

Vermont Clean Water Board Meeting Minutes

Date/Time: Wednesday, February 14, 2024, 2:30 – 4 PM

Virtual Option to Attend: [Microsoft Teams Meeting](#)

Physical Location to Attend In-Person: Agency of Natural Resources, One National Life Drive, Montpelier, VT 05602 in the Catamount Room (Davis Building, 2nd Floor, Room D215).

Meeting details, materials, and recordings available at: <https://dec.vermont.gov/water-investment/cwi/board/meetings>

Clean Water Board Members/Designees:

Douglas Farnham, Agency of Administration (AoA) Chief Recovery Officer and Designated Clean Water Board Chair (Present)

Tayt Brooks, Agency of Commerce and Community Development (ACCD) Deputy Secretary (Present)

Alison Conant, public member (Absent)

Bob Flint, public member (Present)

Joe Flynn, Agency of Transportation (VTrans) Secretary (Present)

Julie Moore, Agency of Natural Resources (ANR) Secretary (Present)

Jim Giffin, public member (Present)

Anson Tebbetts, Agency of Agriculture, Food and Markets (AAFV) Secretary (Present)

Chad Tyler, public member (Present)

1. Welcome

Recording Time Stamp 00:00¹

Douglas Farnham, Chief Recovery Officer and Clean Water Board Chair

- Welcome and review of agenda
- Review of meeting minutes from December 5 Board meeting. No comments from the Board.

2. Review Governor's State Fiscal Year (SFY) 2025 Clean Water Budget recommendation

Julie Moore, Agency of Natural Resources Secretary

Recording Time Stamp 1:35

- Secretary Moore shared the SFY 2025 Clean Water Budget as proposed by the Governor. This included a review of how Capital and Clean Water Fund dollars are split across line-items. The Governor made no changes to the Board's recommendation.

3. Review Clean Water Fund Operating Statement

Recording Time Stamp 5:33

Nick Kramer, Department of Finance and Management Budget Analyst

- Nick Kramer provided updates to Clean Water Fund revenue projections for State Fiscal Years 2024-2026. Successive revenue estimates for any given fiscal year are on a downward trend. Nick indicated these revenue trends reinforce the importance of the Board's conservative budgeting approach since budget targets are determined so far in advance of realizing the actual revenue.
 - Jim Giffin, public member of the Board, asked for and received clarification on the distinction between the contingency reserve line and the unallocated/unreserved lines.
 - Board had brief discussion on the trends and potential floor of expected revenue from the Property Transfer Tax Clean Water Surcharge.

¹ Please refer to the available meeting recording to learn more about discussion content under each agenda item. Recording Time Stamps are highlighted to direct focus on the recording. Recording can be directly accessed here:

<https://youtu.be/rugHQq1RdX4>

4. Review Clean Water Fund Contingency Reserve Plan **Recording Time Stamp 23:00**

Emily Bird, Dept. of Environmental Conservation Clean Water Initiative Program Manager

- Emily Bird provided an overview of the Contingency Reserve Plan, a summary of proposed changes, and a visual diagram of revenue reconciliation timelines in alignment with fiscal year budget builds. She shared updates to the Contingency Plan including: 1. clarification of the plan’s intent, 2. considerations for the Board to recommend changes to the Reserve balance, 3. clarification and refinement of the process for secondary Reserve purpose.
 - Jim Giffin suggested that the Plan be renamed as “Guidelines” and other Board members expressed no concern for this change.
 - Jim Giffin made the motion to approve the “Guidelines.” Secretary Moore seconded the motion and the motion passed without further discussion.

5. Presentation of the Recommendations on Water Quality Trading Report **Recording Time Stamp 51:55**

Amy Polaczyk, Dept. of Environmental Conservation Wastewater Program Manager and Kevin Burke, Dept. of Environmental Conservation Stormwater Program Manager

- Amy Polaczyk and Kevin Burke shared a summary of the Water Quality Trading report which stems from a requirement of Act 76 of 2019 to consult with the Board before sharing with the legislature for further consideration. It is not recommended to pursue this methodology at this time given existing trading-like mechanisms, lack of demand, and the required development timeline.
 - Secretary Moore asked if there are any places that have already used water quality trading effectively. Amy said that the most valuable example of this is from Connecticut nitrogen trading in the 1990s. She reached out to the people involved in that process and it took many years and a lot of people to develop that process.
 - Jim Giffin asked how existing trading rules or opportunities interface with Act 250 permits. Amy noted that she will follow up with the ANR planning office before filing the report to make sure that this is addressed.

6. Public comment

Recording Time Stamp 1:09:21

Led by Douglas Farnham

1. Albert Perry advocated to increase the Reserve amount and shared that he is concerned to see the decrease in the budget from last year. He suggested that the Board create a budget for more than one year in advance, so the public knows what to expect in coming years.
2. Peter Benevento asked for funds for an alum treatment in Lake Carmi.
3. Andrea Englehardt supported Pete’s comment to step in with an alum treatment for Lake Carmi.
 - Emily Bird shared that there is alum treatment implementation funding for SFY2025 pending results of feasibility study and permitting that is baked into the Board’s recommended budget pending legislative authorization.
4. The Board received some public comments via email listed here and attached to these minutes:
 - Lindsey Waterhouse (see page 4).
 - Luca Conte (see page 7).
 - Elizabeth Malko (see page 8).

7. Other business, determine next steps, closing remarks

Recording Time Stamp 1:22:28

Led by Douglas Farnham

- a. [Vermont Clean Water Initiative 2023 Performance Report](#) is submitted to Legislature and U.S. Environmental Protection Agency
 - b. Explore the data on the [Clean Water Interactive Dashboard](#)
 - c. Watch the recent [Clean Water Conversation](#) on the Vermont Clean Water Initiative 2023 Performance Report
- Secretary Moore offered appreciation for the Clean Water Performance Report. She said challenges are ahead and it is a gift to have this kind of information that tracks progress over time. This information is being used as a model for how ANR will track the state’s climate work for global climate solutions.
 - Emily Bird shared that the CWIP team will reach out to the Board in early summer with a timeline on the SFY 2026 budget cycle and the Board will reconvene in October.

8. Meeting Adjourned at 4:01 pm

Recording Time Stamp 1:31:17

From: [Lindsey Waterhouse](#)
To: [ANR - Clean Water VT](#)
Cc: [Miller, Colleen](#); [john-widness](#); [Lindsey Waterhouse](#)
Subject: Re: 2/14 CWB Meeting
Date: Tuesday, February 13, 2024 5:50:22 AM
Attachments: [Comments For the Vermont Clean Water Board - 262024.docx](#)
[LCW - Resume - Update 3.odt](#)

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EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

I wish to thank the Vermont Clean Water Board and the Agency of Natural Resources, and the Governor for all that you are doing to help improve the State of Vermont's lakes and rivers health for all Vermonters.

I am a retired Bioenvironmental Engineer with over 45 years of experience helping to control and reduce anthropogenic environmental stressors. I currently support work being accomplished by the Federation of Vermont Lakes and Ponds, and the Lake Bomoseen Association.

I have attached a copy of my last professional Curriculum Vitae supporting that experience, along with an eight page summary expressing my concerns after thoroughly reviewing the 2022 Report and the currently proposed Clean Water Budget. I would ask the Board to please review my report and focus their valuable time on my concerns expressed in the Results section of the report under Observations and Recommendations.

Thank you so much for the critical work you do, and in considering my thoughts and recommendations.

Sincerely,

Lindsey C, Waterhouse

On Mon, Feb 12, 2024 at 10:55 AM ANR - Clean Water VT
<ANR.CleanWaterVT@vermont.gov> wrote:

Hi Lindsey,

Thank you for reaching out. You are welcome to email over your written comments and we can make sure the Board has them as part of their consideration of public comment for the February meeting.

Best

Gianna Petito (she/her) | Grants Supervisor

Vermont Agency of Natural Resources | Department of Environmental Conservation

Water Investment Division | Clean Water Initiative Program

One National Life Drive, Davis 3 | Montpelier, VT 05620-3510

802-636-7547 office/cell

gianna.petito@vermont.gov

<http://dec.vermont.gov/water-investment/cwi>

The Agency of Natural Resources supports telework, and there are times when I may be working from another office location. I am available to connect by phone and email. I am also available to connect in-person upon request.

From: Lindsey Waterhouse <waterhouse.lindsey@gmail.com>

Sent: Monday, February 12, 2024 9:25 AM

To: ANR - Clean Water VT <ANR.CleanWaterVT@vermont.gov>; Lindsey Waterhouse <waterhouse.lindsey@gmail.com>

Subject: 2/14 CWB Meeting

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Greetings -

I am unable to attend the Clean Water Board in person due to my work schedule.

I have prepared a written report with my comments.

How can I ensure my information is included in this session for consideration?

Thank you in advance for your assistance.

Lindsey Waterhouse

From: [Luca Conte](#)
To: [ANR - Clean Water VT](#)
Subject: 2/14/24 CWB Meeting and Comments
Date: Wednesday, February 14, 2024 9:47:34 AM
Attachments: [Comments For the Vermont Clean Water Board - 262024.docx](#)

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All: I am the President of the Lake Bomoseen Preservation Trust (LBPT) and have reviewed the document prepared by Mr. Waterhouse entitled “Comments for the Clean Water Board.”

I have known Mr. Waterhouse for the past several years and have been impressed by both his deep knowledge of the Environmental Sciences and his commitment to the improvement of Vermont’s environmental health, especially as concerns lake, river, and ground waters.

As for his “Comments” and analysis attached below, I find this analysis thorough and his recommendations sound, especially concerning: 1) the need for at least one more method of water quality testing and monitoring that involves the collection of real data (rather than the SWAT model of estimation alone); and 2) the need to address the fundamental discrepancy between the already lagging estimated rate of TMDL reduction and the 20 year goals and methodologies established by the initial program plan.

Thank you in advance for your consideration, as well as your efforts on behalf of Vermont’s waters.

Sincerely,

Luca E. Conte, Ph.D.
Lake Bomoseen Preservation Trust

From: [ELIZABETH BIRD](#)
To: [ANR - Clean Water VT](#)
Subject: 2/14/24 CWB Meeting and Comments
Date: Wednesday, February 14, 2024 1:10:40 PM

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EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.

All: I am the President of the Lake Bomoseen Association (LBA) and have reviewed the document prepared by Mr. Waterhouse entitled "Comments for the Clean Water Board."

For the past several years I have worked with Mr. Waterhouse on Lake Health issues and am impressed by his deep knowledge of the Environmental Sciences and his commitment to the improvement of Vermont's environmental health, especially as concerns lake, river, and ground waters.

His comments and analysis (attached) below, are thorough, his recommendations sound. We agree that there is a need for:

- 1) At least one more method of water quality testing and monitoring that involves the collection of real data (rather than the SWAT model of estimation alone)
- 2) A need to address the fundamental discrepancy between the estimated rate of TMDL reduction and the 20 year goals and methodologies established by the initial program plan.

Thank you in advance for your consideration, as well as your efforts on behalf of Vermont's waters.

Sincerely,

Elizabeth Bird
Lake Bomoseen Association (LBA)

COMMENTS FOR THE VERMONT CLEAN WATER BOARD

APPROACH, DEPLOYMENT, AND RESULTS; ONE VERMONTNER'S
OBSERVATIONS



LINDSEY WATERHOUSE | MAJOR, USAF RET, BIOENVIRONMENTAL ENGINEER |
FEBRUARY 14, 2024

APPROACH – VT TMDL DEVELOPMENT AND PHOSPHORUS REDUCTION

The same thing that makes the State of Vermont so spectacular is the same thing that has created the environmental state that we now find ourselves in. The majesty of our Green and Taconic mountains, our amazing elevations, and ridgelines, have plagued our homesteading and family farming traditions since the state's inception. I come from a long line of those green mountain hillside rock farmers. To be productive and profitable Vermont farmers realized early on that it was/is the valleys and lowlands along the Winooski, Otter Creek, Lamoille, Lake Champlain, Lake Memphremagog, and even the Poultney River where adequate acreage could be found to establish enough food stuffs to feed dairy cows as well as the States population. Water, unfortunately flows downhill, and penetrates the soils, which all combine and collect in our amazing rivers, lakes, and ponds.

- In 2016, the State, in coordination with the U.S. EPA established an agreement to address the excessive eutrophication that was occurring in our States Lakes and Ponds. Specifically, Lakes Champlain and Memphremagog. Yet, the current program affects all major state drainages and watersheds. Smaller inland lakes have not been immune to these impacts either. Just visit the shores or talk to camp owners and persons utilizing the resource offered by Lake Carmi, and its recent designation of a lake in peril.
- To do that, a Total Maximum Daily Load* or TMDL was established for these two receiving waters and their associated watersheds. The TMDL focused specifically on the nutrient phosphorus to restore water quality. That agreement established a 20-year performance period in which the State of Vermont would establish funding, programs, procedures, and projects to reduce the phosphorus load by 227.6 metric tons/year. This is believed to be a more environmentally acceptable loading standard, reducing the impacts caused by phosphorus pollution in excess of Clean Water Standards.
- It should be noted that this was/is not voluntary. This is basically a compliance agreement between the State of Vermont and the federal government, to ensure compliance with the national Clean Water Act (CWA), as these two lakes and their associated systems are considered **impaired**, requiring corrective actions to comply with the CWA. “The Environmental Protection Agency’s (EPA) regulations for implementing CWA section 303(d) are codified in the Water Quality Planning and Management Regulations at 40 CFR Part 130. The law requires that states establish priority rankings and develop Total Maximum Daily Loads (TMDLs) for waters on the lists of impaired waters (40 CFR 130.7).” TMDL standards, developed by the U.S. EPA for both Lakes Champlain and Memphremagog were established in signed agreements with the State of Vermont. Reference - [Phosphorus TMDLs for Vermont Segments of Lake Champlain, June 17, 2016 \(epa.gov\)](#); and a summary of all actions to date @ [Lake Champlain Phosphorus TMDL: A Commitment to Clean Water | US EPA](#); [Lake Memphremagog Phosphorus Total Maximum Daily Load \(vermont.gov\)](#).
- These agreements were made in coordination with the Vermont Agency of Natural Resources, the Vermont Department of Environmental Conservation and the Vermont Agency of Agriculture, Food, and Markets. All agreements, funding and support were encompassed under Act 64, the Vermont Clean Water Act, and established water quality standards to include phosphorous to be contained in the Vermont Water Quality Standards Environmental Protection Rule Chapter 29A, dated 15 November 2023. Ref - [Vermont Water Quality Standards](#)
- Funding to support Act 64 and the Vermont CWA is overseen by the Vermont Clean Water Board which in turn establishes the Clean Water Budget. Ref - [Clean Water Board | Department of Environmental Conservation \(vermont.gov\)](#). The most current report regarding the States Performance can be found at [Vermont Clean Water Initiative 2022 Performance Report.pdf](#). Vermont is required by agreement to review their performance every two and five years through written reports to the U.S. EPA.

- I. The current report ([Vermont Clean Water Initiative 2022 Performance Report.pdf](#).) contains a summary of actions accomplished to date as of year 7 of its 20-year journey (35% of the performance period) to comply with the proposed TMDLs.
 - **\$336.9 million** dollars has been spent in clean water projects through grants, contracts, and loans from SFY 2016 to 2022.
 - The established goal for the two lakes is a total reduction of **227.6** metric tons/year to meet the proposed TMDLs for each of the targeted basins, or approximately **11.38 metric tons per year** over the 20-year performance period.
 - The current report indicates a total “**estimated**” phosphorus reduction of **41.8 metric tons** has been accomplished to date for the projects currently completed or **18.4%** of the total required for compliance/to meet the proposed (TMDL) reduction goal.
 - The current estimated rate of reduction is estimated to be **5.97 metric tons/year**.
 - The estimated cost to date is **\$8.1 million dollars per metric ton reduced**.
 - Approximately **185.5 metric tons/year** or **82%** of the reduction goal remains to be accomplished with 13 years (**65%**) of the performance period remaining or **14.3 metric tons/year** to meet the TMDL by 2037.

All of this information and the associated numbers were obtained or generated from the [Vermont Clean Water Initiative 2022 Performance Report.pdf](#).

DEPLOYMENT – VT METHODS AND ACTIONS RESULTING IN THE CURRENT STATE OF REPORTED CWI OUTCOMES

The scope and complexity of this “project” is mind boggling to say the least and now appears fully engaged and being put into play throughout the State. As an outside observer and a retired Bioenvironmental Engineer, I find it amazing, incredible, and marvelous, among other superlatives, that Vermont is taking lake and river health improvement in this capacity to try to right what hopefully was, a sinking ship. My words and concerns expressed in this document are not at all intended to not acknowledge the amazing work accomplished to date, but to rather ask, how effective is the work to date in accomplishing the actual goal, and are we as a state moving accurately and effectively in the right direction? Are we in fact, righting the ship?

My concern focuses solely on two issues regarding the State’s deployment of the Clean Water Initiative Program or CWIP:

1. The use and application of the SWAT model as the singular method and focus to predict and estimate the effectiveness of Vermont’s efforts to control Agricultural run-off and the resulting phosphorus load reductions associated with non-point source projects.
2. Inadequate funding and support to obtain actual water quality analytical data (the gold standard for establishing baseline environmental impact and corrective action plan performance) in support of CWIP projects to validate both model accuracy and long term confirmable, not estimated, TMDL target load reduction and compliance.

Note here – These are also concerns expressed by the EPA in response to Vermont’s performance reports. The following excerpts are contained from EPA reviews of provided TMDL implementation report cards:

- “The 2022 Performance Report indicates that actions tracked by the state so far have resulted in an estimated reduction of 39.9 metric tons of phosphorus per year, or about 19 percent of the total reduction target. This represents a relatively small increase in reductions from the previous year. We recognize that methods for tracking effectiveness of some measures continue to be further developed and that most of the results of new permit programs and related measures may not be measurable for several years, however, we note that the pace of reductions identified in the Performance Report in Figure 38 is lower than the necessary annual reductions, which calls into question whether TBP milestones and current efforts and funding are sufficient to reach the 20-year TMDL goals. Current average annual reductions have been 5.2 metric tons while DEC projects’ needing 11.5 metric tons to reach the TMDL goal.
- 2019 Performance Report - In future basin plans, EPA recommends the inclusion of quantitative five-year milestones for all ongoing actions. EPA believes this would provide a more clear and objective way to evaluate progress on the actions with no end point and would further serve to ensure that significant progress continues to be made on these actions during each planning cycle.
- The basis for TMDL development, associated water quality standards, and the need for water quality monitoring is contained in the EPA document - Phosphorus TMDLs for Vermont Segments of Lake Champlain, June 17, 2016

Deployment of this project, initiated in the 2016/2017 timeframe, is currently organized and controlled within the Vermont Clean Water Initiative Program or CWIP. To quote - “The Clean Water Initiative Program (CWIP) funds, tracks, and reports on priority projects to restore Vermont’s waters, and communicates progress toward meeting water quality restoration targets outlined in the [Total Maximum Daily Loads](#) (or TMDLs). CWIP also coordinates funding, tracking, and reporting of clean water efforts for federal and state partners, including Clean Water Initiative partner state agencies – the [Agencies of Agriculture, Food and Markets](#); [Commerce and Community Development](#); [Natural Resources](#); and [Transportation](#) – and the [Lake Champlain Regional Conservation Partnership Program](#) of the Natural Resources Conservation Service. Reference webpage @ [Clean Water Initiative | Department of Environmental Conservation \(vermont.gov\)](#).

The current basis and accounting for Vermont CWIP actions are contained in the 2022 annual report and at the [Clean Water Project Tracking & Accounting | Department of Environmental Conservation \(vermont.gov\)](#) webpage.

Ultimate project compliance and overall performance is predicated on what Vermont has defined as it’s “Standard Operating Procedures, or SOPs. There are three:

- [Standard Operating Procedures for Tracking & Accounting of Agricultural Conservation Practices](#) (June 28, 2022)
- [Standard Operating Procedures for Tracking & Accounting of Developed Lands Regulatory Projects & Non-Regulatory Clean Water Projects](#) (June 28, 2022)
- [Standard Operating Procedures for Tracking & Accounting of Natural Resources Restoration Projects](#) (June 28, 2022)

My comments and concerns will only focus on the first SOP, yet it is likely that similar concerns may apply to the other two. I focus on the first, as it clearly addresses the dominant contribution source impacting actual TMDL acquisition and compliance, and it represents the largest non-point source impacting Vermont Lake Health. It should be noted that the DEC received no written or public comments for the Agricultural Conservation Practices SOPs during the spring 2022 public comment period. Based upon my review of this SOP, I believe the level of complexity and knowledge to provide meaningful comment by the general public was the reason the State did not receive any concerns; and technical review of this document, due to its critical role in defining and estimating CWIP funding priorities should have been considered for outsourcing to an independent third party with appropriate knowledge and background in environmental computer modeling and non-point source remediation experience to validate its strengths, weaknesses, and accuracy.

To quote from the SOP: “Phosphorus Accounting - Clean water projects target nutrient and sediment pollution to waterbodies and improve water quality over the long term. While measured water quality parameters are the ultimate indicator of progress, it will take time for Vermont’s waters to realize the benefits of clean water projects. To provide incremental measures of accountability, DEC estimates the pollutant reductions associated with clean water projects installed across state and federal funding programs and regulatory programs in Vermont. Total phosphorus load reduction is estimated based on the clean water project type, as measuring phosphorus load reductions at the project level through water quality monitoring would be cost-prohibitive and very challenging to conduct in a scientifically robust manner at most sites.”

The basis of this statement does not appear sound, not supporting current best scientific and management practices. The impact/lack of timely water quality analysis and the resulting critical data gaps are contained in the February 2000, GAO report, WATER QUALITY, Identification and Remediation of Polluted Waters Impeded by Data Gaps, Statement of Peter F. Guerrero, Director, Environmental Protection Issues, Resources, Community, and Economic Development Division ([t-rced-00-88.pdf \(gao.gov\)](https://www.gao.gov/assets/t-rced-00-88.pdf)):

“States reported that they have much more of the data they need to develop TMDLs for pollution problems caused by **point sources** than by **nonpoint sources**. States can more readily identify and measure point sources of pollution because these sources generally discharge pollutants through distinct points, such as pipes. Conversely, nonpoint sources are difficult to identify and measure because of their diffuse nature. As a result, developing TMDLs for pollution problems caused by nonpoint sources often requires additional data collection and analysis. Only three states reported having a majority of the data they need to develop TMDLs for these types of problems.”

And; “Monitoring water quality is a key activity for implementing the Clean Water Act. The act requires states to set standards for the levels of quality that are needed for bodies of water so that they support their intended uses. States compare monitoring data, or other information, with water quality standards to determine if their waters are of acceptable quality.”

The State of Vermont is instead using a very sophisticated model called SWAT (Soil and Water Assessment Tool) in the absence of a recurring water quality monitoring program to validate project outcomes. Ideally, the process would incorporate both components to support outcomes or make adjustments to the model and the funded remediation projects. The currently reported reduction levels and those projected efficiencies contained in the current report, solely depend on these computers modeled projections, and are not validated through a supporting water quality analysis process or program. Again, per the SOP:

1. Estimated baseline total phosphorus load from land treated, prior to treatment by a practice. This is based on the area of land draining to the practice, or the practice area, and the average phosphorus loading rate from the land use. Baseline phosphorus loading rates for each land use, soil type, and slope combination are obtained from the TMDL Soil Water Assessment Tool (SWAT) model results (Tetra Tech 2015a)
2. Estimated annual phosphorus reduction performance – referred to as an “efficiency” – of the practice type. This is often expressed as a percentage of total phosphorus load reduced and is based on research of practice performance relevant to conditions in Vermont.

I wish to acknowledge that the application of sophisticated computer modeling is routinely used to assist in helping to define the impact of environmental pollutants whether chemical, physical, or biological (Ref - [Assessment of Surface Water Model Maintenance and Support Status \(epa.gov\)](#)). I have personally used complex gaussian air quality programs to estimate toxic chemical vapor and gas releases to public human receptors; however, those models were used in conjunction with real-time analysis to support actual emergency impact and response decision making.

I offer the following information in concern that we should not put all our eggs in the one basket that SWAT and its current updates and modifications has offered us:

1. Critical concerns from the GAO report ([t-rced-00-88.pdf \(gao.gov\)](https://www.gao.gov/assets/t-rced-00-88.pdf)).

- a. “Monitoring water quality is a key activity for implementing the Clean Water Act. The act requires states to set standards for the levels of quality that are needed for bodies of water so that they support their intended uses. States compare monitoring data, or other information, with water quality standards to determine if their waters are of acceptable quality.”
 - b. Current EPA guidance and proposed TMDL regulations discuss the need for monitoring after pollutant controls or other activities are implemented to determine if the TMDL is working and the body of water is attaining water quality standards. This means that significant new monitoring efforts will be needed, particularly for TMDLs addressing nonpoint sources of pollution, because the effectiveness of controls to reduce such pollution can be affected by site-specific conditions.
 - c. Forty-five states reported that the lack of resources was a key limitation to making more progress on improving water quality. In addition, several states pointed out that they are operating under state-imposed staffing level ceilings, and other states said they are limited in how many samples they can analyze because of shortages in lab funding. EPA officials told us that overall, less resources are being devoted to monitoring and assessment at the state level than ever before.
2. Use of the SWAT model for TMDL development and SOP application was dependent and based upon the limited total phosphorus analyses collected from the impacted watersheds by the State of Vermont.
 - a. It was not comprehensive and only looked at the one contaminant, phosphorus, and only considered total phosphorus in this application. It did not consider the impacts of dissolved phosphorus, particulate phosphorus, and biologically available forms of phosphorus.
 - b. The SWAT model focuses on surface water run-off, assuming sorption of dissolved phosphorus within the subsurface soils, not considering permeable coarse and waterlogged soils with low ability to retain phosphorus.
 - c. SWAT primarily focuses on the impact of rainfall/storm-event phosphorus run-off and does not consider soluble phosphorus contributions during routine baseflow watershed conditions.
 - d. It did not consider other critical water-quality indices to include Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), pH, Turbidity, and Nitrate, among others.
 - e. Computer model effectiveness is only as good as the actual analytical data obtained over time to ensure data quality and accuracy:
 - i. Ref – MDPI; Predictive Modeling of Urban Lake Water Quality Using Machine Learning:
 - I. A 20-Year Study Dependence on Quality of Data:
 - a. Machine learning models are as good as the data they are trained on. In our study, the data spanning two decades was subjected to various preprocessing steps to handle inconsistencies, errors, or gaps. However, even the minutest oversight in this process could affect the model’s performance. While we were meticulous in handling missing values and outliers, potential anomalies, or measurement errors inherent in the data could still influence the model results. Future work could involve more sophisticated data-cleaning techniques and the possible incorporation of error-correction methods to further improve model performance.
 - b. Need for Constant Updating: The water quality patterns can change over time due to a plethora of factors such as climate change, urbanization, changes in land use, and technological advancements in pollution control. Consequently, the model should be updated regularly with new data to maintain its predictive accuracy. This poses an ongoing challenge and highlights the need for continuous data collection and monitoring efforts.
 - f. The EPA conducted two separate assessments looking at the modifications made by the State of Vermont to the SWAT model customizing it for Vermont specific environmental conditions. In neither case could an uncertainty/accuracy level be determined, impairing the margin of safety (MOS) typically applied to TMDL modeling tools to help buffer potential errors and data gaps. Potential impacts

attributable to model uncertainty are discussed in the article - EVALUATION OF MODELING TOOLS FOR TMDL DEVELOPMENT AND IMPLEMENTATION, R. Muñoz-Carpena, G. Vellidis, A. Shirmohammadi, W. W. Wallender; 2006 American Society of Agricultural and Biological Engineers ISSN 0001-2351

- i. The issue of model uncertainty has important policy, regulatory, and management implications, but the source and magnitude of uncertainty and its impact on TMDL assessment have not been studied in depth.
 - ii. Results indicate that uncertainty in TMDL models is a real issue and should be taken into consideration not only during the TMDL development phase, but also in the design of BMPs during the TMDL implementation phase.
 - iii. This collective study concludes that the best method to account for uncertainty would be to develop uncertainty probability distribution functions and incorporate such uncertainties into TMDL load allocation through the margin of safety (MOS), the magnitude of which is generally selected arbitrarily at the present time. It is proposed that explicit quantification of uncertainty be made an integral part of the TMDL process. This will benefit private industry, the scientific community, regulatory agencies, and action agencies involved with TMDL development and implementation.
 - iv. The outcome of this review indicates that the status of tools for assessment and implementation of TMDLs for four of the most common stream impairments is inconsistent.
- g. Additional potential deficiencies identified in the use and application of the SWAT model are contained in the literature, Fields of Application of SWAT Hydrological Model—A Review; Josip Janjić and Lidija Tadić – March 2023 - [Earth | Free Full-Text | Fields of Application of SWAT Hydrological Model—A Review \(mdpi.com\)](#)
- i. A significant disadvantage of SWAT is the large quantity of data required to generate accurate results, which may not be accessible in some regions. Another limitation is that the model does not simulate the transport of chemicals through subsurface tile drains and groundwater, which is particularly significant in lowland regions and when simulating stable chemicals that can leach to and accumulate in groundwater. Despite these limitations, the modified SWAT code with added transport capabilities through tile and groundwater flow can be advantageous for catchment-scale environmental exposure studies and developing best management practices or mitigation strategies.
3. Inadequate funding and support of water quality testing within the current Vermont Clean Water Budget
- a. As contained in the current 2022 report and the SFY 2023/24 Clean Water Budget, there is less than 0.4% allocated for any forms of monitoring to measure CWIP funded projects' water quality benefit.

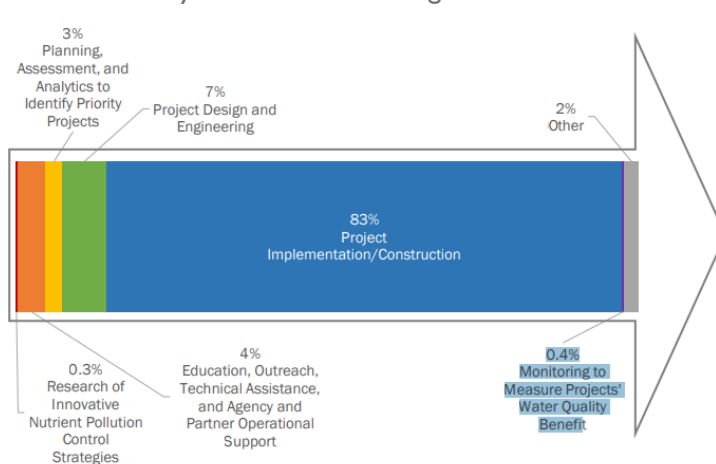


Figure 11. Percentage of dollars awarded by State of Vermont agencies to various steps of the clean water project development process, SFY 2016-2022.

- b. The only current statewide water quality monitoring programs available to Vermont Lake Associations, municipalities, and the public are:

- i. 1. the State Lay Monitoring Program ([Lay Monitoring Program | Department of Environmental Conservation \(vermont.gov\)](https://www.vermont.gov/conservation/lay-monitoring-program)). The Vermont Lay Monitoring Program (LMP) trains and equips volunteers (or Lay Monitors) to conduct periodic lake water quality sampling from their boat using quality-assured methods. This program only focuses on a single event/location summertime sampling period. The program was implemented in 1979 and the principal goals remain the same today; and
- ii. 2. The LaRosa Partnership Program or LPP. Established in 2003, this program is limited to organizations applying for and meeting a site selection process. According to the Vermont website, the LPP is funded through CWIP funding, and is assumed to be included in the 0.4% identified in figure 11 above.
- c. Experience associated with obtaining CWIP funding in support of projects contributing to phosphorus TMDL load reduction.
 - i. In 2023, the Lake Bomoseen Association developed a proposal and obtained project funding from the South Lake Champlain Clean Water Service Provider in support of a Lake Bomoseen Lake Watershed Action Plan. Although the project proposal contained a line item to support a water quality monitoring and QAPP program to establish baseline levels for all tributaries potentially contributing to phosphorus loading and hyper-eutrophication and help quantify the results and impacts of future remediation projects to control those environmental stressors, it was removed from the final project funding. The response offered by SLCCWIP for the removal from the proposal and the resulting grant, was that water quality testing was not fundable using CWIP dollars.
 - I. It should be noted that the entire multi-component sampling plan and the required Quality Assurance Project Plan (QAPP) for the Lake Bomoseen LWAP would only have cost an additional \$5000.00 to accomplish, supporting the BMP recommended by the EPA.
 - ii. This seems to be in direct contrast to best management practices and guidelines established by the U.S EPA regarding the ability to measure and quantify the corrective actions taken in support of the phosphorus TMDL load reduction and VT CWA goals.
 - iii. These same concerns regarding funding and water monitoring requirements to support the impact of remediation projects to reduce phosphorus and the proposed TMDL were provided as comments to the South Lake Champlain Tactical Basin Plan provided by the VT DEC in the Town of Wells in 2022. No responses regarding those concerns were received or answered.

RESULTS – CONCLUSIONS - CONSIDERATIONS FOR THE CLEAN WATER BOARD

I hope this exercise was not in vain. I do not have a Ph.D., but I do have quite a bit of experience working with projects focused on Environmental remediation over the past 45 years. Although many of the numbers provided in the 2022 report are estimates, they are the best scientific estimates currently available. The Board faces a huge task in looking at the allocation of funds and how the precious environmental dollars our little state must spend are allocated. That makes this even all the more important and critical that the work being produced is the best scientifically achievable and evidence-based going into the remaining 13 years of the TMDL performance period.

I. Observations:

- a. At the current estimated rate of phosphorous reduction, the State of Vermont will not be able to achieve the established water quality TMDLs. The current Report summary clearly shows a need for either time extension or increased funding. Based upon my understanding, neither are either achievable or would be allowed without significant non-compliance penalty. Simple examples are contained in the 2022 Report and the numbers previously provided in this document under Approach.

- i. Simple Examples:
 - 1. The current estimated rate of reduction is 5.97 (6) Metric Tons/Year, versus the remaining required reduction rate to meet the 2037 performance period goal. That would require a reduction rate of 14.3 (14) Metric Tons/Year.
 - 2. The current cost per metric ton reduced to date is \$8.1 Million dollars per metric ton, giving the total estimated project cost to achieve TMDL compliance in the time remaining time to be \$1.5 Billion dollars. A number not likely achievable based upon the current funding experience and budget limitations.
- ii. I recognize these are gross estimates, but they are estimates based upon those estimates projected by the State as contained in the 2022 Report. What this means to me is there is a need for change and modification to our current approach, rather than continuing with business as usual.
- b. The application of the SWAT model currently being used to help establish required corrective actions, define project locations, project prioritization and assist in funds allocation should continue, but only recognizing that it is a model. That these are estimates, and margins of errors for this tool are not clearly defined for Vermont conditions, and its accuracy remains un-proven. Although, this will make a novel future research paper to enhance future models and improve TMDL development methodologies, we are using this as the basis for real time project development and corrective action, under a limited duration of time and a federal compliance order. We are excluding requirements that would establish actual **evidence-based practice** to support our remediation activities by not ensuring actual, real-time, seasonal, and storm versus base flow conditions to augment and support our modeling. We need to validate its strengths and it's weaknesses/errors, allowing adjustment in how we are focusing our projects and the associated funds allocations in support of the CWIP process.
- c. There is an immediate need to increase the emphasis on, and in-turn, funds allocation under the current Clean Water budget to better support water quality testing and data acquisition to validate the impacts and effectiveness of all CWIP funded studies and corrective action projects. The current allocation of 0.4% of the Clean Water budget is unacceptable and does not support best management practice for environmental pollution project control and creates significant data gaps needed to help support better evidence-based practice, project risk assessment, and project prioritization.

2. Recommendations:

- a. A comprehensive review of the current Clean Water Project plan supporting TMDL compliance is necessary to ensure the State of Vermont is able to meet its commitments as defined in our signed compliance agreements and as required under the federal Clean Water Act. We should do this proactively before the EPA directs us to do so.
 - i. The importance of this cannot be emphasized enough. One immediate example exists being the inability to initiate in-situ remediation of the St Albans Bay phosphorus and corresponding algal bloom problems until the associated tributary TMDL limits are met.
- b. We need to change the current practice/approach of using modeling estimates as the sole guide and basis for project remediation activities. I would ask the Board to please consider having the ANR/DEC consider adding a fourth Standard Operating that would make Water Quality monitoring and testing as a "fourth rail" if you will, to improve and support the need for actual, rather than estimated program effectiveness. This needs to be done sooner, rather than later, as I would assume the EPA will ultimately want actual water quality data to validate actual/final TMDL acquisition and compliance. Guidance to achieve this is already contained in the Vermont Water Quality Monitoring Program Strategy 2011-2020; Ref. - https://dec.vermont.gov/sites/dec/files/documents/WSMD_MonitoringStrategy2015.pdf
- c. CWIP funding programs should acknowledge and support the need to also include chemical pollutant analysis as a critical part of its funding focus and corrective actions rather than the current practice focusing studies and corrective actions primarily based upon the physical/anthropogenic watershed stressors.

- d. Additional funding to support water quality testing and monitoring in support of Vermont lake health by private lake associations, public groups, and municipalities needs to be significantly improved. The limited scope of the Lay Monitoring and LLP programs are inadequate to meet current needs and best practice for those organizations and their ability to help define and contribute to the control and remediation of the chemical risks posed to each individual Vermont lake. A strategy such as developed and applied by the U.S. EPA's National Lakes Assessment ([National Lakes Assessment | US EPA](#)) should be used as a basis for improving this process.

I would like to greatly acknowledge the incredibly difficult and exhaustive work completed to date by the State of Vermont, and only hope that my observations and recommendations will be considered by the Board moving forward in its quest to improve Vermont lake, river, and stream health.

The information contained in this report is strictly the opinions of the author. Use of this information or changes to the format should only be taken with the author's approval. Lindsey C. Waterhouse, 12/3/2024

Lindsey C. Waterhouse

177 Bigelow Hill Road • Fair Haven, VT • 05743 • Ph. (802) 265-3237

E-mail: lindsey.waterhouse@uvmhealth.org

Industrial Hygienist, Safety Officer, Environmental Engineer, and Project Manager

Thirty seven years of experience leading comprehensive industrial hygiene, occupational health, safety, environmental protection and radiation safety programs.

- Currently employed as the Safety and Ergonomics Specialist, Environmental Health and Safety Department, University of Vermont Medical Center, Burlington, Vermont. Responsible for leadership and management of the Environment of Care (EC) and institution-wide safety and ergonomic programs. Chairman of the Employee Injury and Illness, and Hazard Surveillance Committees.
- Retired from Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire in 2014 where I served for 13 years as Manager, Safety and Environmental Programs. Responsible for management and coordination of Environment of Care activities, corporate industrial hygiene and safety programs, and environmental compliance activities. Established an Occupational Health and Safety Management System to include integration with occupational medicine and institutional wellness programs.
- Four years' experience as a Senior Project Manager for an international engineering consulting firm. Developed, implemented and executed occupational health, safety, and environmental engineering service lines for the company nationally and internationally.
- Retired U. S. Air Force Officer. Assigned to major medical facilities as the manager of Bioenvironmental Engineering Services. Selected for assignment to the U. S. Air Force Medical Inspection Directorate to assess occupational health programs and medical facility compliance with U.S. Air Force medical and Joint Commission standards worldwide.
- Considerable experience in occupational safety and health and environmental program development, auditing, standards interpretation, environmental permitting and related business development matters.
- Extensive experience defining and communicating the risk associated with occupational health and safety hazards and environmental compliance needs to staff, corporate leadership and regulatory and public organizations.
- Routinely called upon to facilitate meetings and provide formal presentations to employees, executive management, labor union officials, and state and federal regulatory agencies. Trained in the application of quality management concepts, and Greenbelt, DMAIC, lean six certified.
- Strengths include leadership and management experience in the private, federal, and state sectors.
- Excellent technical writing, report development, communication and presentation skills.
- Extensive experience in the development, implementation, and delivery of safety education programs.
- Competent in the use and application of Microsoft Office softwares, project planning software, statistical methods and control charts (SigmaZone) and use and application of industrial hygiene analytical equipment.
- Extensive experience working with information systems staff and consultants to develop corporate occupational health and safety management software systems.

Education:

- Norwich University, Northfield, VT: B.S., Engineering Technology/Environmental, 1973-1977.
- USAF School of Aerospace Medicine, Brooks AFB, TX: Bioenvironmental Engineering Course, 1978.
- University of Arizona, Tucson, AZ: Graduate studies in industrial hygiene, industrial ventilation and independent studies in advanced air monitoring techniques.
- Air Force Institute of Technology: Air Force Education with Industry Fellowship with the Occupational Safety and Health Response Team, Salt Lake City, UT.
- Certificate Program in Occupational Health and Safety Management, AIHA, 2012.
- Harvard School of Public Health, Ergonomics and Human factors, October 2013.
- Greenbelt, Lean Six Sigma certified, Dartmouth-Hitchcock Value Institute, September 2014.

Professional Profile

September 2014 to Present, Safety Specialist, University of Vermont Medical Center, Burlington, Vermont. Responsible for management of Environment of Care programs, safety programs and associated regulatory requirements. Chairperson for the Employee Injury and Illness Prevention and Hazard Surveillance Subcommittees. Participates and supports the management of all EC Subcommittees. Works collaboratively with Human Resources, Employee Health, Nursing Education, Patient Safety, Facilities Management, Risk Management, Accreditation and Regulatory Affairs, and operational unit managers in support of Safety Management and Environment of Care programs and operations.

- Worked to support EC corrective actions following 2014 Joint Commission accreditation survey.
- CY 2015 - Supported EC assessments in 350 departments to ensure the safety of staff, visitors, and patients while improving the quality of patient care.
- Established a dashboard to better define institutional injury and illness trends to help target “At Risk” locations for injury, illness, and loss prevention activities.
- Established safety education programs in support of new employee and new leader orientation, nursing orientation, facilities management, and fire and life safety operations.
- Developed and lead projects to address workplace musculoskeletal injury prevention, development of an EC Tracer system, and improvement in employee injury reporting.

April 2003 to September 2014, Manager, Safety and Environmental Programs, Dartmouth-Hitchcock Medical Center (DHMC), Lebanon, NH. Responsible for management and compliance with the Joint Commission Environment of Care standards affecting DHMC operations; Corporate Environmental Safety Officer, overseeing all occupational health and safety programs; management of environmental compliance operations to include hazardous material control and waste disposal, industrial discharge permit compliance, EPA Tier II reporting, and environmental program compliance auditing. Managed an annual budget of \$1.2 million dollars and the activities of four professional support staff.

- Developed comprehensive plans and policies to support and guide Environment of Care activities.
- Initiated occupational health and safety programs which have established DHMC as the bellwether for injury reduction in acute care hospitals insured by the Liberty Mutual Insurance Company.
- Received no identified Environment of Care deficiencies impacting Joint Commission Accreditation for the 2005, 2008, 2011 and 2014 Joint Commission Accreditation Surveys.
- Initiated hospital hazardous waste and hazardous waste medication management programs resulting in no deficient findings during a March 2006 EPA, and July 2011 NH DES hazardous waste compliance assessments.
- Established a clinical respiratory protection program used by OSHA and NIOSH as an example of a model clinical respiratory protection program.
- Developed and supports recurring air sampling and occupational exposure strategies to assess possible employee exposure to toxic substances and occupational stressors.
- Implemented a Safe Patient Handling Program to reduce nursing musculoskeletal injuries. Project outcomes have realized a 1.5 million dollar savings in worker’s compensation costs.
- Developed and implemented proposals to support development of a corporate e-learning system to help support corporate compliance programs.
- Chairperson for the DHMC Environment of Care and D-H PHEWS (Partners in Health, Environment, Wellness and Safety Committees).
- Routinely called upon to represent DHMC in matters of occupational health and safety, and environmental management compliance actions.

April 2001 to April 2003, Manager of Safety, Fletcher Allen Health Care, Burlington, VT. Responsible for compliance activities for all elements of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) Environment of Care (EC) as well as the development, implementation and monitoring of the Safety Management Program. Provided support and oversight for the Environment of Care Committee/Subcommittee activities and the coordination of all EC performance improvement and data collection activities. Some accomplishments include:

- Established a model Hospital Construction Safety Program encompassing Contractor Safety Orientation, Health and Safety Plan Development, Interim Life Safety Measures, and Infection Control Risk Assessments.
- Developed and implemented a standardized Hazard Surveillance Audit Process for all direct patient and non-patient care areas. Actions contributed to no EC type 1 deficiencies during the May 2003 Joint Commission Survey.
- Developed programs and processes to assess accident and injury incident rates to better focus loss prevention activities. Actions produced significant reductions in staff lost workdays, reduced OSHA incident rates, reduced worker compensation costs and an improved safety culture.
- Developed and implemented a Safe Patient Handling Program for all health care organizations conducting patient transfer and handling activities.
- Developed multiple safety education programs to include - New Employee Orientation, Manager Safety, Employee Mandatory Annual Training, Safe Patient Handling, Office and Industrial Ergonomics, Contractor Safety Orientation, and multiple presentations for EC and Safety Programs.
- Managed and coordinated the development of the EC Management Process, JCAHO EC Survey Preparation, EC Intranet Web Site, EC Safety Manual, and Quarterly and Annual EC reports.

August 1998 to April 2001, Environmental, Safety and Occupational Health Coordinator, Department of Buildings and General Services, Montpelier, VT. Responsible for the development and implementation of environmental and occupational health and safety programs, policies, and procedures for the State of Vermont, Department of Buildings and General Services (BGS). Duties involve coordination of occupational health and safety and environmental engineering programs with all BGS Division Directors and their respective section supervisors. Conducts special projects in direct support to the Commissioner, Buildings and General Services. Provides consulting services in support of Loss Prevention activities to state agencies and departments. Chairman of the department's Health and Safety, and Environmental Management Committees. Accomplishments include:

- Developed and managed comprehensive health and safety programs for BGS.
- Established comprehensive health and safety training programs targeted at employee needs.
- Conducted environmental and safety compliance audits of all major BGS facilities.
- Established an occupational physical monitoring program for BGS employees.
- Developed and implemented an Environmental Management System, meeting the requirements of ISO 14001 in support of the Governor's Executive Order 04-99.
- Established metrics to evaluate and validate ESOH program effectiveness.
- Established procedures to evaluate work-related musculoskeletal disorders for application in all state agencies.
- Chaired the task force responsible for developing the State of Vermont's Workplace Violence Policy.
- Developed contracts to support occupational health and environmental program operations

October 1994 to August 1998, Senior Project Manager and Industrial hygiene, safety and environmental engineering consultant, EA Engineering, Science and Technology, Newburgh, NY. Responsible for the marketing, development, planning, budgeting, implementation, and management of occupational safety and health, and environmental protection projects for an international consulting firm. Developed projects in support of client requirements to include:

- Phase I environmental site assessment following ASTM E-1527/28 protocols.
- Exposure assessment projects for employees exposed to lead, chrome, arsenic, mercury, and cadmium.
- Lead based paint exposure and risk assessment projects for eighteen Air Force bases throughout the United States and Europe.
- An environmental oversight study of a chemical manufacturing company to assess compliance with the OSHA Process Safety Management Standard and EPA Risk Management Program requirements.
- Developed and implemented programs to conduct confined space hazard assessments of 4100 confined spaces at 23 Air Force bases throughout the United States and Europe.
- Team Chief and project manager for conducting environmental, occupational safety and health, and fire safety compliance audits at 1423 Federal Aviation Administration facilities within the FAA's Eastern and Central Regions.

- Developed and implemented confined space, hazardous materials, and lock-out/tag-out training programs.
 - Assessments of military installations to identify, sample and inventory PCB containing articles and items
- Additional duties included occupational health and safety manager for EA Northeast area operations, and proposal team leader responsible for proposal development and project negotiations

June 1993 to September 1994, Senior Bioenvironmental Engineer, United States Air Force Inspection Agency, Medical Directorate, Kirtland AFB, NM. Evaluated Air Force Medical, Occupational and Community Health, Environmental Surveillance, and Radiation Safety Programs worldwide ensuring compliance with Air Force, Federal, State, JCAHO and Host Nation regulations. Helped develop and implement the Malcolm Baldrige based audit system currently used by the AF Medical Inspection Directorate.

August 1987 to June 1993, Chief, Bioenvironmental Engineering Services, and Alaskan Air Command Bioenvironmental Engineer, United States Air Force, 3rd Medical Center, Elmendorf AFB, Anchorage, AK. Responsible for leading a team of 22 people conducting environmental pollution, industrial hygiene, potable water, and radiation safety programs for 400 industrial facilities, and 17,000 personnel. Developed comprehensive programs to support occupational exposure assessments, hazard communication, respiratory protection, confined space, hearing protection, radiation safety (ionizing and non-ionizing), fetal protection, blood-borne pathogens, ergonomics and industrial ventilation programs. Developed and implemented pollution prevention programs to control and re-use installation hazardous materials using a hazardous materials “pharmacy” concept. Implemented a program to sample, characterize and control industrial and medical infectious/hazardous waste in support of the base TSD facility and RCRA, Part B permit. As Alaskan Air Command Bioenvironmental Engineer developed policy and directed all Air Force Bioenvironmental Engineering resources and operations for the Air Force within the State of Alaska. Director of a state certified laboratory in support of microbiological examination of potable water systems. Nuclear Regulatory Commission (NRC) license manager and Command Radiation Safety Officer.

July 1986 to May 1977:

Compliance Safety and Health Officer, Air Force Institute of Technology.

Conducted a one-year, Air Force Education with Industry Fellowship with the Occupational Safety and Health Administration, OSHA Health Response Team, Salt Lake City, Utah. Conducted operations in support of the development of health standards for wood dust, formaldehyde, glycol ethers, and hazardous waste emergency response operations. Conducted compliance operations to support OSHA Regions X, V, II and I.

Chief, Bioenvironmental Engineering Services, USAF Hospital Dover, Dover AFB, DE. Managed the industrial hygiene, radiation safety and environmental engineering support for a multi-mission large Air Force Base with an industrial population of 7000 personnel. Designed a RCRA closure plan for an industrial wastewater lagoon responsible for solvent contamination of the shallow potable water aquifer. Director of a state certified laboratory in support of the microbiological examination of potable water systems. Base Radiation Safety Officer.

Chief, Bioenvironmental Engineering Services, USAF Clinic McChord, McChord AFB, WA. Directed the industrial hygiene, radiation safety and environmental engineering support for a multi-mission large Air Force Base. Director of a state certified laboratory in support of the microbiological examination of potable water systems. Helped develop and implement the U.S. Air Force Installation Restoration Program during its infancy. Base Radiation Safety Officer.

Associate Chief, Bioenvironmental Engineering, USAF Regional Hospital Davis Monthan, Davis Monthan AFB, AZ. Managed the industrial hygiene and radiation safety program support for a multi-mission large Air Force Base. Helped develop and evaluate a field expedient method for the detection and analysis of hydrazine and unsymmetrical, dimethyl hydrazine in support of Titan II missile operations.

Professional Affiliations:

Member of the American Industrial Hygiene Association, American Conference of Governmental Industrial Hygienists, National Fire Prevention Association, and the American Society for Health Care Engineering.

Registered Professional Industrial Hygienist, Association of Professional Industrial Hygienists, APIH
Registry No. 09970110

Awards and Recognition:

- Received the Air Force Meritorious Service, Commendation, and Achievement Medals for Outstanding Achievement in support of Air Force Bioenvironmental Engineering Operations.
- Numerous letters of endorsement and recognition by flag officers and other senior U.S. Air Force officials.
- Acknowledged for outstanding achievement by the Assistant Secretary for the US Department of Labor for support of OSHA health standards development.
- Recognized by Governor Howard Dean for the development of an Environmental Management System in support of Vermont, Department of Buildings and General Services operations.
- The U.S. EPA, Office of Solid Waste and Emergency Response – Recognized for assistance in the development of the document - Managing Pharmaceutical Waste, A 10-Step Blueprint for Healthcare Facilities In the United States (August 2008).
- Harvard School of Public Health Center for Work, Health and Well-being, September 2012. Recognized for contributing to the SafeWell Practice Guidelines: An Integrated Approach to Worker Health, Version 2.0

References:

Professional:

- Mr. Victor Hillman, CIH, CSP, MS, Liberty Mutual Insurance, Risk Control Services, telephone phone number: (781) 891-8900, Option 1, ext. 37261
- Robert K. McLellan, MD, MPH, FACOEM; Chief, Section of Occupational and Environmental Medicine, Medical Director, Live Well/Work Well; Dartmouth-Hitchcock
(Robert.K.McLellan@hitchcock.org)

Other personal and work related references provided upon request.