coastal SFY10
Historical Sediment PAHs - (8) York SFY10
Historical Sediment PAHs - (9) New Sediment SFY10

Folder 6e Historical Semi-volatiles - Sediment – All Basins

Historical Sediment Semi-volatiles - (1) Potomac-Shenandoah SFY10
Historical Sediment Semi-volatiles - (2) James SFY10
Historical Sediment Semi-volatiles - (3) Rappahannock SFY10
Historical Sediment Semi-volatiles - (4) Roanoke SFY10
Historical Sediment Semi-volatiles - (5) Chowan SFY10
Historical Sediment Semi-volatiles - (6) Tennessee-Big Sandy SFY10
Historical Sediment Semi-volatiles - (7) Small Chesapeake-Coastal SFY10
Historical Sediment Semi-volatiles - (8) York SFY10
Historical Sediment Semi-volatiles - (9) New SFY10

List of Appendices

Appendix A	**DEQ Water Quality Standards Feb2010**
Appendix B	**Facilities and Outfalls with Toxics Parameter Limits SFY10**
Appendix C	**Permits, Parameters, Limits and Units SFY09**
Appendix D	**Permitted Toxics Parameters and DMR Results SFY10**
Appendix E	**Summary of Sediment Screening Values SFY10**
Appendix F	**Toxics-Monitoring Station/Date/Parameter Group-Code List SFY10**
Appendix G	**EPA Risk-Based Screening Values for Fish Tissues SFY10**
Appendix H1	**Freshwater Biological Stations SFY10**
Appendix H2	**Freshwater Probabilistic Monitoring Sites – SFY10**
Appendix H3	**Estuarine Probabilistic Monitoring Sites – Summer SFY10**
Appendix I	**Special Studies Related to Toxics – SFY10**
Appendix J1	**Results of Water Column PCB Sampling in the James River 2009**
Appendix J2	**Results of Water Column PCB Sampling in the Elizabeth River 2009**
Appendix K1	**Segments Potentially Impaired by Toxics 2010 303d List**
Appendix K2	**Delisted Formerly Toxics Impaired Segments – 2010 IR**
Appendix L	**References**

Glossary of Acronyms, Abbreviations and Technical Terms

Ambient Monitoring	The monitoring of physical and chemical characteristics within the Commonwealth's rivers, streams, lakes and estuaries. Ambient monitoring and assessment characterize ecological stressors and evaluate their potential impact on aquatic organisms and other wildlife, and on human health and recreational use of Virginia's waters.
AMD	Acid Mine Drainage
Aroclor	Aroclors® - technical mixtures of PCBs made by Monsanto during the period of the 1930s through 1977.
ALU	Aquatic Life Designated Use
B4B	Businesses for the Bay Program
BDE	Bromated diphenyl ether
B-IBI	Benthic Index of Biotic Integrity
BTU	British Thermal Unit - the amount of energy required to increase the temperature of 1 pound of water by 1 degree Fahrenheit, at normal atmospheric pressure.
CBP	Chesapeake Bay Program
CEDS	Comprehensive Environmental Data System
CIMS	CBP Information Management System
Compliance Monitoring	The monitoring of in-pipe concentrations of permitted discharges, which is one element in the prevention of contamination by toxics. Compliance monitoring evaluates whether or not the concentrations of potential pollutants in industrial, municipal or other permitted discharges are within the allowable limits specified in their permits.
CPMI	Coastal Plain Macroinvertebrate Index – used to evaluate the health of freshwater benthic communities in the Coastal Plain Region of Virginia
CVs	Consensus-Based Sediment Quality Guidelines – Critical values for contaminants in freshwater sediment (replace freshwater use of previously utilized ER-L and ER-M values intended for assessment of estuarine and marine sediments; MacDonald et al. 2000). See also PEC, below.
CWA	Federal Clean Water Act (1983) that first described the scope and purpose of water quality standards and defined the authority and responsibility of the U.S. EPA and the various states in relation to the requirements for, submission of, and establishment of such standards.
DCLS	Division of Consolidated Laboratory Services
DEQ	Department of Environmental Quality
DMR	Discharge Monitoring Report
EDAS	Ecological Data Application System (database)
EEC	Extreme Effects Concentration – the concentration of a contaminant above which adverse effects to sediment-dwelling organisms frequently or always occur
ELG	Effluent Limitation Guidelines
EMS	Environmental Management System
ER-L	Effects Range-Low
ER-M	Effects Range-Moderate
EPA	Environmental Protection Agency
FY	Fiscal year
IBI	Index of Biological Integrity
ICPRB	Interstate Commission for the Potomac River Basin
IR	"Integrated Report" – abbreviation for the 305(b)/303(d) Water Quality Integrated Assessment Report

IRIS	Integrated Risk Information System - a database of human health effects that may result from exposure to various substances found in the environment. IRIS is provided online by EPA and its Office of Research and Development, National Center for Environmental Assessment. (http://cfpub.epa.gov/ncea/iris/index.cfm)
MEC	Midrange Effect Concentration – the concentration of a contaminant above which adverse effects to sediment-dwelling organisms frequently occur
MGD	Millions of Gallons per Day
Microgram	(µg or ug) One millionth of a gram.
MonPlan	Annual Water Quality Monitoring Plan
MY	Monitoring Year
Nanogram	(ng) One billionth of a gram
NARS	National Aquatic Resources Survey
NCCA	National Coastal Condition Assessment
NOAA	National Oceanic and Atmospheric Administration
NPEP	National Partnership for Environmental Priorities
NPS	Non-Point Source (pollution)
OC-Pesticides or OCP	Organo-chlorine Pesticide
OEE	Office of Environmental Education
OP-Pesticides or OPP	Organo-phosphorus Pesticide
OPP or OP2	Office of Pollution Prevention
PAH	Polycyclic Aromatic Hydrocarbon
PBTs	Persistent Bioaccumulative Toxics – Toxic substances that accumulate (bio-concentrate) and persist in the tissues of living organisms.
PCB	Polychlorinated biphenyl
PEC	Consensus-based *Probable Effects Concentrations* for chemical contaminants in freshwater sediments (MacDonald et al. 2000). See also CV, above.
Picogram	(pg) One trillionth of a gram
PMP	Pollutant Minimalization Plan - An iterative plan with a programmed schedule and final goal for the reduction (minimalization) of toxic discharge (e.g. in particular PCBs) from a permitted point source. It supplants the necessity of establishing a reduced, fixed numerical limit which may be impossible to attain for a permitted discharge.
POTW	Publicly Owned Treatment Works
P2 or PP	Pollution Prevention Program
ProbMon	Probabilistic Monitoring Program
QAPP	Quality Assurance Program and Project Plan
RBP	Rapid Bioassessment Protocol
SFY	State Fiscal Year (July 1 – June 30)
SIC	Standard Industrial Classification
SOP	Standard Operating Procedure
SPMD	Semi-Permeable Membrane Device
STORET	EPA's legacy national ecological database (short for data 'STOrage and RETrieval' system)
SV	Screening Value
TBT	Tributyltin
TEC	Threshold Effect Concentration – the concentration of a contaminant below which adverse effects to sediment-dwelling organisms are unlikely to occur
TMDL	Total Maximum Daily Load study
TMP	Toxics Management Program
TMR	Toxics Management Regulation
TOC	Toxics of Concern

TRE	Toxics Reduction Evaluation
TRI	Toxic Release Inventory - The Toxics Release Inventory documents the total quantities of EPA-listed toxic compounds that are released annually (to the waters, the air and the land) by permitted facilities within the Commonwealth. Changes in the quantities of toxics released are indicative of the effectiveness of pollution prevention programs, but are not an adequate or representative measure of environmental impact or impairment.
TRISW	Toxics Reduction in State Waters (report)
TSV	Tissue Screening Value – risk-based screening values used by DEQ and VDH for evaluating fish-tissues for human consumption
USGS	United States Geological Survey
VISE	Virginia Information Source for Energy (Website)
VDH	Virginia Department of Health
VEEP	Virginia Environmental Excellence Program
VERC	Virginia Emergency Response Council
VH2E	Virginia Hospitals for a Healthy Environment
VIMS	Virginia Institute of Marine Science
VMN	Virginia Mentoring Network
VPDES	Virginia Pollutant Discharge Elimination System
VPI	Virginia Polytechnic Institute and State University
VSCI	Virginia Stream Condition Index – used to evaluate the health of freshwater benthic communities in the Piedmont and Mountain Regions of Virginia.
WET	Whole Effluent Toxicity
WQBEL	Water Quality Based Effluent Limitation
WQM	Water Quality Monitoring
WQMA	Office of Water Quality Monitoring and Assessment
WQS	Water Quality Standard(s)
WQX	Water Quality Exchange – EPA's new generation water quality information storage database, which has replaced the legacy STORET database.
WTPs	Water Treatment Plants
WWTPs	Wastewater Treatment Plants

Executive Summary

The Virginia Department of Environmental Quality (DEQ) submits the annual Toxics Reduction in State Waters (TRISW) Report to the Governor and General Assembly of the Commonwealth on January 1st of each year, in accordance with Virginia Code § 62.1 - 44.17:3.

The primary objective of the TRISW Report is to document the Commonwealth's progress toward reducing toxics in state waters and improving water quality. This commitment includes three principal types of activities: (1) the prevention of contamination of the Commonwealth's waters by toxics, (2) the continued monitoring of those waters for the presence of toxics and (3) the implementation of remedial measures to reduce and/or eliminate toxics found in the Commonwealth's waters.

Prevention

Permitting: Compliance monitoring, the monitoring of in-pipe concentrations of permitted discharges, is one essential element of the prevention of contamination by toxics of the Commonwealth's waters. During State Fiscal Year 2010 (SFY10), DEQ's Toxics Management Program (TMP) included 304 reporting facilities with 622 outfalls that had active permit-defined toxics limits in their effluents, as recorded in DEQ's Comprehensive Environmental Data System (CEDS) database. Approximately 4.3% of 2,473 individual parameter records exceeded the permitted average concentration and 4.1% of 3,097 exceeded their maximum permitted concentrations; almost all were incidental elevations of total or dissolved metals in discharges from municipal wastewater treatment plants.

Pollution Prevention: The 2010 Pollution Prevention Annual Report will be available on the DEQ WebPages at http://www.deq.virginia.gov/p2/homepage.html on January 1, 2011. Among the highlights of Pollution Prevention successes affecting reduction of toxics in state waters in the past year are the following:

- At the end of 2010, there were approximately 450 facilities in the Virginia Environmental Excellence Program (VEEP), 20 of which received special recognition. Virginia still provides performance-based permit fee discounts (from 2 to 20%) for "going beyond compliance." In 2010, over $127,300 in fee discounts were distributed among more than 100 VEEP facilities that implemented and carried out their Environmental Management System (EMS) plans. A review of VEEP annual performance for 2010 reported a reduction of 7.8 tons in the use of hazardous materials and a decrease of 325 tons in the generation of hazardous wastes.
- Total water use was reduced by 994.4 million gallons during the past year, and energy consumption was reduced by 144.9 billion BTUs.
- Releases to the atmosphere were also significantly reduced: emission of toxics, greenhouse gases (NOx, SO_x), volatile organics and particulate matter were reduced by more than 3,900 tons.
- DEQ's Voluntary Mercury Reduction Initiatives also have been continued successfully. The "Virginia Switch Out" Project for the recycling of automotive mercury switches has removed 56,097 switches and recycled 123.4 pounds of mercury since 2006. Nearly 40 facilities have also pledged to annually recycle 53,000 energy efficient fluorescent light bulbs, which also contain small quantities of mercury. (Refer to DEQ's Mercury Reduction Webpage - http://www.deq.virginia.gov/p2/mercury/homepage.html.)
- Virginia's National Partnership for Environmental Priorities (NPEP) has joined EPA Region 3 and other Middle Atlantic States in the commitment to reduce priority chemical use. Four new facilities have pledged to reduce their releases by 6,500 pounds and others have eliminated their use of lead or have begun recapturing and recycling lead.

Environmental Education: Across the state, twelve regional teams continue to bring together local conservation organizations and education agencies to implement stewardship projects, provide field experiences for students and educate citizens about local issues. Virginia Naturally's monthly electronic newsletter provides over 2,000 educators and litter and recycling program managers across Virginia with information on special features (conferences, etc.), funding and awards deadlines, upcoming events, partner updates and resources. Non-competitive litter prevention and recycling grants ($1,524,694 in 2010) were provided to 306 local governments. The Environmental Educators Leadership Program and numerous Stewardship Training Workshops have provided training for hundreds of educators statewide.

Toxics Release Inventory (TRI): The Toxics Release Inventory documents the total quantities of EPA-listed toxic compounds that are released annually to waters, air and the land by permitted facilities within the Commonwealth. Changes in the quantities of toxics released are indicative of the effectiveness of pollution prevention programs, but are not an adequate or representative measure of environmental impact or impairment.

The March 2010 TRI Report is available on the DEQ Website at: http://www.deq.virginia.gov/sara3. It summarizes data from calendar year 2008, during which 455 facilities filed 1672 individual reports. Statewide toxic releases to the water totaled approximately 20.3 million pounds or 39.3% of the total onsite releases to all media during 2008. This quantity represents a 9.4% increase from the 18.4 million pounds released to the water in 2007. Nitrate compounds (19.8 million pounds) represented 99.0% of the top ten TRI chemicals released to water. Nitrates, however, are of much more concern for their effects as nutrients rather than as toxics. Toxics criteria for dissolved nitrates in drinking water were not exceeded during SFY 2010.

Monitoring

Water Quality Monitoring Programs: Ambient water quality monitoring consists of the measurement of physical and chemical characteristics within the Commonwealth's streams, rivers, lakes, reservoirs and estuaries. Ambient monitoring and assessment characterizes ecological stressors and evaluates their potential impact on aquatic organisms and other wildlife, and on human health and recreational use of Virginia's waters.

Periodic updates and revisions of the agency's WQM Strategy are necessary as part of the continual planning process within DEQ's Water Quality Monitoring and Assessment (WQMA) Program. By 2008, the monitoring program had fully implemented two major changes in the 2007 WQMA Strategy that affected toxics monitoring and assessment; the adaptation of the monitoring program to the newly delineated sub-watersheds of the National Watershed Boundary Dataset (NWBD) and the realignment of the monitoring year to correspond with the calendar year rather than the state fiscal year. Between 2002 and 2010, more than 98 % of the Commonwealth's 1247 small watersheds were monitored.

Summer (Jul-Sep) of 2009 was the tenth year of DEQ's estuarine probabilistic monitoring (ProbMon) and the spring and fall of 2010 comprised the tenth year of its freshwater probabilistic monitoring. Because of resource limitations, the sampling and analysis for sediment organic contaminants was suspended at freshwater ProbMon sites in SFY07. Sediment chemistry (metals and organics) sampling and toxicity testing were continued at estuarine ProbMon sites during the 2009 field season (SFY10) with resources provided by a probabilistic survey-targeted supplement to a federal grant, complimented with Chesapeake Bay Program support.

In the 2010 305(b)/303(d) Water Quality Integrated Assessment Reports, sediment chemistry, sediment toxicity and benthic taxonomic results from DEQ's Estuarine Probabilistic Monitoring Program were used for a toxics-related "Weight-of-Evidence" assessment of aquatic life use at 300 estuarine sites. These results, primarily from minor tidal tributaries, complement those from the Chesapeake Bay Program's benthic probabilistic monitoring program, which emphasizes the extensive mainstem areas of major tidal tributaries and the main Bay. More recent ProbMon results from 2010 (an additional 22 estuarine and 50 near-shore oceanic sites) will be incorporated into the 2012 Integrated Report. An additional line of chemical evidence, based on the solubility of polycyclic aromatic hydrocarbons (PAHs) present in the sediment, has now been added to the weight of evidence assessment procedure.

Analytical results from the downsized 2009 Fish Tissue Monitoring Program sampling are now available (http://www.deq.virginia.gov/fishtissue/). Five sites in the James River basin were sampled in early 2009 as part of a Kepone special study; the results from that study are posted at the Fish Tissue WebPages link above. Agency plans to sample fish tissues and sediment during 2010 were suspended due to limited resources. However, fish samples for ecological risk assessments were collected at 22 estuarine sites from June - September 2010 as part of the National Aquatic Resources Survey (NARS), National Coastal Condition Assessment (NCCA) Program. The results of those samples are expected to be available for the 2011 TRIW Report.

Extensive monitoring of toxics for more than three decades has revealed that the distribution and concentration of contaminants vary greatly among sediment samples, whether they are nearby duplicates collected on the same day or sequential samples collected over various time spans. No definitive long-term trends have been detected to document consistent changes in toxics contamination. The probabilistic monitoring of toxics during the past eight years has demonstrated that statewide, concentrations of dissolved trace metals and organics in ambient waters are generally representative of global background levels, except near confirmed or suspected point sources. Periodic reports on the probabilistic results provide a baseline for future comparisons. Recent developments of more efficient sampling designs, sampling technologies and analytical methods offer promise of more effective documentation of short-term changes and mid-term trends in toxics in the near future.

Assessment and Remediation

Assessment: The most recent (2010) 305(b)/303(d) Water Quality Integrated Report identified 12,101 miles of impaired streams and rivers, 96,651 acres of impaired lakes, and 2,157 square miles of impaired estuaries. Of those impaired by toxics, over 99% were listed for fish consumption advisories, primarily for PCBs (31.0% of toxics-impaired rivers, 56.1% of lakes, 98.4% of estuaries) or mercury (61.4% of rivers, 42.3% of lakes, 1.0% of estuaries). Because the number of segments united into each Total Maximum Daily Load (TMDL) varies with the hydrography and the extent of the impairment, the exact number and schedule of toxics-related TMDLs to be developed and implemented is not certain. DEQ's PCB Strategy (2005) establishes priorities for TMDL development and discusses various options for remediation. Analyses for the 2012 Integrated Report will begin in 2011, and any new PCB-impaired segments will be integrated into the Strategy.

Remediation / Reduction: A number of toxics-related TMDLs have been completed and approved since 2002; two in 2002, three in 2004, and 16 in 2007, all for PCBs in the Shenandoah (5) or in other Virginia tributaries to the Potomac (16). Two benthic TMDLs were completed for toxics parameters, one (copper and zinc) in the New River basin (2004) and one (PAHs and lead) in the Shenandoah (2006). Two TMDLs for chlorides were also completed, in the Holston River basin in 2006 and in the Big Sandy basin in 2007. An ammonia TMDL in the Shenandoah basin was completed in 2009, and a PCB TMDL in the Roanoke

(Staunton) River basin and a complex mercury TMDL in the Shenandoah River basin were completed in 2010.The Smith River has a benthic TMDL within which a stressor analysis is ongoing. PAHs have been implicated as a potential stressor. PCB TMDL development initiated for the upper tidal James River and the Elizabeth River in 2009 has continued and public meetings are being held in December (2010) and January (2011). The agency's TMDL history, current status and development plans are available at http://www.deq.virginia.gov/tmdl/.

As these TMDLs are completed and scheduled for implementation, and others are added, follow-up monitoring will be initiated to evaluate their effectiveness in reducing toxics contamination. The effective implementation of these TMDLs should result in measurable reductions of contaminants in a number of the state's watersheds within a few years.

A number of water bodies and/or segments previously listed for toxics have recently been removed from the 303(d) list: several segments in the Shenandoah for nitrates (public water supply), several segments in the Elizabeth River system for tributyltin (aquatic life), two segments in the Dan River for DDT (fish consumption), two segments in the Holston River basin for lead (aquatic life), one segment in the Clinch and one in the Russell Fork for PCBs (fish consumption), and two segments of Lake Anna and an adjacent tributary for lead (aquatic life, wildlife).

Continued Commitment

DEQ continues its commitment to toxics reduction by the prevention of contamination, continued water quality monitoring, and the implementation of remedial measures. The Virginia Pollutant Discharge Elimination System, the Pollution Prevention Program, and the Environmental Education Program join with other agencies, programs and stakeholders to promote public awareness, as well as to control and reduce toxics releases. The Toxics Release Inventory and various water programs constantly monitor and document the release to, and the presence and movement of toxics in aquatic environments. Close coordination between monitoring and assessment activities will identify new sources of contamination as they occur and document the effectiveness of load allocations and other remedial measures developed and implemented by the TMDL Program. The agency anticipates significant reductions of toxics in the state's waters as a result of continued TMDL implementation.

Foreword

State Fiscal Year 2010 Toxics Reduction in State Waters Report (January 2011)

The Virginia Department of Environmental Quality (DEQ) plans and executes its Ambient Water Quality Monitoring Program on an annual basis. Guidelines for the program include:

- A long-term Water Quality Monitoring and Assessment (WQMA) Strategy, revised and accepted by EPA Region 3 in April of 2007 (another revision will be prepared and submitted in 2011),
- Formal Quality Assurance Program and Project Plan (QAPP),
- Established Standard Operating Procedures (SOPs), and
- Standardized Sampling Protocols.

The agency's annual monitoring program plan (MonPlan) corresponds with the calendar year. This helps synchronize various monitoring activities and assessment periods with the 'ecological' or 'water year'. Monitoring activities summarized in this report, however, still refer to the State Fiscal Year (SFY - July 1 of each year through June 30 of the following year) in order to provide complete analytical results by January 1.

The SFY10 Toxics Reduction in State Waters Report (TRISW- Jan 11 – thirteenth in the series) summarizes all toxics monitoring and reduction activities carried out between July 1, 2009 and June 30, 2010. The historical summaries of toxics monitoring results in Folders 3 through 6 are cumulative, with the addition of the corresponding year's results in each new report.

To minimize the size of the report, reduce production time and costs, and facilitate its distribution to interested parties, the data tables, figures and appendices of this report are presented in their complete form on, and may be downloaded from the DEQ WebPages at http://www.deq.virginia.gov/watermonitoring/tox.html. Electronic copies of the complete report, including tables, figures and appendices, are available on CD upon request from Don Smith at (804) 698-4429 or Donald.Smith@deq.virginia.gov.

In the Water Quality Monitoring section, data summaries of yearly sets of monitoring results are available in both tabular and graphical forms. Graphical summaries of historical toxics monitoring results (which use statistical interval-estimates for median parameter values) will continue to appear with each annual report to assist in the visual evaluation of:

- Two- to five-year (short-term) changes in water and sediment quality,
- Differences among drainage basins (contemporary, geographic trends) year by year, and
- Differences among years within individual basins (basin-specific, short-term temporal variations).

Eventually, as each year's results are added to the report, historical results in the form of graphed statistical interval-estimates will facilitate the visual evaluation of longer-term trends. Graphed historical summaries (SFY97 – SFY10) for each major drainage basin appear in this year's report, but the relatively short period of record and changes in methodologies and detection limits make the interpretation of trends difficult.

1.0 Introduction

The Virginia Department of Environmental Quality submits a Toxics Reduction in State Waters (TRISW) Report to the Governor and the General Assembly of the Commonwealth by January 1st of each year, in accordance with Chapter 3.1, Title 62.1, § 62.1-44.17:3 of the Code of Virginia.

1.1 The Report: Toxics Reduction in State Waters

The primary objective of the TRISW Report is to document the state's commitment to improving water quality; more specifically, in relation to chemical contamination which may induce toxic effects on aquatic life, other wildlife or on human health. This commitment includes:

1. The prevention of contamination of the Commonwealth's waters by toxics,
2. The persistent monitoring of the those waters for the presence of toxics, and
3. The implementation of remedial measures to reduce and/or eliminate toxics found in the state's waters.

Each report provides a summary of the toxics-related prevention, monitoring and remediation activities of the previous State Fiscal Year (SFY = July 1 - June 30).

Although the reduction of toxics in the state's waters is primarily the responsibility of the DEQ, various agencies and organizations participate in the process, including the Virginia Department of Conservation and Recreation (DCR), the Virginia Department of Health (VDH), the U.S. EPA's Interstate Chesapeake Bay Program (CBP), and the U.S. Geological Survey (USGS). This report summarizes the results of current activities directed toward toxics reduction and provides guidance on how to access further resources and information on specific subjects.

DEQ submitted the first TRISW Report in January 1998. The January 1999 report provided basic background information related to the report's objectives and a basic model for its continued evolution. The current, fourteenth TRISW Report (January 2011) contains tables of both raw data and statistical summaries of SFY10 monitoring results, as well as cumulative graphical summaries of results from 1997 through the present.

1.2 Functional Definitions: Toxicity, Water Quality Criteria, and Water Quality Standards

1.2.1 Defining "Toxicity":

The Virginia Code (Chapter 3.1, Title 62.1, § 62.1-44.17:2) defines "toxicity" as "the inherent potential or capacity of a material to cause adverse effects on a living organism, including acute or chronic effects on aquatic life, detrimental effects on human health, or other adverse environmental effects." This definition is rather broad, since an excess or even a deficit of many non-toxic substances can also cause adverse effects, both acute and chronic, on living organisms. This report consequently restricts the definition of "toxicity" to include only to those substances that are directly and "chemically" detrimental to living organisms when they are "in excess." Direct chemical effects would exclude the physical effects of excess sedimentation or the indirect effects of nutrient enrichment, for example, both of which would also be detrimental to aquatic life. Furthermore, the concept of "other adverse environmental effects" must be defined in biological terms, since toxicity can only be observed, described, and quantified in relation to living organisms. The classification of chemical substances ("a material") within the category of "toxics" (those that cause

toxicity) is always based on the observed effects of their presence on specific living organisms. In fact, the concept of "excess" itself is defined in terms of the concentrations at or above which living organisms experience detrimental effects.

Toxicity varies enormously among chemical substances. The amount and concentration of a substance necessary to demonstrate "deleterious effects" also varies. The Federal Clean Water Act (CWA – 1983) defined the responsibility of the Environmental Protection Agency in identifying the critical concentrations at which distinct chemical substances begin to elicit a specified degree of deleterious effect, and establishing the associated "Water Quality Criteria" to identify impaired waters.

1.2.2 Federal Water Quality Criteria:

The CWA first described the scope and purpose of water quality standards and defined the authority and responsibility of the U.S. EPA and the various states in relation to the requirements for, submission of, and establishment of such standards. Since then, EPA has published various lists of toxic materials for which the movement, use, and/or release into the environment must be documented or for which concentrations in the environment must be monitored and their effects assessed and subsequently controlled. EPA carefully reviews the results of published studies (both academic and commercial) and conducts its own research to determine what concentrations of chemical substances are detrimental to aquatic life, other wildlife and human health, and to what degree. Based on the results of this evaluation "Water Quality Criteria" may be established for freshwater, saltwater or drinking water, identifying the concentrations that induce direct chronic or acute toxic effects on aquatic life, subsequent poisonous effects on wildlife or humans, or long term carcinogenic (cancer producing) effects on human health.

- On December 22, 1992, the U.S. EPA published in the *Federal Register* a comprehensive list of 126 chemical substances for which it had established water quality criteria related to aquatic life in freshwater and saltwater and/or to human health risks.
- Subsequent studies often (1) identified additional toxics for which criteria were established, or (2) resulted in the establishment of new criteria for previously defined toxics. The list was modified during the ensuing years. For example, the EPA's publication of conversion factors in May 1995 lowered the acute and chronic freshwater criteria and the acute saltwater criteria for the dissolved metals arsenic, cadmium, chromium III and VI, copper, lead, mercury, nickel, silver, zinc, and selenium.
- The EPA provides its most recent complete list of nationally recommended water quality criteria for both priority (120) and non-priority (47) toxic pollutants in electronic form on the EPA WebPages at: http://www.epa.gov/waterscience/criteria/wqcriteria.html.
- Additional modifications of existing criteria, as well as the establishment of criteria for new substances, continue to update the EPA list and help maintain or improve the quality of the nation's waters. Detailed information on recent updates may be found at:
    - Aquatic Life: http://www.epa.gov/waterscience/criteria/aqlife.html#final
        - EPA is revising the current aquatic life criteria for lead, silver, and selenium. EPA is also re-evaluating the current aquatic life criteria for ammonia, and developing new aquatic life criteria for atrazine.
    - Human Health: http://www.epa.gov/waterscience/criteria/humanhealth/15table-fs.htm
        - EPA is publishing 15 updated nationally recommended water quality criteria for the protection of human health: chlorobenzene, cyanide, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,1-dichloroethylene, 1,3-dichloropropene, endrin, ethylbenzene, hexachlorocyclopentadiene, lindane, thallium, toluene, 1,2-transdichloroethylene, 1,2,4-trichlorobenzene, and vinyl chloride.

The proliferation of new chemical products in the market, as well as emerging concerns over the effects of established chemical and pharmaceutical products, makes the use of a static list inadvisable.

1.2.3 State Water Quality Standards - WQS:

Once federal "Water Quality Criteria" have been established for a chemical substance, it is the responsibility of the individual states to establish "Water Quality Standards" within their own legal Code that are protective of the "designated uses" assigned to each body of water. The most commonly designated uses include the support of aquatic life, fish consumption, shellfish consumption, human primary contact (swimming) or secondary contact (fishing, boating) recreation, public water supplies (where applicable), and wildlife.

The Commonwealth of Virginia has established and periodically revised its water quality standards, which EPA reviews and must approve prior to their application (9 VAC 25-260 Virginia Water Quality Standards. Statutory Authority: § 62.1-44.15 3a of the Code of Virginia). These state standards undergo a formal "Triennial Review" for periodic updating. In reality, the Commonwealth's WQS are almost constantly under review. The most recently adopted WQS are presented in their entirety in Appendix A and are also available on the DEQ-WQS WebPages at http://www.deq.virginia.gov/wqs. The State Water Control Board approved all Triennial Review amendments to section 9 VAC 25-260-140, "Criteria for Surface Water, at their October 17, 2008 meeting. The amendments became effective upon EPA approval on February 1, 2010.

Approximately 90 parameters in the criteria table in section 9 VAC 25-260-140 (Appendix A) had amendments that were approved by the Board and EPA. The majority of the amendments consisted of changes to numerical criteria for human health based on updated EPA guidance that is more stringent - due either to a Relative Source Contribution factor or an increase to the estimated amount of consumed fish tissue being incorporated into the formula EPA utilizes in the updated criteria calculations.

Three new criteria based on EPA updates for toxic analytes will be added to the WQS: Diazinon, methyl-mercury (as a fish tissue concentration criterion), and nonylphenol. Two new footnotes have been added. One concerns the number of significant digits to be utilized when assessing for the parameters and the other was added to explain application of the methyl-mercury criterion to wet weight concentration in edible tissue for to the most commonly eaten species.

Amendments to cadmium freshwater aquatic life criteria and fresh- and saltwater aquatic life criteria for lead in section 9 VAC 25-260-140 are expected to be part of the next triennial review. The amendments incorporate the latest compilation of toxicity literature available for cadmium in freshwater and incorporate the EPA-recommended conversion factor for lead criteria.

For further information relative to Virginia's Water Quality Standards, contact David Whitehurst at (804) 698-4121 or David.Whitehurst@deq.virginia.gov.

1.3 Federal Reporting Requirements

In addition to the biennial 305(b)/303(d) Water Quality Integrated Report, federal law requires reporting procedures for the production, movement, storage, use, and release of many of these toxic substances.

These procedures, as well as Virginia's annual Toxics Release Inventory (TRI) Report, are discussed more fully below.

2.0 Activities Directed toward Toxics Reduction

As indicated above, DEQ's activities directed toward the reduction of toxics in state waters fall into three general categories: the prevention of contamination of the Commonwealth's waters by toxics, the monitoring of the those waters for the presence of toxics, and the implementation of remediation to reduce and/or eliminate toxics found in the state's waters. All three classes of activity are geared toward maintaining the concentrations of potentially toxic substances in the state's waters below those concentrations that result in toxic effects, *i.e.*, within the bounds defined by water quality standards, with the understanding that many such substances can never be completely eliminated from the environment.

Many potentially toxic substances may be produced or released from the environment by natural processes. The leaching of elemental metals (e.g., arsenic, lead, copper) from natural geologic formations would be one example, or the release of toxic gases by geothermal activity. The weathering or release of naturally occurring organic contaminants from fossil fuels deposits, without human intervention, would be another. It is inevitable, with our current rate of economic and industrial development and our increasing dependence upon manufactured products, that some toxic materials will find their way into the environment during the production, use, and/or disposal of modern products.

2.1 Prevention

The primary prevention activities carried out by DEQ may be characterized as regulatory, non-regulatory, and educational.

The regulatory Virginia Pollutant Discharge Elimination System (VPDES) requires that concentration limits be established for all potentially toxic substances in permitted discharges from industrial, institutional, and/or municipal wastewater treatment facilities to ensure that Virginia's water quality standards are not violated in the water bodies receiving such discharges.

The non-regulatory programs of the Office of Pollution Prevention (OPP) encourage industries, commercial enterprises, governmental and private facilities throughout the Commonwealth to establish Environmental Management Plans (EMPs) to minimize the use of hazardous materials, and to maximize the use of "green products and services" and the recycling of wastes.

The Office of Environmental Education provides environmental orientation and educational programs for teachers and students through electronic newsletters and other outreach activities (workshops and other training events, meaningful watershed experiences, oyster and fish festivals, etc.) to foster environmental stewardship, including non-competitive litter prevention and recycling grants.

2.2 Monitoring and Assessment

The VPDES Program performs end of pipe compliance monitoring in the form of announced and unannounced facility inspections, as well as requiring permitted facilities (industrial and municipal) to monitor their discharges and to file periodic electronic Discharge Monitoring Reports (DMRs) to document their compliance with permit limit requirements.

DEQ's integrated ambient Water Quality Monitoring (WQM) Program collects water, sediment, and fish tissue samples from the Commonwealth's streams, rivers, lakes and reservoirs, estuaries, and near shore waters to document compliance with water quality standards and sediment and fish tissue screening values. The structure and integration of the various components of the ambient WQM Program are described in detail in DEQ's Water Quality Monitoring Strategy, available on the DEQ Water Quality Monitoring WebPages (http://www.deq.virginia.gov/watermonitoring/monstrat.html). The major components involved with toxics monitoring include the watershed station network, the freshwater and estuarine probabilistic monitoring networks, the trend monitoring network and special studies, including the TMDL Program. Some program specific monitoring also contributes to the toxics efforts: the Chesapeake Bay Program, the Lakes Monitoring Program, the Biological Monitoring Program, and the Targeted Fish Tissue and Sediment Monitoring Program.

DEQ's SARA Title III Program receives annual electronic TRI summaries from reporting facilities statewide, and produces an annual TRI Report that documents the movement, on site disposal, off site transfer, and release of toxic materials to the air, water and land, as prescribed by federal regulations.

2.3 Remediation

Although DEQ participates in several programs that deal with the remediation of toxic contamination (e.g., Brownfields Program, Federal Facilities Program, Superfund Program, etc.), the primary agency-driven program involved in remediation of toxics-related impairments in aquatic environments is the TMDL Program. Once impaired waters have been identified, it is the responsibility of the TMDL Program to confirm the cause of the impairment, identify its source(s), and develop plans to restore and maintain the water quality. TMDL is a term that represents the total pollutant (toxicant) a waterbody can assimilate and still meet water quality standards. Once a TMDL has been reviewed and approved by EPA, an implementation plan (based on the TMDL) is developed for reducing the input of the associated toxics into the system. Depending on the type of toxicant, its source(s), and the historical background of the contamination, implementation may include reducing permit limits for a toxicant in the discharge from a permitted facility or, in the specific case of PCBs, establishing programmed Pollutant Minimalization Plans (PMPs) with permitted point sources, executing Best Management Plans (BMPs) for non-point sources or, on occasion, the physical removal of contaminated substrate from legacy point sources.

2.4 Analysis of Toxics from Ambient Waters

The majority of toxics-related samples collected by the ambient WQM Program are analyzed by the Division of Consolidated Laboratory Services (DCLS) of the Virginia Department of General Services, although academic or commercial laboratories may be contracted for some specialized analyses. Toxic elements and chemical compounds are generally categorized into several primary groups, each of which has specific chemical analysis codes to identify the procedures necessary for its complete analysis by DCLS. The primary groups normally considered include:

- Clean dissolved and total trace metals in the water column,
- Toxic metals in the sediment,
- Dissolved organic contaminants,
- Organic contaminants in the sediment, and
- Toxic metals and organics in fish tissues.

The data summaries provided in the following sections of this report are organized to correspond with these categories. Various groups of toxic organic compounds (*e.g.*, PAHs, semi-volatiles, and PCBs) are generally evaluated together with pesticides.

Table 1 of this report summarizes the currently active toxics-related Parameter Group Codes and the specifically associated analytes in the current DCLS laboratory catalogue within the DEQ CEDS database, including their associated reportable limits, costs, and turnaround times. The exact reportable limits may vary from day to day, depending on the stability of the analytical apparatus, the purity of reference materials and blanks, and possible interference from other substances present in the samples collected in the field. Various Parameter Group Codes included in this list are seldom utilized within the Ambient WQM Program. Some are specific to other matrices, such as fish tissues, soil, etc., or are utilized specifically for industrial facilities. Other group codes have been updated and replaced with new codes because of concern with new chemical products or the availability of newer analytical methods with lower detection limits for the analytes of interest. Those parameter group codes actually employed by the AWQM Program during SFY10 are enumerated in Table 2.

Table 2.A summarizes the number of samples, the analytical expenses, and the parameter group codes included in toxics-related analyses performed and billed by the state laboratory (DCLS) during the 2010 state fiscal year. Toxics samples, analytical costs, etc., that are associated with the fish tissue and sediment monitoring program, collected during various toxics-related special studies, or collected in the Estuarine Probabilistic Monitoring Program, are generally analyzed elsewhere via contracted services. The costs of contracted analytical services for the major toxics-related programs and special studies are summarized in Table 2.B.

3.0 Toxics-Related Results – SFY2010

3.1 Prevention

3.1.1 Reduction of Toxics by Pollution Prevention

DEQ's Office of Pollution Prevention (OPP) contributes to the reduction of toxics in the state's waters through its multimedia (i.e., air, water, and waste) non-regulatory Pollution Prevention (P2) Program. The P2 Program focuses primarily on the reduction of solid wastes and resource consumption. The reduction of waste and resource consumption, however, also reduces the movement, use, and release of toxic materials. Such reductions occur not only within the consumer population but also among retail outlets and, perhaps most important of all, among industries using and/or producing toxic materials.

The annual Pollution Prevention Report, submitted to the Governor and the General Assembly in December of each year, describes OPP's activities for the year. The 2010 report summarizes the pollution prevention strategies developed and implemented by the Virginia Pollution Prevention Program, which is coordinated with other DEQ activities as well as with those of the Department of Conservation and Recreation. The current annual report characterizes activities carried out by the major components of the Pollution Prevention Program during 2010, several of which are briefly summarized below.

- **Virginia Green Tourism** - Virginia Green, the Commonwealth's initiative to promote voluntary pollution prevention within the tourism industry, began its pilot phase in 2006. As of October 2010, it included 875 participants, an increase of 228 participants since last year at this time. Of these, 82 new members joined during the challenge promotion for the 75th Anniversary of the Blue Ridge Parkway. The program is fast approaching its 2010 goal of 1000 participants. Among the participants are included permanent tourist attractions, conference and convention centers, programmed tourist events, lodging facilities, restaurants, travel organizations, visitor centers and numerous other partners, all

dedicated to minimizing their impact on the environment by maximizing the use of recyclable materials, reducing water and energy use, and purchasing and using eco-friendly services and products. The Virginia Green Suppliers Network was established in September 2010 to provide sources for participants interested in green products and services. A five-minute recruitment video was launched in October 2010, and the program's new marketing website was established at the end of the year:

http://www.deq.state.va.us/p2/virginiagreen/.

- **Environmental Excellence Program (VEEP)** - At the end of 2010 there were approximately 450 facilities in the Virginia Environmental Excellence Program (VEEP). This Program recognizes three levels of performance for participating facilities: (1) E2 (Environmental Enterprise) for facilities that have made significant progress toward the development of an Environmental Management System (EMS), have made a commitment to pollution prevention and have a record of sustained compliance with environmental regulations (2) E3 (Exemplary Environmental Enterprise) for facilities that have exceeded the E2 requirements and have a fully-implemented EMS, and (3) E4 (Extraordinary Environmental Enterprise) for facilities that have exceeded the E3 requirements, have completed at least one full cycle of an EMS as verified by a third-party auditor and have demonstrated a commitment to continuous and sustainable environmental progress and community involvement. At present, approximately 63% of the facilities are at the E2 level, about 31% of them are at the E3 level, and the remaining 6% are at the E4 level. In 2010, DEQ received more than 170 VEEP applications, about 25% for new facilities and the rest for renewing facilities or those moving to another level of the program.

  Twenty facilities were honored with special recognition during 2010. Virginia still provides performance-based permit fee discounts for "going beyond compliance." Potential discounts vary by category: 5-20% for hazardous waste reduction, 10-20% for solid waste reduction, and 2-20% for reduction of water use and release. In 2010, over $127,300 in fee discounts were distributed among VEEP facilities that implemented and performed their Environmental Management Plans.

- A review of VEEP annual performance reports for 2010 indicated the following changes from baseline reference values. Total water use was reduced by 994.4 million gallons. The use of hazardous materials decreased by 7.8 tons, and hazardous waste generation was reduced by 325 tons. The emission of greenhouse gases (NOx, SOx) was reduced by 3,900 tons. Emissions of volatile organic compounds to the air decreased by five tons. Total energy use was reduced by 144,900 million BTU's. Over $24.3 million in cost savings were realized during this process.

- DEQ's Voluntary Mercury Reduction Initiatives have also been successful. Members of the "Virginia Switch Out" Project for the recycling of automotive mercury switches have removed 56,097 switches, and recycled 123.4 pounds of mercury since 2006, when the program was initiated. Facilities have pledged to annually recycle almost 53,000 energy efficient fluorescent light bulbs, which also contain small quantities of mercury. (Refer to DEQ's Mercury Reduction WebPages - http://www.deq.virginia.gov/p2/mercury/homepage.html.)

- DEQ's OPP also administers the commonwealth's National Partnership for Environmental Priorities (NPEP) program, which encourages public and private organizations to form voluntary partnerships (with states and the EPA) that reduce the use or release of substances that have been designated "Priority Chemicals" – i.e., substances that are persistent, bioaccumulative and toxic. This year, four additional facilities joined NPEP, committing to reduce priority chemical release by 6,500 pounds. The Virginia Department of Corrections has begun to capture and recycle lead from shooting ranges and

DuPont Front Royal is reducing lead used in its products. The City of Chesapeake garage and the Lee Hall Maintenance and Operations Center in Newport News are reducing the use of lead wheel weights.

For additional information concerning the Pollution Prevention (P2) Program, visit the DEQ WebPages at http://www.deq.virginia.gov/p2/ , or contact:

Sharon Baxter
Director, Office of Pollution Prevention
629 E. Main Street
Richmond, VA 23219
(804) 698-4344
Sharon.Baxter@deq.virginia.gov

3.1.2 Reduction of Toxics from Permitted Discharges and Compliance Monitoring of Permitted Facilities

Both private and public facilities that discharge effluents into the state's waters are required to obtain permits from the State Water Control Board. The Virginia Pollutant Discharge Elimination System (VPDES) requires the establishment of limitations for such permits to ensure that Virginia's water quality standards are not violated in the water bodies receiving such discharges.

"Appendix B - Facilities & Outfalls with Toxics Parameter Limits SFY10" of this report lists facilities that currently have or have applied for permits that contain limits on the quantity or concentration of discharged toxics in their effluents. The same spreadsheet includes their respective addresses, geographic locations, receiving streams, etc. During SFY10, 304 reporting facilities with 622 outfalls had one or more toxics limits in their permits. The effective limits (when specified) and reporting frequencies for toxics may vary, depending upon the chemical parameters involved. In some cases, a permit may have been modified, reissued, or adjusted in terms of the current limits within the past year. The current toxics parameters included in each permit, along with their limits and required reporting frequencies, are listed in "Appendix C – Permit Parameters Units & Frequencies SFY10." The compliance results of each permitted facility's Discharge Monitoring Reports (DMRs) during SFY10 are reported in "Appendix D – Permitted Toxics Parameters & DMR Results SFY10." Some facilities may hold permits requiring only that they report, without a limit-specified value with which they must comply. Since they do not have a numeric value limit, they cannot be used for compliance testing. Of 7,585 parameter-specific DMRs filed in SFY 2010, 2,472 had limits for the average concentration of a toxicant. Of these, 107 (4.3%) reports exceeded their permit limit. Parameter-specific maximum concentration limits were specified in 3,097 DMRs. Of these, 128 (4.1%) exceeded the limit specified in their permit. Almost all of these were short term exceedances for total recoverable copper or total recoverable zinc at municipal wastewater treatment plants. Runs of three or more consecutive exceedances of maximum concentration limits were only observed nine times for total recoverable copper and five times for zinc. Average concentration limits were exceeded even less frequently (Seven for copper and three for zinc).

Further information on the compliance of specific permitted facilities is available from the corresponding regional Water Compliance Manager. The most current contact information for each regional office is available on the DEQ WebPages at http://www.deq.virginia.gov/regions/.

3.1.3 Reduction of Toxics by Environmental Education

DEQ's Office of Environmental Education (OEE) contributes to toxics reduction in various ways. The Virginia Naturally Program distributes monthly newsletters to over 2,000 educators and litter and recycling program managers across the state. In 2010, 55 new partners signed up to participate in the statewide network. Training was provided to 932 community educators at 20 professional development workshops, and coordination, public information and educational resources were provided to 5,320 people at 22 outreach events.

In FY 2010, 306 local governments were given Non-Competitive Litter Prevention and Recycling Grants. A total of $1,524,694 was awarded and was matched by an additional $11,061,966 in cash and in-kind services, a match of 730%. The Environmental Educators Leadership Program (EELP) has involved more than 100 different educators across the Commonwealth.

The OEE continues to build capacity within ten Regional Environmental Education Teams to provide high quality environmental education and encourage direct citizen involvement in natural resource stewardship projects. In 2010, $30,131 in NOAA funding, awarded as Virginia Naturally Classroom and Partner Grants, provided support for students conducting meaningful environmental watershed investigations at 34 schools.

A total of 200 Virginia teachers, non-formal educators and college students participated in 13 workshops for Virginia Project WET – Water Education for Teachers, and its associated curriculum. In August, the OEE, in partnership with DCR, the Virginia Tech's Master Naturalists, and the Virginia Association of Soil and Water Conservations Districts, received a three-year $225,000 NOAA capacity building grant to train non-formal educators to deliver high quality programs and services to K-12 teachers and their students.

3.1.4 Virginia Toxics Release Inventory

Under the provisions of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986, also known as SARA Title III, Virginia manufacturing and federal government facilities that release certain chemicals to the air, water or land, or that transfer these chemicals for off-site treatment, disposal, recycling, or energy recovery, are required to submit reports to the EPA. This information is reported on Form R - Toxic Chemical Release Inventory Reporting Form and is collectively referred to as the Toxic Release Inventory. Although the Report itself is an *a posteriori* monitoring tool, the intent of the program is to minimize the quantity, movement, and disposal of toxic materials.

The most recent Virginia Toxic Release Inventory Report (SARA Title III TRI, March 2010 for the 2008 activity year - http://www.deq.virginia.gov/sara3/3132008.html) indicated that 455 Virginia facilities filed 1,672 individual reports on the release, transfer, or management of TRI chemicals or chemical categories. These reports included 178 of more than 650 chemicals and chemical categories for which TRI reporting is required. This year's reporting represented decreases of approximately 0.87% from the 459 facilities and 6.38% from the 1786 reports filed in 2007.

Statewide, the tallied toxic releases to the water totaled approximately 20.29 million pounds or 39.35% of the total onsite releases to all media during 2008. This quantity represents a 9.36% increase from the 18.38 million pounds released to the water in 2007. On-site releases to water include discharges to surface waters, such as rivers, lakes, ponds, and streams. On-site releases to the land (~ 2.95 million lbs. or 5.72% of the total releases) refer to discharges to landfills, surface impoundments, land treatment, application farming, or any other release of a TRI chemical to land within the boundaries of a facility. Some of these discharges may eventually find their way into the Commonwealth's surface waters as well. Virginia does not permit

under-ground injection as a method of hazardous waste disposal; consequently, no under-ground injection of TRI chemicals was reported in 2008. An additional 28.32 million pounds (54.93%) was released to the air, either from stacks or as fugitive air. A portion of these releases may also return to the Commonwealth's soil and waterways in the form of aerial deposition.

The top ten chemicals and chemical categories accounted for more than 99.99% of the on-site TRI chemical releases to water. The top ten TRI chemicals released to water were: nitrate compounds (98.96% = 19.804 million lbs.), manganese and manganese compounds (0.44% = 0.089 million pounds), zinc and zinc compounds (0.26% = 0.052 million pounds), barium and barium compounds (0.17% = 0.035 million pounds), copper and copper compounds (0.09% = 0.018 million pounds), vanadium and vanadium compounds (0.03% = 0.006), arsenic and arsenic compounds (0.02% = 0.004 million pounds), nickel and nickel compounds (0.01% = 0.002 million pounds), various glycol ethers (0.01% = 0.002 million pounds), and chromium and chromium compounds (0.005% = 0.001 million pounds). All others totaled 0.002% and < 0.001 million pounds. Nitrate compounds are a common byproduct of industrial and domestic wastewater treatment processes and have consistently been reported as the major chemical released to surface water. Nitrates often induce nutrient problems in water bodies at lower than toxic concentrations.

A considerable amount of additional information on specific groups of chemicals and the quantities of their chemical releases is available in analyses within the original report (2008 VIRGINIA TOXICS RELEASE INVENTORY REPORT - March 2010). The March 2009 Virginia TRI Summary Report, summarizing data from CY2007 industry reports, is available on the DEQ Website at: http://www.deq.virginia.gov/sara3/3132007.html.

For further information on the Virginia TRI, contact:

Primary Contact: Nichelle D. McDaniel
Program Coordinator, SARA Title III
(804) 698-4159
Nichelle.McDaniel@deq.virginia.gov

Alternate Contact: Sanjay Thirunagari
Environmental Program Manager, SARA Title III
(804) 698-4193.
Sanjay.Thirunagari@deq.virginia.gov

Additional sources of information on the TRI: Community Right-to-Know, including the access and use of TRI data and fact sheets for individual states, are available from the EPA's Internet site http://www.epa.gov/tri/.

The next Virginia TRI report, summarizing toxic releases for calendar year 2009, should be available in March 2011.

3.2 Monitoring of Toxics in Ambient Waters – SFY2010

3.2.1 Surface Waters and Sediments

During the assessment process, concentrations of toxic contaminants found in the water column are compared with the Virginia Water Quality Standards (Appendix A - DEQ Water Quality Standards Feb2010), and concentrations of toxic contaminants found in sediment are compared with the screening

values found in "Appendix E - Summary of Sediment Screening Values SFY10." "Appendix F – WQM Toxics Monitoring Station Group Code List SFY10" lists the all monitoring stations where water and/or sediment samples were collected for each DCLS toxics parameter group code during SFY10.

Numerous tables and folders containing raw and summarized monitoring results are described in the following sections of this report. The tables contain all the descriptive information (metadata) relative to each monitoring station, the raw data results for each analyte, and descriptive statistical summaries for the results from each major river basin during SFY10. Corresponding Folders contain cumulative historical summaries of the results from each year in which a TRISW Report has been produced, by river basin and analyte. A Microsoft Excel® file titled "Introduction to Tables and Folders" is included in the two directories containing the Tables and Folders. This introductory file lists the specific analytes contained in each table and folder, and explains the meaning of the Program Codes associated with the samples.

At the present time, all existing water quality criteria and standards for toxic substances in water are defined in terms of dissolved concentrations. In many cases, the defined standards are extremely low concentrations, near or below the detection limits of common analytical equipment and methodologies. In the past, it was often necessary to collect and concentrate large volumes of water samples to produce meaningful results. Sampling of waters with such low concentrations of toxics also presents severe problems in terms of sample contamination. Consequently, careful planning and specific SOPs are necessary to ensure the quality control of sample collection, transport of the sample, and subsequent chemical analyses to guarantee the accuracy and defensibility of the results. A number of newly developed sampling and analytic technologies are now in use for improving the representativeness, accuracy, and precision of measuring dissolved toxics in the water column. For more detailed descriptions of these new procedures, refer to the January 2007 TRISW Report.

3.2.1.1 Dissolved Metals in Surface Waters

DEQ's dissolved clean metals SOP (DEQ-WQA, 1998) is currently being applied in the collection and analysis of 19 dissolved trace metals in freshwater and of 16 metals in brackish and saltwater samples. "Table 3 – Clean Dissolved Metals All Basins SFY10" presents the results of clean, dissolved metals monitoring during SFY10. Individual spreadsheets in Table 3 summarize the results from Freshwater and Estuarine Probabilistic Monitoring Programs, the Shenandoah River Basin Mercury Special Study and several TMDL and other Special Studies. Basin-by-basin historical summaries of clean dissolved metals results can be found in the Excel® workbooks "Folder 3 Historic Dissolved Clean Metals - All Basins."

3.2.1.2 Total Metals in Surface Waters

Because there are no Water Quality Standards for total metals in the water column, the sampling of total metals has not normally been included in ambient water quality monitoring. In recent years, however, sampling for benthic TMDL studies has revealed that the health of benthic communities in freshwater streams is often more highly correlated with the concentrations of total metals in the water column than with dissolved metals. Consequently, more recently total clean metals have been sampled along with dissolved metals at most probabilistic monitoring stations. During SFY10, DEQ researchers also collected clean total mercury samples from the Shenandoah River basin for the purpose of monitoring the transport of mercury (Hg) at many of the same sites where clean dissolved mercury samples were collected. Additional total metals samples were collected for several incident response studies and for industrial compliance monitoring. The resultant data from these samples are included in the spreadsheets of "Table 4

– Total Metals Water All Basins SFY10" and in the workbooks of "Folder 4 – Metals Total Water Historical."

3.2.1.3 Total Metals in Sediments

"Table 5a – Metals Sediment All Basins SFY10" presents tabular results and a statistical data summary of the SFY10 WQM freshwater sediment metals data, primarily from freshwater probabilistic monitoring sites and analyzed by DCLS. "Table 5b – Metals Sediment Estuarine ProbMon SFY10," reports the results of sediment metals analyses from the Estuarine Probabilistic Monitoring Program samples that were collected during the 2010 fiscal year and analyzed by contracted laboratories.

The Excel® workbooks of "Folder 5 – Historic Metals Sediment All Basins," present historical summaries of sediment metals in both non-tidal freshwaters and tidal estuarine waters.

3.2.1.4 Dissolved Pesticides and Other Organic Contaminants

The concentrations of dissolved organic compounds in the water column are generally extremely low, often at or below the detection limits of generally available analytical methods. For this reason, DEQ has suspended most ambient monitoring of dissolved organics using traditional methods. Semi-Permeable Membrane Devices (SPMDs) have been employed in several special studies on the distribution of polychlorinated biphenyls (PCBs) in the past.

To assist in the generation of PCB data for use in the development of TMDLs, DEQ now utilizes EPA's low-detect Method 1668. Historically, PCBs were not detected in ambient river water or effluents using traditional compliance methods (EPA Method 608 and 8082). These methods have elevated detection levels and are selective toward PCB Aroclor analysis. Recently, EPA recommended the use of Method 1668 for TMDL development since it is capable of detecting much lower concentrations of PCBs. It uses clean sampling techniques and a congener-specific, high resolution/low detection analytical method to measure concentrations in the pg/L (one picogram or one trillionth of a gram per liter) range. Data have been generated using this method for TMDL development within PCB impaired water bodies in the tidal Potomac River, the Roanoke (Staunton) River, Levisa Fork, the upper tidal James River and the Elizabeth River watershed. Some recent results from the James River and Elizabeth River studies are presented in Appendices I.1 and I.2 of this report, respectively.

3.2.1.5 Pesticides and Other Organics in Sediment

3.2.1.5.1 Chlorinated Pesticides in Freshwater Sediment

"Table 6a OC Pesticides Sediment All Basins SFY10" summarizes the results of chlorinated pesticide analyses of sediment carried out in SFY2010. The samples were collected from various small streams in the City of Charlottesville as part of a benthic TMDL special study.

3.2.1.5.2 Phosphorylated Pesticides in Freshwater Sediment

No analyses of phosphorylated pesticides were carried out during SFY2010. Tables 6b.1 (Group 1) and 6b.2 (Group 2) are included in this Report only as place holders.

3.2.1.5.3 Herbicides in Freshwater Sediment

No sediment herbicide samples from any basin were collected or analyzed during SFY 2010. Table 6c is included in this Report as a reserved table.

3.2.1.5.4 Polycyclic Aromatic Hydrocarbons (PAHs) in Freshwater Sediment

"Table 6d1 PAHs Sediment Grp1 All Basins SFY10" and "Table 6d2 PAHs Sediment Grp2 All Basins SFY10" summarize the results of PAH analyses of sediment samples collected during SFY2010. The samples were collected from various small streams in the City of Charlottesville as part of a benthic TMDL special study.

3.2.1.5.5 Semi-volatile Organics in Freshwater Sediment

"Table 6e Semi-Volatiles Sediment All Basins SFY10" summarized the results of semi-volatile organics analyses performed on sediment samples in SFY2010. These samples were also collected from various small streams in the City of Charlottesville as part of a benthic TMDL special study.

3.2.1.5.6 Polychlorinated Biphenyls (PCBs) in Freshwater Sediment

No ambient sediment samples were collected or analyzed for PCBs during SFY2010. Table 6d is included in this Report as a reserved table.

3.2.1.5.7 Organics in Estuarine Sediment

"Table 6g Sediment Organics Estuarine ProbMon SFY10" summarizes the results of sediment organics analyses performed on samples collected from 50 probabilistic estuarine sites during SFY2010. Resources for the analyses of these samples were provided by federal grant funds and they were analyzed by a contracted commercial laboratory. They include six tidal sites from the Back Bay / North Landing River drainage, eleven sites from Coastal Delmarva estuaries, three sites from the eastern shore of Chesapeake Bay, six sites from the James River drainage, seven sites from tidal tributaries and embayments of the Potomac River, three sites in the Rappahannock River basin, twelve sites along the western shore of Chesapeake Bay and two tidal sites from the York River basin. PAH, pesticides, and PCB results are included on separate tabs of the same Excel workbook.

3.2.1.5.8 Polycyclic Aromatic Hydrocarbons (PAHs) in the Water Column

A single sample for the analysis of PAHs in the water column was collected during an Incident Response investigation in a tributary to the lower James River during SFY2010. The results are presented in "Table 6h PAHs Water All Basins SFY10."

During the late summer of 2010 (July – September, SFY11) water samples for PAH analyses were added to the sample collection at 22 Virginia sites within the National Aquatic Resources Survey (NARS), National Coastal Condition Assessment (NCCA), as well as to 50 probabilistic near-shore oceanic sites along the Virginia coast. This special sampling was carried out because of concern about possible contamination of coastal waters resulting from the Deepwater Horizon Gulf oil spill and to provide baseline data of dissolved PAH levels prior to future offshore oil exploration and extraction along the Middle Atlantic continental shelf. Resources for the analyses of these samples were provided by DEQ's Office of Spill Response and Remediation. The results from this sampling will be included in next year's TRISW Report (Jan 2012).

3.2.2 Fish Tissue Contamination

DEQ's specialized Fish Tissue and Sediment Monitoring Program was suspended during 2010 because of resource limitations. No fish or sediment samples were collected by this program during SFY2010; however, the results were received this year from special Kepone monitoring carried out in the James and Chickahominy Rivers during 2009. "Table 7 – Fish Tissue Pesticides WQMA 2009 Recd 10" summarizes the results of that study. The concentrations of toxic substances found in fish fillets are used to evaluate "human health risk" by comparing them to screening values found in "Appendix G - EPA Risk-Based Screening Values for Fish Tissues SFY10."

DEQ did collect estuarine fish samples and sediment samples from 22 estuarine probabilistic sites during July through September 2010 as part of the National Aquatic Resources Survey (NARS), National Coastal Condition Assessment (NCCA) Program. The analytic results from those samples will be included in the 2011 TRISW Report (Jan 2012). Fish samples analyzed within this program, however, will be whole fish samples to be evaluated for "ecological risk" rather than fish fillet samples that are normally used for "human health risk" evaluations.

Several recent reports on agency fish tissue and sediment monitoring can be found on the DEQ WebPages at http://www.deq.virginia.gov/fishtissue. Additional information on the fish-tissue/sediment monitoring program is available from Gabriel Darkwah at (804) 698- 4127 or Gabriel.Darkwah@deq.virginia.gov.

3.2.3 Biological Monitoring

Benthic Community Evaluation: Field sampling and evaluation of both freshwater and estuarine benthic communities has proven to be an invaluable tool in the assessment of water and sediment quality. Significantly stressed benthic communities may indicate the impact of toxics in the environment, but follow-up evaluation is required to confirm the cause of the observed benthic impairment.

3.2.3.1 Freshwater Benthic Monitoring

"Appendix H1 – Freshwater Biological Stations SFY10" of this report lists the freshwater biological monitoring stations visited during SFY10. Regional biologists carried out a total of 698 site visits at 545 sites; 478 sites in the Piedmont and Appalachian Zones were subsequently evaluated using the Virginia Stream Condition Index (VSCI). Of those visits, approximately 14.5% resulted in evaluations of severe stress, possibly related to toxics. An additional 78 visits were made to 67 sites for evaluation using the Coastal Plain Macroinvertebrate Index (CPMI). Approximately 12.8% of those scores also indicated severe stress. The list in Appendix H1 includes a number of the 106 freshwater probabilistic sites that are also described in Appendix H2.

"Appendix H2 - Freshwater Probabilistic Monitoring Sites SFY10" provides a comprehensive list of the freshwater probabilistic monitoring stations that were included in the ambient program during fiscal year 2010. Many of these (the wadeable sites) were also sampled for benthic invertebrate populations and are also included in Appendix H1. This list summarizes 113 site visits to 106 freshwater probabilistic stations, including autumn visits to calendar year 2009 sites and spring visits to calendar year 2010 sites, as well as a number of follow-up visits for other purposes (e.g., TMDL or other special study projects).

3.2.3.2 Estuarine Benthic Monitoring

Chesapeake Bay and other tidal waters: The Chesapeake Bay Program conducts probabilistic monitoring of benthic communities. As a second phase of assessment based on the CBP B-IBI, a stressor diagnostic tool calculates the probability of contamination as a cause for each impaired benthic sample. Another benthic assessment methodology is used for estuarine probabilistic monitoring following NCCA protocols in the Bay and other tidal coastal waters. It consists of a weight-of-evidence evaluation based on the Sediment Quality Triad (SQT). Estuarine probabilistic monitoring following the NCCA protocols provides data on the chemical contamination of sediment, the toxicity of sediment and an evaluation of benthic community wellbeing using three indices of stress, the Chesapeake Bay Program's "Benthic Index of Biological Integrity" (B-IBI) plus Diagnostic Tool in tidal Chesapeake Bay waters, the Middle Atlantic Region B-IBI for other tidal coastal waters, and the EMAP (MAIA) Index of Estuarine Condition discriminant function for the Virginia Biogeographic Province (VA-IEC) as a secondary index in all tidal waters. This methodology is described in detail in the current Assessment Guidance Manual (http://www.deq.virginia.gov/wqa/) for the biennial 305(b)/303(d) Water Quality Integrated Assessment Reports.

"Appendix H3 - Estuarine ProbMon Sites Summer SFY10" provides a complete list of the DEQ estuarine probabilistic stations sampled during July - September 2009. Weight-of-evidence assessments for Aquatic Life Use at Estuarine ProbMon stations sampled during the six-year 2003 – 2008 period are included in the 2010 305(b)/303(d) Water Quality Integrated Report.

3.2.4 Special Studies Related to Toxics

3.2.4.1 Regional Special Studies Involving Toxics

Special studies are often initiated independently at the Regional Office level in response to locally recognized problems. Often, these regional special studies are related to TMDL development for impaired waters, but they may also be initiated to evaluate new monitoring or analytical methods, or to investigate potential problems with new agricultural practices, etc. Regional special studies that dealt specifically with toxics during SFY10 are summarized in detailed descriptions within "Appendix I – Special Studies Related to Toxics SFY10." Briefly, they consist of:

Northern RO	Motts Run Mercury Study
	Lake Anna PCB Study
	Tripps Run/Holmes Run Benthic Study (metals)
	South Fork Catoctin Creek Benthic Study (metals)
Piedmont RO	James River PCB Study
Blue Ridge RO	
Lynchburg	None during SFY 2010
Roanoke	Smith River Benthic Study (possible PAHs)
	Roanoke River PCB Study
	New River PCB Study
Southwest RO	Bluestone River PCB Study
	Levisa Fork PCB Study
	Clinch River Low Level Mercury Sampling Study
	Straight-pipe Sewage Benthic Study (complicated by coal mine drainage)
Tidewater RO	Low Level PCB Study in Elizabeth and Lower James Rivers

Valley RO	Continuing South River Mercury Studies Meadow Creek/Schenks Branch/Moores Creek Benthic Study (PAHs) Shenandoah River PCB Study

The names and contact information for the responsible individuals at the Regional and/or Central Offices are also provided in Appendix I. Interim or final reports from various toxics-related studies are also available on the DEQ Website - "Water Reports" page (http://www.deq.virginia.gov/water/reports.html) and "TMDLs in Virginia" page (http://www.deq.virginia.gov/tmdl/).

3.2.4.2 Probabilistic Near-Shore Oceanic Survey

During August of 2010, DEQ carried out a first ever probabilistic survey of near-shore oceanic waters between Virginia's onshore beaches and the three-nautical-mile state territorial limit. During this survey, dissolved metals, total metals, and selected PAHs were sampled, as well as conventional parameters such as chlorophyll, nutrients and bacteria, from the water column at 50 random sites. Additional samples were collected for the evaluation of the sediment quality triad (sediment chemistry, sediment toxicity, and benthic community health) at the same 50 sites. Results of these analyses and of weight-of-evidence aquatic life use assessments will be presented in the January 2012 TRISW Report.

3.2.5 Other Program Specific Studies

3.2.5.1 The Chesapeake Bay Program

3.2.5.1.1 Toxics Reduction and Prevention Strategy

The 1987 Chesapeake Bay Agreement committed the signatories to develop, adopt and begin implementation of a basin wide toxics strategy to achieve a reduction of toxics, consistent with the Water Quality Act of 1987, which would ensure protection of human health and living resources. Following the implementation of a multi-jurisdictional effort to define the nature, extent, and magnitude of toxics problems, the initial strategy was further strengthened with the adoption of the 1994 Basin Wide Toxics Reduction and Prevention Strategy. The primary goal of the 1994 strategy was to have a:

> *"Bay free of toxics by reducing and eliminating the input of chemical contaminants from all controllable sources to levels that result in no toxic or bioaccumulative impact on living resources that inhabit the Bay or on human health."*

3.2.5.1.2 Toxics 2000 Strategy

Building upon progress achieved through the implementation of the 1994 Strategy, the Chesapeake Bay Program Executive Council adopted a revised strategy in December 2000 known as the "Toxics 2000 Strategy". With the retention of the 1994 goal, new objectives and commitments were developed and incorporated into the document. An important strategy objective was to strive for zero release of chemical contaminants from point and non-point sources through pollution prevention and other voluntary means. For those areas with known chemical contaminant problems and referenced as Regions of Concern, such as the Elizabeth River in Southeastern Virginia, the strategy included commitments leading to their restoration. Finally, the strategy included commitments that would provide the means to measure progress toward meeting the overall strategy goal. One approach consisted of periodic toxics characterizations, accomplished in 1999 and again in 2008, in which information derived from biological and chemical monitoring were synthesized within the context of toxicological impacts.

3.2.5.1.3 Current Toxics-Related Activities

A general organizational restructuring of the Chesapeake Bay Program was carried out in 2008. Activities of the former Toxics Subcommittee were suspended, at least temporarily, and the new structure does not expressly include a Toxics Subcommittee. It does however include a "team" with the objectives to "Protect and Restore Water Quality." Toxics-related goals and activities have not yet been redefined following the transition to the new structure. The current shift in realignment of CBP monitoring efforts from tidal to non-tidal watershed sources (both point and non-point) of nutrient and sediment input and emphasis on the Bay-wide TMDL development for these stressors has resulted in less emphasis on toxics in tidal waters, at least for the present.

During the summer (June-September) of 2010, because of the concern about potential petroleum pollution from the Deepwater Horizon Gulf oil spill and from future petroleum exploration off the coast of Virginia, DEQ added water column PAH sampling and analyses to its Estuarine Probabilistic Monitoring Program. This effort, in conjunction with the NARS-NCCA, will help establish baseline reference values for petroleum-related hydrocarbons in the water column. Twenty-one of 23 NCCA probabilistic sites fell within the Chesapeake Bay watershed, and the CBP provided resources for the purchase of sample containers and PAH analyses of samples from those sites. In addition, the CBP provided resources for fish tissue analyses of PAHs at five of the NCCA probabilistic sites.

Additional information on the concentrations and trends of toxic substances and other water quality parameters, in the Chesapeake Bay and it tributaries, is currently available on the Chesapeake Bay Website at http://www.chesapeakebay.net/toxics1.htm, or by using the search engine available at http://www.chesapeakebay.net/pubsearch.aspx?menuitem=14874

For additional information about DEQ's Chesapeake Bay monitoring contact Rick Hoffman at (804) 698-4334 or Rick.Hoffman@deq.virginia.gov.

3.2.5.2 The Elizabeth River Program

In 1997, in response to indications of water quality impairment by toxics in the Elizabeth River and its tributaries, DEQ and a group of Elizabeth River Project stakeholders collaborated to produce a comprehensive Water Quality Monitoring plan for the water bodies of concern. Under guidelines included in that plan, a baseline environmental study began in January 1998 with the goal of allowing the future assessment of trends in contaminant concentrations and their effects. Scientists from the Virginia Institute of Marine Science, Old Dominion University, and the Department of Environmental Quality worked with representatives from state, federal, and local authorities and other stakeholders to design and conduct the monitoring effort.

While DEQ and ODU continue to monitor for conventional pollutants and nutrients, most studies specifically involving toxics and their effects in the Elizabeth River system have been concluded. Because of reduced regional office staff and lack of Elizabeth River funding, toxics-related activities during 2010 were restricted to continued sampling and public meetings related to PCB studies and TMDL development.

PCB TMDL: The Elizabeth River and its tributaries do have VDH fish consumption advisories for PCBs. Ambient water samples for PCB analyses were collected under both "dry" and "wet" weather conditions from locations throughout the watershed during spring and early summer of 2009. A new method (EPA Method 1668) using high resolution gas chromatography / high resolution mass spectrometry, capable of

parts per quadrillion detection levels, was used for sample analysis. These results are now available (Appendices I.1 & I.2) and will be used to support development of a TMDL for PCBs within the watershed.

Additional information on the Elizabeth River Project is available from Roger Everton, Environmental Manager, DEQ Tidewater Regional Office, at (757) 518-2150 or via email at Roger.Everton@deq.virginia.gov.

3.3 The Calendar Year 2011 Water Quality Monitoring Plan2010

The Annual Monitoring Plan (MonPlan) provides a complete list of the ambient WQM stations that will be actively sampled during the corresponding calendar year. The DEQ Monitoring Year corresponds to the calendar year in order to synchronize various ambient monitoring program schedules with one another, with the ecological and water year cycles, and with the "assessment window" or monitoring period considered for each 305(b)/303(d) Water Quality Integrated Report assessment and listing cycle. The synchronization scheme is described in detail in the 2007 revision of DEQ's Water Quality Monitoring and Assessment Strategy (http://www.deq.virginia.gov/watermonitoring/monstrat.html).

The MonPlan for calendar year 2011 will be completed in December 2010 and will be implemented on January 1, 2011. It will initiate the third two-year rotation in the second six-year cycle of DEQ's statewide Watershed Monitoring Network. Once finalized, each annual Monitoring Plan is summarized and posted on the DEQ Website at http://www.deq.virginia.gov/watermonitoring/. That portion of the new plan that deals with long-term trend stations will continue with minimum modification. Because 2011 constitutes the first year of a two-year rotation (January 1, 2011 through December 31, 2012) of the watershed monitoring network, it will require the relocation of numerous watershed monitoring sites. Other aspects of the Plan, which deal with TMDLs and other special studies or with shorter term rotations such as lake monitoring or citizen requests, require significant updating for inclusion in each new MonPlan.

4.0 Assessment of Toxics in Ambient Waters:

4.1 The 305(b)/303(d) Water Quality Integrated Assessment Report

A new Water Quality Integrated Assessment Report (IR) was prepared for 2010. The assessment window for this IR extends from January 1, 2003 – December 31, 2008. The complete 2010 305(b)/303(d) Water Quality Integrated Report, the associated 2010 Assessment Guidance Manual, and interactive maps are available via the DEQ Water Quality Assessment WebPages at: http://www.deq.virginia.gov/wqa/homepage.html . Any recent changes in assessment methodologies for toxics, such as revised or new water quality standards, are described in the 2010 Assessment Guidance Manual available from the same WebPages.

4.1.1 The 305(b) Water Quality Assessment

The 2010 Assessment identifies a total of 12,101 miles of impaired rivers, 96,651 acres of lakes, and 2,157 square miles of impaired estuaries. The extents of impairments caused by specifically identified toxics are summarized in the table below. The total river miles, lake acres and estuarine square miles of toxics impairments summed at the foot of the table are not comparable to the totals cited above, because many of the impaired reaches summarized in the table may be included under two or more causes (e.g., the same river mile may be listed under PCBs in fish tissue and mercury in fish tissue). Of the listings in the table,

the vast majority were the result of fish tissue consumption advisories: 92.7% of river miles, 98.5% of lake acres, and 99.5% of estuarine square miles. Fish consumption advisories were primarily for PCBs (31.0% of the toxics-related river impairments, 56.1% of the lakes, and 98.4% of the estuaries), or mercury (61.5% of the river impairments, 42.3% of the lakes, and 1.0% of estuaries). Both of these contaminants are persistent and bioaccumulative, being found in much higher concentrations in fish tissues than in the surrounding environment.

Extent of Impairment by Confirmed Toxics in the 2010 305(b)/303(d) Integrated Report

Pollutant	Water Body Type (units)	Extent Impaired (whole numbers)
Aldrin (Fish tissue)	Rivers (miles)	6
	Lakes (acres)	0
	Estuaries (sq. miles)	0
Ammonia (un-ionized)	Rivers (miles)	3
	Lakes (acres)	0
	Estuaries (sq. miles)	0
Benzo(a)pyrene Benzo(b)flouranthene (PAHs)	Rivers (miles)	7
	Lakes (acres)	74
	Estuaries (sq. miles)	0
Benzo(k)fluoranthene (PAH)	Rivers (miles)	7
	Lakes (acres)	74
	Estuaries (sq. miles)	1
Cadmium	Rivers (miles)	5
	Lakes (acres)	26
	Estuaries (sq. miles)	0
Chlordane	Rivers (miles)	5
	Lakes (acres)	0
	Estuaries (sq. miles)	0
Chloride	Rivers (miles)	11
	Lakes (acres)	0
	Estuaries (sq. miles)	5
Copper	Rivers (miles)	10
	Lakes (acres)	574
	Estuaries (sq. miles)	0
DDT	Rivers (miles)	13
	Lakes (acres)	0
	Estuaries (sq. miles)	0
DDT (Fish tissue)	Rivers (miles)	2
	Lakes (acres)	44
	Estuaries (sq. miles)	0
DDD/DDE	Rivers (miles)	0 / 15
	Lakes (acres)	44 / 44
	Estuaries (sq. miles)	0 / 0
Dioxin	Rivers (miles)	0
	Lakes (acres)	0
	Estuaries (sq. miles)	3
Heptachlor Epoxide	Rivers (miles)	14
	Lakes (acres)	0
	Estuaries (sq. miles)	0
Manganese	Rivers (miles)	4
	Lakes (acres)	0
	Estuaries (sq. miles)	0
Mercury (Fish tissue)	Rivers (miles)	2,059
	Lakes (acres)	56,202
	Estuaries (sq. miles)	22
Mirex	Rivers (miles)	54
	Lakes (acres)	0
	Estuaries (sq. miles)	0
PCBs (Fish tissue)	Rivers (miles)	1,036
	Lakes (acres)	74,496
	Estuaries (sq. miles)	2,087
PCBs (Water column)	Rivers (miles)	102
	Lakes (acres)	1,245
	Estuaries (sq. miles)	1
Sediment Bioassays (Estuarine and Marine waters)	Rivers (miles)	N/A
	Lakes (acres)	N/A
	Estuaries (sq. miles)	1
Zinc	Rivers (miles)	9
	Lakes (acres)	26
	Estuaries (sq. miles)	0

Total Toxics Impairments	Rivers (miles)	3,347	Total Fish Consumption Impairments	Rivers (miles)	3,103	92.71%
	Lakes (acres)	132,761		Lakes (acres)	130,742	98.48%
	Estuaries (sq. miles)	2,120		Estuaries (sq. miles)	2,109	99.48%

4.1.2 The 303(d) Impaired Waters List

The impaired waters list from the 2010 305(b)/303(d) Water Quality Assessment Integrated Report includes a total of 6769 impaired waterbody segments. Of these, 2146 (31.7%) are potentially related to contamination by toxic substances ("Appendix K1 – Segments Potentially Impaired by Toxics 2010 303d List"). Of the 2146 impaired segments that are potentially toxics related, however, only 1482 (21.9% of the total segments) could be attributed to specifically identified contaminants. Bioassessment of benthic communities accounted for the other 664 impaired segments, and impaired benthic communities are more often the result of excessive sedimentation, eutrophication, hydrological modification, or other forms of habitat disturbance than a result of contamination.

Of the 1482 impairments associated with specifically identified contaminants, the vast majority (1418 segments or 95.7%) were for fish consumption. Fish consumption advisories were posted based on fish tissue screening values being exceeded by PCBs (1031 segments), metals (mercury - 312 segments), pesticides (23 segments), dioxin (20 segments), and PAHs (8 segments).

Because the size and number of segments united into each TMDL vary with the hydrography and the extent of the impairment, the exact number of TMDLs to be developed and implemented, and the schedule for doing, so are not yet certain. DEQ's PCB Strategy (2005) establishes priorities for TMDL development and discusses various options for remediation. Any new PCB-impaired segments identified in the 2010 Integrated Report will be integrated into the strategy.

4.1.3 Delisted, previously impaired segments

A number of waterbody segments listed as impaired in previous Water Quality Integrated Reports were partially delisted or removed from the 303(d) list in 2010 ("Appendix K2 – Delisted Formerly Impaired Segments 2010 IR"). Among those associated with identified toxics were Muddy Creek (1 seg - Shenandoah River Basin - Nitrates - Public Water Supply), Elizabeth River mainstem (3 segs), Elizabeth River Eastern Branch (1 seg), Elizabeth River Southern Branch (2 segs), and Lafayette River (1 seg) (James River Basin - Tributyltin - Aquatic Life), Dan River (2 segs - Roanoke River Basin - DDT in fish tissue - Fish Consumption), Beaver Creek (2 segs - Holston River Basin, South Fork - Lead - Aquatic Life), Stock Creek (1 seg - Clinch River Basin) and Russell Fork (1 seg - Big Sandy River Basin - PCB in fish tissue - Fish Consumption), and Contrary Creek and adjacent Lake Anna (2 segs - York River Basin - Lead - Aquatic Life/Wildlife). Nitrate levels in Muddy Creek declined following TMDL implementation. Tributyltin listings in the Elizabeth River system were removed following the EPA approval of a revised DEQ saltwater criterion for tributyltin. Delisting of the Beaver Creek lead impairment was approved by EPA Region 3 in 2005, based on more contemporary results that revealed sediment lead concentrations well below the screening values, plus the presence of several metals sensitive benthic macroinvertebrate taxa. Unfortunately, the authorization for delisting was overlooked during the preparation of the previous (2008) Integrated Report. Fish consumption advisories for DDT (Dan River) and PCB (Stock Creek, Russell Fork) were removed when results from additional, more recent fish sampling and tissue analyses revealed no exceedances of fish tissue criteria. The Contrary Creek/Lake Anna listing for lead was removed because the original listing had been an error; further review of the data from 2003 through 2008 revealed that no exceedances of the lead criterion had occurred.

Numerous segments of transition zone waters in the tidal Potomac (2 segs), James (4 segs), Rappahannock (33 segs), Chowan/Dismal Swamp (10 segs), Severn (1 seg), and York (9 segs) River Basins had previously been listed for Aquatic Life and Wildlife uses because of chloride exceedances. These segments were delisted following EPA approval of the Triennial Review conclusion that the chloride criterion should not be applied to transitional (oligohaline) tidal waters.

Although listings for benthic macroinvertebrate impairments are not necessarily related to toxics, they are used as a warning flag to prompt the search for causative stressors. Seven estuarine segments, associated with five probabilistic monitoring sites, that had previously been listed based on weight-of-evidence aquatic life use assessments, were delisted because sediment chemistry and toxicity analyses did not reveal sufficient toxics-related cause. The segments/sites were reclassified from 5A (impaired - requiring TMDL) to 3B (observed effects – requiring further study) based exclusively on their benthic index scores. Ten additional segments, associated with six freshwater monitoring sites, were delisted because more recent repetitive evaluations with an improved Stream Condition Index (SCI) scored the benthic communities as non-impaired.

Additional information on the 305(b)/303(d) Water Quality Integrated Report is available from Darryl Glover at (804) 698-4321 or Darryl.Glover@deq.virginia.gov.

4.2 Most Recent Virginia Department of Health Fishing Restrictions and Health Advisories

The Virginia Department of Health regularly issues "Fish Consumption Advisories and Restrictions" for Virginia waterways based upon the results from the DEQ Fish Tissue and Sediment Monitoring Program and other sources. All waters subject to these restrictions and advisories are included in DEQ's biennial 303(d) lists. The VDH Website always contains the most recently published updates to fishing restrictions and closures due to concerns related to human health and fish consumption. The complete VDH fishing restrictions and health advisories currently in effect for any waters in the state can be found summarized and mapped by basin at:
http://www.vdh.virginia.gov/epidemiology/DEE/PublicHealthToxicology/Advisories/index.htm.

Several new advisories and modifications of previous advisories have been issued within the past year. New advisories on PCB contamination in blue crabs, specifically related to consumption of the hepatopancreas or "mustard," were issued in January 2009 for the Southern Branch Elizabeth River and for King Creek, a tributary to the York River. More recently (October 2009), geographic extensions were added to several previous advisories on PCBs in fish tissues, among them tidal embayments and tributaries to the Potomac River, Mill Creek near Fort Monroe (Hampton City), Dan River below Danville, Lovills Creek Lake –Yadkin River, lower Nottoway River, Emporia Reservoir and lower Meherrin River, tidal Poquoson and Piankatank Rivers, Mattaponi and Pamunkey Rivers. One recent additional fish consumption advisory was announced by the Virginia Department of Health on November 18, 2009. This was in response to a North Carolina Division of Public Health advisory for mercury in walleye collected in the North Carolina portion of Lake Gaston.

Additional information from DEQ's fish-tissue/sediment monitoring program is available from Gabriel Darkwah, Office of Water Quality Monitoring and Assessment at (804) 698-4127 or Gabriel.Darkwah@deq.virginia.gov. Several recent reports as well as analytical results from fish tissue and sediment monitoring by the agency are available on the DEQ WebPages at http://www.deq.virginia.gov/fishtissue.

5.0 Remediation of Toxics in Ambient Waters:

Total Maximum Daily Load (TMDL) Program

The TMDL Program is an important component of DEQ's toxics remediation in aquatic environments. A number of toxics-related TMDLs have been completed and approved in recent years. Completed TMDLs can be identified and viewed by using the search form on the TMDL WebPages at https://www.deq.virginia.gov/TMDLDataSearch/ReportSearch.jspx. Queries can be performed based on pollutant, major river basin, political jurisdiction, and water body name or watershed identification. Various other toxics-related TMDLs have completed the public comment phase and have been submitted to EPA for final approval. They are listed on DEQ's TMDL WebPages at https://www.deq.virginia.gov/TMDLDataSearch/DraftReports.jspx.

Approved Toxics-Related TMDLs

TMDL	Basin	Pollutant(s)	EPA Approval Date
Muddy Creek Watershed	Shenandoah River	Nitrates	04/27/2000
Shenandoah River Watershed	Shenandoah River	PCBs	10/01/2001
North River and Dry River Watersheds	Shenandoah River	Nitrates	01/01/2004
Quail Run Watershed	Shenandoah River	Ammonia, Chlorine	03/23/2004
Black Creek and Tributaries	Clinch-Powell River	Manganese, Alkalinity	06/03/2004
Peak Creek Watershed	New River	Copper, Zinc, E. coli	12/02/2004
Upper North Fork Holston River	Holston River	Chloride	06/22/2006
Lewis Creek Watershed	Shenandoah River	Lead, PAHs, Sediment	08/02/2006
Garden Creek Watershed	Big Sandy River	Chloride, TDS	11/04/2007
Potomac River Watershed	Potomac River	PCBs	10/31/2007
West Strait Creek, Strait Creek	Shenandoah River	Ammonia, CBOD5, Sediment	09/10/2009
Roanoke (Staunton) River Watershed	Roanoke River	PCBs	04/09/2010
South River, South Fork Shenandoah River, Shenandoah River	Shenandoah River	Mercury	06/03/2010

Draft Toxics-Related TMDL Reports

TMDL	Basin	Pollutant(s)	End of Public Comment Period
Levisa Fork Watershed including Garden Creek	Levisa Fork	PCBs, Bacteria, Sediment	02/15/2010
North Fork Holston River	Holston River	Mercury	03/01/2010
Powell River, North Fork Powell River Watersheds	Powell River	Potential Heptachlor Epoxide, Sulfates	03/15/2010
Smith River Watershed	Smith River	Potential PAHs (benthic)	04/28/2010

Other toxics-related TMDLs have recently been initiated. TMDL investigations to identify PCB sources began in SFY 2009 and are scheduled to be completed in 2014 for the Tidal James River Basin, including the Elizabeth River. PCB source investigation work has also been initiated in the New River Basin and the Shenandoah Basin. While a PCB TMDL was developed in 2001 for the Shenandoah River, the use of updated analytical technologies now warrants revisiting this watershed. Several TMDLs have been phased (*i.e.*, developmental period extended), including the Levisa Fork for a PCB impairment, a benthic impairment for eleven segments in the Tennessee/Big Sandy basin (PAHs) and a single benthic impairment (unknown toxicant) in the Roanoke Basin. TMDLs are phased when there is substantial uncertainty in the TMDL (e.g., stressor has not been confirmed as the cause for the impairment; source(s) of the pollutant causing the impairment have not been identified or confirmed).

As mentioned earlier in section 4.1.3 (p. 37), waters related to Virginia's only TMDL for nitrate in a public water supply (Muddy Creek – Dry River in Rockingham County) no longer exceed the drinking water standard and Muddy Creek has now been removed from the impaired waters list (2010 Water Quality Integrated Report). Various other waters previously listed for toxics violations (e.g., tributyltin, lead, DDT, PCB - section 4.1.3, p 37) have also been delisted in the 2010 IR.

As additional TMDLs are completed and scheduled for implementation, and others are added, follow-up monitoring will be initiated to evaluate their effectiveness in reducing toxics contamination. The effective implementation of these TMDLs should result in measurable reductions of contaminants in the state's

waters within a few years. The agency's TMDL history, current status, and development plans are available at http://www.deq.virginia.gov/tmdl/.

Close coordination between monitoring and assessment activities identifies new sources of contamination as they occur and document the effectiveness of load allocations and other remedial measures developed and implemented by the TMDL Program. The agency anticipates significant reductions of toxics in the state's waters as a result of continued TMDL implementation.

For additional information concerning toxics-related TMDLs contact:

Central Office –	Mark Richards, Mark.Richards@deq.virginia.gov	(804) 698-4392
	Craig Lott, Craig.Lott@deq.virginia.gov	(804) 698-4240
Blue Ridge Regional Office		
Roanoke -	Mary Dail, Mary.Dail@deq.virginia.gov	(540) 562-6715
Lynchburg -	Paula Nash, Paula.Nash@deq.virginia.gov	(434) 582-6216
Northern Regional Office –	Bryant Thomas, Bryant.Thomas@deq.virginia.gov	(703) 583-3843
Piedmont Regional Office –	Margaret Smigo, Margaret.Smigo@deq.virginia.gov	(804) 527-5124
Southwest Regional Office –	Allen Newman, Allen.Newman@deq.virginia.gov	(276) 676-4804
Tidewater Regional Office –	Roger Everton, Roger.Everton@deq.virginia.gov	(757) 518-2150
Valley Regional Office –	Tara Sieber, Tara.Sieber@deq.virginia.gov	(540) 574-7870

6.0 Summary and Conclusions

DEQ's commitments to toxics reduction include (1) the prevention of contamination of the state's waters by toxics, (2) the continued monitoring of those waters for the presence of toxics, and (3) the development of TMDLs and the implementation of remedial measures to reduce and/or eliminate toxics found in the state's waters. The following summary is organized in relation to the interacting, cyclic relationship among these three activities and incorporates all eight specific items of information identified in the original legislation (Chapter 3.1, Title 62.1, § 62.1-44.17:3 of the Code of Virginia) requiring this report.

6.1 Pollution Prevention

6.1.1 Virginia Pollutant Discharge Elimination System (VPDES)

During SFY10, DEQ's Toxics Management Program included 304 reporting facilities with 622 outfalls that had toxics limits in their VPDES permits (Appendix B). All of the associated permits had start dates prior to July of 2009. A total of 7,581 parameter-specific Discharge Monitoring Reports (DMRs) were filed during state fiscal year 2010. Of the 3,097 parameter-specific max-concentration DMR results reported, 128 (4.1%) had measured values that exceeded their permitted maximum concentration limits (Appendix D). Among the 2,473 DMRs with limits on average concentration, 107 (4.3%) exceedances were observed. In most cases, they resulted from minor isolated variations that occasionally exceeded the limit - almost always for total metals but occasionally for dissolved metals (copper and zinc were the most common) at municipal wastewater treatment plants. Parameter-specific exceedances persisted during multiple (≥3) reporting dates on 24 occasions during the period.

6.1.2 Office of Pollution Prevention

The 2010 Pollution Prevention Annual Report is available on the DEQ WebPages at http://www.deq.virginia.gov/p2/homepage.html . Virginia Green, the Commonwealth's initiative to

promote pollution prevention within the tourism industry, now includes 875 participants, 228 more than last year at this time. At the end of 2010, VEEP included approximately 450 facilities, 20 of which received Governor's Environmental Excellence Awards for their performance during the year. Virginia awarded over $127,300 in fee discounts to more than 100 VEEP facilities for the implementation and performance of their Environmental Management Plans. VEEP reported a 7.8 ton reduction in the use of hazardous materials and hazardous waste generation was reduced by 325 tons. Releases of greenhouse gases to the atmosphere were also significantly reduced: NO_x and SO_x emissions were reduced by 3,900 tons. Emissions of volatile organic compounds to the air were reduced by five tons. Total water use was reduced by 994.4 million gallons and total energy consumption was reduced by 144.9 billion BTU's, at a cost savings of over $24.3 million. Since its inception in 2006, Virginia's voluntary mercury reduction incentive has removed 56,097 mercury switches from recycled automobiles and recycled 123.4 pounds of mercury, and facilities have pledged the annual recycling of almost 53,000 mercury containing fluorescent light bulbs. Four new facilities joining NPEP have pledged to reduce the release of priority chemicals by 6,500 pounds, and various facilities have begun to capture and recycle lead, or reduce or eliminate the use of lead in their products and services.

6.1.3 Environmental Education

Across the state, twelve regional teams continue to bring together local conservation organizations and education agencies to implement stewardship projects, provide field experiences for students and educate citizens about local issues. Virginia Naturally's monthly electronic newsletter provides over 2,000 educators and litter and recycling program managers across Virginia with information on special features (conferences, etc.), funding and awards deadlines, upcoming events, partner updates and resources. Non-competitive litter prevention and recycling grants ($1,524,694 in 2010) have been provided to 306 local governments. The Environmental Educators Leadership Program and numerous Stewardship Training Workshops have provided training for hundreds of educators statewide.

6.1.4 Toxics Release Inventory

The March 2010 TRI Report is available on the DEQ Website at: http://www.deq.virginia.gov/sara3/ . It summarizes data from 2008, during which 455 Virginia facilities filed 1672 individual reports on the release, transfer, or management of TRI chemicals. Statewide toxic releases to the water totaled approximately 20.3 million pounds or 39.3% of the total onsite releases to all media during 2007. This quantity represents a 9.4% increase from the 18.4 million pounds released to the water in 2007. Of the top ten TRI chemicals released to water, nitrate compounds represented 99.0% of the total (19.80 million lbs.). Nitrates are of much more concern for their effect as nutrients rather than as toxics.

6.2 Monitoring - Water Quality Monitoring Programs

Statewide, DEQ's Water Quality Monitoring Programs collected and analyzed 571 toxics-related samples at DCLS during SFY09, 728 from sediments and 499 from water. Much of the freshwater sampling was in association with mercury in the Shenandoah and South Fork Shenandoah special studies (25.2%) and the Freshwater and Estuarine Probabilistic Monitoring Programs (31.7% and 17.2%, respectively) represented most of the remaining. TMDL and other toxics-related special studies accounted for another 6.5% and quality assurance samples 16.5%. The Estuarine Probabilistic Monitoring Program also collected sediment samples from an additional 50 sites; these were analyzed elsewhere for chemical contamination (metals and organics) and toxicity, as well as for benthic community health. Scheduled activities from the current Water Quality Monitoring Plan are available at http://www.deq.virginia.gov/watermonitoring/.

6.3 Assessment, Remediation, and the Continued Reduction of Toxics

6.3.1 Assessed Impairments – The 2010 305(b)/303(d) Water Quality Integrated Assessment Report

The 2010 Integrated Report identified 12,101 miles of impaired streams and rivers, 96,651 acres of impaired lakes, and 2,157 square miles of impaired estuaries. Of those impaired by specifically identified toxics, 92.7% of the river miles, 98.5% of lake acres, and 99.5% of the estuarine area were listed for fish consumption advisories, primarily for PCBs (31.0% of toxics impaired rivers, 56.1% of lakes, 98.4% of estuaries) or mercury (61.4% of rivers, 42.3% of lakes, 1.0% of estuaries). Because the number of segments united into each TMDL varies with the hydrography and the extent of the impairment, the exact number and schedule of TMDLs to be developed and implemented is not yet certain. DEQ's PCB Strategy (2005) establishes priorities for TMDL development and discusses various options for remediation, and any newly identified PCB-impaired segments will be integrated into the strategy.

6.3.2 Remediation / Reduction

A number of toxics-related TMDLs have been completed and approved since 2000; two in 2002, three in 2004, and 16 in 2007, all for PCBs in the Shenandoah (5) or in other Virginia tributaries to the Potomac (16). The Potomac tributary PCB TMDLs were incorporated into the interstate Potomac River PCB TMDL developed under the auspices of the Interstate Commission for the Potomac River Basin. This TMDL was submitted in November 2007and was subsequently approved by EPA. Two benthic TMDLs were completed for toxics parameters in 2006, one (copper and zinc) in the New River basin and one (PAHs and lead) in the Shenandoah. Two additional toxics-related TMDLs were approved in 2007, one for chlorides in Garden Creek of the Big Sandy Basin, and the other for PCBs in the Potomac. A TMDL that included ammonia was approved for Strait Creek in the Shenandoah Basin in 2009. A PCB TMDL was approved for the Roanoke (Staunton) River in April of 2010 and a mercury TMDL in the South River, South Fork Shenandoah River, and Shenandoah River was approved in June of 2010.

The draft TMDL for PCBs (plus bacteria and sediment) in the Levisa Fork completed public comment in February 2010. The draft Smith River benthic TMDL, in which PAHs are implicated, underwent public comment in the spring of 2010, but continues as a phased TMDL until specific causes are identified. The draft for four mercury TMDLs in the North Fork of the Holston River completed public comment in March of 2010, as did a draft TMDL for heptachlor Epoxide and sulfates in the North Fork Powell and Powell Rivers. Several additional toxics-related TMDLs are in development. The source identification study for PCBs, initiated during 2009 for TMDL development on the upper tidal James River and the Elizabeth River, was continued in 2010 and has public meetings scheduled through the end of 2010 and into 2011. The agency's TMDL history, current status and development plans are available at http://www.deq.virginia.gov/tmdl/.

As these TMDLs are completed and scheduled for implementation, and others are added, follow-up monitoring will be initiated to evaluate their effectiveness in reducing toxics contamination. The portion of the Muddy Creek-Dry River-North River watershed that was included on the 1998 303(d) list as impaired due to potential violations of the nitrate drinking water standard, has been in compliance for the past six years, and was delisted in 2010. The effective implementation of additional TMDLs should result in similar measurable reductions of contaminants in a number of the state's watersheds within a few years.

6.3.3 Continued Commitment

DEQ continues its commitment to toxics reduction by the prevention of contamination, continued water quality monitoring, and the implementation of remedial measures. The Virginia Pollutant Discharge Elimination System and the Pollution Prevention Program join with other programs and stakeholders to control and reduce toxics releases. The Toxics Release Inventory and various water programs constantly monitor and document the release to, and the presence and movement of toxics within aquatic environments. Close coordination between monitoring and assessment activities will continue to identify new sources of contamination as they occur and document the effectiveness of load allocations and other remedial measures developed and implemented by the TMDL Program. The agency anticipates significant reductions of toxics in the state's waters as a result of continued TMDL implementation.

7.0 References

A cumulative bibliography of general references and publications cited in this and previous TRISW Reports is included in "Appendix L – References."