# State of Vermont

## Feasibility Study for an Agency of Agriculture Food and Markets/ Department of Environmental Conservation Laboratory

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Project #13184.00

The S/L/A/M Collaborative

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# Executive Summary



## *Background*

In August, 2011, Winooski River floodwaters resulting from Tropical Storm Irene severely damaged the Vermont Agency of Agriculture Food and Markets (VAAFM) and Vermont Department of Environmental Conservation (DEC) Laboratory in the Waterbury State Office Complex. Since that time, laboratory operations have been scattered among several temporary locations, most significantly at the Hills Building at the University of Vermont. Co-location of the two programs in the Hills Building is subject to a lease that expires in August, 2015 (with two options to extend the lease until August, 2017). Subsequently, as part of a comprehensive redevelopment plan for the Waterbury State Office Complex, the decision was made to demolish the VAAFM-DEC laboratory building. No permanent future site has yet been identified for these programs.

Responding to the need for a long-term plan to replace the VAAFM – DEC laboratory facility, this feasibility study was authorized and funded by the Vermont General Assembly pursuant to Act 51 of 2013, which directed VAAFM and DEC, in consultation with the Department of Buildings and General Services (BGS), to "examine and report to the General Assembly on the feasibility of sharing the same laboratory, exploring relationships with the University of Vermont and the Vermont State Colleges system, or other public or private entities, and determining what specialized services may be sold within the Northeast region to fulfill state and regional laboratory needs … [including] a cost-benefit analysis and a governance model."

This study was designed to explore three options for replacing the VAAFM and DEC lab functions lost following Tropical Storm Irene:

- **Option 1** is to ***OUTSOURCE*** essential laboratory testing to commercial laboratories and/or to public laboratories in other states.
- **Option 2** is to replicate the model that existed in the Waterbury facility as closely as possible, whereby the Agency of Agriculture and the Department of Environmental Conservation would be ***CO-LOCATED*** but maintain separate laboratory operations in the same facility.
- **Option 3** is to consolidate VAAFM and DEC programs in a single ***COLLABORATIVE*** facility operated jointly by the two agencies under a new governance model, in order to maximize efficiency and eliminate duplication.

## *Laboratory Missions*

The Vermont Statewide Strategic Plan articulates the following strategic priorities that are supported by the mission of the VAAFM and DEC laboratories :

- "Promote programs, policies and legislation that support economic growth and competitive advantage for Vermont businesses and job creation in Vermont. Provide fair and consistent regulation of the marketplace."
- "Protect, sustain and enhance conservation of our natural resources for the benefit of this and future generations and to enhance our quality of life."
- "Maintain and enhance the health and productivity of farm and forest land, and wildlife habitats, including ecosystem services (flood resilience, water quality, clean air etc.)"
- "Establish a statewide crop and feed safety program that manages all aspects of agricultural commodity safety, including pathogens, pesticides and other potential contaminants."

The VAAFM and DEC laboratories provide a wide range of services to the people of Vermont, consistent with these priorities and the broad VAAFM and DEC missions to protect human and animal health, safeguard environmental resources, and foster commerce and economic development. Lab services protect the integrity of iconic Vermont institutions such as the dairy and maple syrup industries, develop data that protect and support the long term vitality of important air, soil, and water resources, and extend into many other less visible areas of Vermont life.

While the daily services provided by the labs are critical to commercial activities and long term environmental protection, the labs' ability to quickly and effectively respond to urgent health threats and emerging threats to natural resources is essential. Not only are major unanticipated situations a regular occurrence, but these situations by their nature cannot be planned for in advance. The capacity of the labs to respond quickly and nimbly is essential to the protection of consumers, and to the continuing viability of major Vermont industries such as dairy. Several ongoing or emergency situations addressed by the labs are highlighted below and more are included in ***Appendix A***.

### 1. Protecting Human and Animal Health

- *Bedbug / Pesticide Misuse*: It was found that hundreds of residential units had potentially been treated with a bedbug pesticide that had been banned for residential use. The Agriculture lab, the Department of Health Lab, and federal authorities worked closely together to obtain and test more than 1000 samples, and provide prompt feedback to concerned citizens.

- *Public Schools / Pesticide Misuse*: It was found that a pesticide to control head lice had been sprayed on a school carpet. The Agriculture lab was able to collect samples, analyze them, and send detailed results and risk analysis to parents within one day.
- *Contaminated Pet Food*: It was found that imported pet food was contaminated with melamine nationwide. The Agriculture lab was able to rapidly obtain and test pet food products locally, and then quickly advise state citizens of the specific risks in their local areas.
- *Mercury Contamination*: As part of a major study of mercury in the northeast, the DEC Lab was instrumental in the development of data describing sediment and fish tissue mercury concentrations from lakes in the Vermont-New Hampshire region, and contributing water chemistry measurements. The DEC laboratory work substantiated the need for Vermont's comprehensive mercury legislation, signed into law in 2005

**2. Safeguarding Environmental Resources**

- *Water Resources*: The LaRosa Analytical Services Grant is a partnership between some of Vermont's volunteer (citizen) watershed groups, the DEC Monitoring, Assessment and Planning Program, and the DEC Laboratory. The project began in 2003 and has since fostered partnerships with 31 associations and assessed over 800 sites throughout Vermont. This program is organized and coordinated so that volunteer sampling expands upon DEC staff sampling; effectively furthering a primary mission of DEC to protect, maintain, enhance and restore the quality of Vermont's surface water resources. The DEC Laboratory provides the analysis at no cost to the volunteer groups.
- *Air Pollutants*: In 2004, EPA established a National Air Toxics Trends Station (NATTS) monitoring network to fulfill the need for long-term air toxics monitoring data of consistent quality. The primary purpose of this 27-site national network of air toxics monitoring stations is tracking trends in ambient levels of air toxic pollutants that are associated with a wide variety of adverse health effects and regulated under the Clean Air Act. DEC's monitoring site in Underhill, Vermont is one of the NATTS sites and is considered a representative national "background" site. The DEC Laboratory provides air toxics analytical results such as volatile organic compounds, carbonyls, and metals to AQCD for this air monitoring.
- *Long-term Continuity and Consistency of Environmental Health Data*: Data comparability and quality are critical for long-term monitoring and decision-making. Vermont invests approximately $500,000 annually in the Lake Champlain Monitoring program. Consistent use of DEC's laboratory for sample analysis ensures that this investment is based on credible data.

**3. Fostering Commerce and Economic Development**

- *Contaminated Produce / Commerce*: After Tropical Storm Irene, the federal Food and Drug Administration recommended that thousands of acres of animal feed be destroyed due to potential contamination. The Agriculture lab was able to test the feed and promptly confirm that it was safe to use, saving the crops and sparing farmers from further financial *harm*.
- *Maple / Food Safety*: Testing over several years has led to numerous improvements in maple industry practices, addressing food safety issues as well as contaminants affecting the flavor of the syrup.
- *Dairy*: The VAAFM diagnostic laboratory handles the product and animal health testing for Vermont's dairy industry. At $493,926,000 produced annually, the Vermont dairy industry is responsible for 73% of the total market value of agricultural products produced in the state. The lab's activities have enabled the number of on-farm processors to increase by more than 35% in the last five years, from 63 in 2008 to 97 in 2013.

**4. Positioning the Lab for Growth and New Areas of Service**

In the coming years, emerging health trends and new federal programs will require implementation and support from the VAAFM and DEC laboratories, including :

- More stringent federal food safety rules
- Organic certification for growers
- Labeling and certification of genetically engineered foods and seeds
- Plant virus screening as it increasingly impacts interstate and international commerce

- Increasing air toxics analysis

## *Options for Replacement of the VAAFM-DEC Laboratories*

1. **Outsourcing**: Of the three primary options (Outsourced, Co-located and Collaborative) only the Co-located and Collaborative models appear to meet all of the needs identified by the State of Vermont. Specifically, the Outsourced model (Option 1) is not more cost effective than the other two options, nor does it appropriately address all issues related to quality and response time. ***Section 3*** of this report outlines in detail the potential for higher annual operating costs associated with outsourcing. Further, review of outsourcing efforts in other states reveals that core laboratory services can be outsourced with only marginal success.

   Other concerns with the Outsourced model are that:

   - It does not appear to handle well the need for research and analysis with respect to new services or growth in services.
   - For some tests, especially in the environmental field, few if any outside labs have the capability to detect the low levels of contaminants that the tests require.
   - It does not appear to be an effective model for urgent and emergency situations, where immediate and/or large scale response is needed. Unlike a state operated lab, it is not likely that an outside lab will be able to set all else aside in such a situation. Many of the incidents outlined above and in ***Appendix A*** would not have been effectively addressed and resolved under an outsourced lab model.

2. **Internal Options**: Option 2 (Co-located) and Option 3 (Collaborative) present two different models for a new state laboratory facility that would continue to deliver the lab services that were provided at the Waterbury facility, and are being provided, with some limitations, today. In considering these options, some key issues should be noted:

   - Several studies in the years prior to Tropical Storm Irene reviewed the operation of the labs and made recommendations for improvements, including consolidation. The most significant is the Association of Public Health Laboratories (APHL) report of 2006, which is included as ***Appendix B*** to this report. The recommendations were generally not implemented at the time, in part due to the limitations of the Waterbury facility, but remain valid.
   - Current lab operations lack full time, dedicated position for safety, waste management, and quality control. The labs are currently relying on their University of Vermont landlord for some of these services. Option 2 and Option 3 both address this need.
   - Option 3 can restore all lab functionality that existed prior to Tropical Storm Irene, accommodate some growth, and provide proper oversight for safety, waste management, and quality control, all without adding to the current number of full time staff positions approved for the lab. Option 2 requires the addition of 3.5 full time staff positions to accomplish this.
   - The size of the facility required to support Option 2 would be approximately 10 percent larger than the facility that would be required for Option 3.
   - Either option could include all of the lab programs that existed in the Waterbury facility. To evaluate the impact of including or excluding some programs from the facility, all programs were classified as either Tier 1, Tier 2, or Tier 3, as follows:
     - ◊ The Tier 1 programs are the analytical labs that are essential to the new facility, and would be included in the new lab governance model proposed for Option 3.
     - ◊ The Tier 3 and some Tier 2 programs could be located elsewhere if necessary, in order to reduce the capital investment in the new facility. The annual operating costs incurred would, however, be greater in many cases.
     - ◊ The Weights and Measures program, which is classified as Tier 3, is the only program adequately housed at the present time.

     Please refer to the cost matrix on page 8 and to ***Section 4*** of this report for additional information.
   - While it is not the intent of this study to make a final, specific site recommendation, several preliminary locations have been considered during the preparation of this study: a new site near Montpelier, a site on or near the University of

Vermont campus or the Vermont Technical College campus, and a site in Colchester adjacent to the new Department of Health lab. The potential synergies to co-locate and/or collaborate with the Department of Health at the Colchester site are numerous, but the site itself presents challenges.

- **The state's lease at the University of Vermont expires in August, 2015, with two one year options. In order to have a new facility ready for occupancy by August, 2017 at the latest, a site needs to be selected and design work needs to begin by late 2014. Please also refer to the schedule in Section 5.**

The Co-located model (Option 2) does adequately address all of the above issues and would be a responsible solution for the State of Vermont. It would be the easiest to implement of the three options because it would essentially be "business as usual" with a new facility modeled after the one in Waterbury that was lost. However, programmatically it would suffer from the same functional weakness of redundant services between VAAFM and DEC. In addition, it could only marginally implement the recommendations of the 2006 APHL study for improved operations.

***Recommended Option***

The Collaborative model (Option 3) is the best choice overall for improved lab functionality, capacity for growth, efficient cost of construction, and reduced operational cost. A significant benefit of such a solution would be the ability to implement proven production workflow enhancements commonly referred to as "Lean Production Management". The one significant challenge with Option 3 is that a major change in governance will be required for it to be successful. However, representatives from VAAFM and DEC have consistently expressed their willingness to treat this challenge as an opportunity for improved collaboration and delivery of services. It is assumed that this willingness will continue and develop further as a program for construction of a new lab continues.

Thus, the significant benefits of a Collaborative Lab model (Option 3) are:

- Reduced cost of construction by approximately $1.7 million, compared to the Co-located model. The anticipated cost for the facility is $14.4 million before escalation and allowances for unforeseen conditions. Assuming construction starting in 2016, the total budget inclusive of these allowances would be $18.1 million, as outlined in ***Section 5*** of this report.
- Reduced cost of facility operation, compared to the Co-located model.
- Reduced staffing costs by approximately $250,000 per year, as compared to the Co-located model.
- Reduced "fee for space" for facility charges by the Vermont Department of Buildings and General Services of roughly $30,000 per year as compared to the Co-located model.
- Best use of space for current needs and future growth.
- Best operational management of work flow and demand to manage growth and peak/emergency situations.
- Most flexibility to adapt to new developments such as growth and changes in testing requirements, and evolving partnerships with neighboring states and with institutions within Vermont. Potential partnerships with other states, with the Department of Health, and with the University of Vermont or Vermont Technical College can be studied further as planning continues.
- Opportunity to implement "Lean Production Management" techniques for streamlined governance, emergency response, delivery of analytical services, and data delivery .
- Opportunity to efficiently implement all recommendations of the 2006 APHL study.
- Alignment with strategic initiatives of the State of Vermont for the delivery of services.
- Enhanced perception of "best use of resources" on the part of VAAFM and DEC from the viewpoint of the citizens of Vermont.
- No significant increase in operational budgets to VAAFM and DEC as the new facility goes into operation.
- All lab functions that existed prior to Tropical Storm Irene can be restored without adding any staff positions.

The loss of the Waterbury lab has produced the opportunity to reimagine the laboratory with a clean slate, no longer constrained by the limited adaptability of that facility. Of the available options, the proposed collaborative laboratory facility makes the best use of that opportunity.

**Recommendations to the Vermont General Assembly, VAAFM, DEC, and BGS**

1. Build a new Collaborative Laboratory (Option 3) for VAAFM and DEC in which all lab functions are aligned based on scientific discipline and method instead of by departmental customer. Include all proposed lab functions in the new facility.
   - Provide funding for and immediately begin a process to determine the preferred location and design for the new facility, and to then select and obtain the rights to a specific site. The site for the new facility should be confirmed no later than the end of 2014 (see schedule in ***Section 5***, page 57). Funding should, at a minimum, provide for site selection, site acquisition, design and planning costs.
   - As part of the site selection process, develop an order of priority among the key factors affecting the decision: proximity to Montpelier, access to BSL-3 space, future collaboration with the Department of Health, and the potential of a higher education partnership.
   - Design the new facility for flexibility and growth, so that the core analytical labs can grow into space occupied by the other labs if necessary, and to facilitate changing priorities as state and regional partnerships evolve. Plan for anticipated growth in testing, including areas such as food safety, organic agriculture, GE seed testing, and air toxics analysis.
   - Please also refer to the table on page 8 for a brief overview of the proposed Collaborative Laboratory, and the implications of several alternative scenarios.
2. Develop a collaborative governance model for a consolidated and jointly operated laboratory that appropriately shares authority, responsibility, cost and benefits between VAAFM and DEC. If not feasible due to legal constraints on the agencies, then shift all lab personnel to either VAAFM or DEC and implement an appropriate governance model. Implementation of this new model need not wait until the new laboratory facility is complete; in fact, it should be implemented at the earliest reasonable opportunity.
   - With the introduction of the new governance model, implement coordinated plans for laboratory safety, laboratory waste management, and laboratory quality assurance.
   - Implement a LIMS (Laboratory Information Management System) throughout the lab (DEC is already using LIMS, but VAAFM needs to bring LIMS online).
3. Both as the project develops and after the new facility is complete, continue to explore and upgrade partnerships with labs in other states, and with institutions in Vermont, to develop areas of leadership and specialized expertise in each location.
4. Implement, at a minimum, all major recommendations of the 2006 APHL Study (see ***Appendix B***, page 75).

## NEW VAAFM-DEC LABORATORY OPTIONS

| FACILITY DESCRIPTION | Personnel in the the Proposed Building | Capital Cost for New Building (Budget) | Cost Per Year to VAAFM / DEC vs. Recommended Option | Average Annual Debt Service (Payable by BGS) see Notes 3 & 10 | Annual Cost for Berlin Space (Payable by BGS) | Other Notes |
|---|---|---|---|---|---|---|
| **RECOMMENDED OPTION** | | | | | | |
| New Collaborative Lab Facility Incorporating All Lab Programs (35,375 square feet) | 15 Analytical Lab staff, 22 other staff, 37 total | $14.4 to $18.1 million | N/A | $1,020,000 to $1,290,000 | None | |
| **ALTERNATIVES** | | | | | | |
| No New Facility - Outsourcing | N/A | N/A | + $592,000 | N/A | None | **The cost of lost ability to provide services and lost responsiveness is not accounted for. Also see Note 9** |
| New Co-located Lab Facility Incorporating All Lab Programs (39,083 square feet) | 18.5 Analytical Lab staff, 22 other staff, 40.5 total | $16.1 to $19.8 million | + $573,000 | $1,150,000 to $1,410,000 | None | |
| New Collaborative Lab Facility Incorporating All Lab Programs Except Weights & Measures (33,225 square feet) | 15 Analytical Lab staff, 21 other staff, 36 total | $13.8 to $17.3 million | Negligible difference in cost anticipated | $980,000 to $1,230,000 | estimated $21,000 in first year | Assumes that Weights & Measures can remain in Berlin. See Notes 4 - 6 |
| New Collaborative Lab Facility Incorporating All Lab Programs Except Weights & Measures and Air Quality (31,275 square feet) | 15 Analytical Lab staff, 19 other staff, 34 total | $13.1 to $16.4 million | See Note 8 | $930,000 to $1,170,000 | estimated $37,000 in first year | Assumes that Weights & Measures and Air Quality can remain in Berlin. See Notes 4 - 8 |

**NOTES:**

1. Personnel count is inclusive of full time and temporary staff.
2. Proposed capital budget for the new building is inclusive of construction cost, design fees, contingencies, etc. as outlined in Section 5.
3. Debt service is based on a 20 year bond at an annual rate of 4.125% (current market rate).
4. Berlin cost is based on a 5 year lease proposal from the landlord and will increase by 2.5% per year starting in the second year
5. Berlin cost is based on the prorated cost for the part of the building occupied by the programs. The entire building must be leased - estimated total cost is $67,200 annually in the first year.
6. Savings compared to the recommended option is negligible. Total cost to the State would be greater if no other program occupies the remainder of the Berlin building to share the cost.
7. If Air Quality remains in Berlin, additional capital expenditures will be required to improve the space. That cost has not been estimated at this time.
8. Additional cost will be incurred to transport Air Quality samples from Berlin to the analytical lab but that cost cannot be readily quantified.
9. The additional cost to the agencies for outsourcing can be expected to increase annually at the rate of inflation plus growth.
10. **If the capital cost is partially reimbursed by FEMA, debt service would be reduced accordingly.**

# 2. Problem Definition

# Problem Definition

## Background and History / Problem Statement



### Background and History

For more than 20 years prior to Tropical Storm Irene in 2011, the Vermont Agency of Agriculture, Food & Markets (VAAFM) and the Agency of Natural Resources - Department of Environmental Conservation (DEC) operated laboratory facilities in a shared facility in Waterbury. While these facilities were co-located in the same building they were operated as separate installations, maintaining separate shipping and receiving areas, separate sample receiving areas and pathways, and separate glassware cleaning and preparation areas. Structurally, the building layout was not conducive to resource sharing between the two laboratories.

In 1995, Vermont conducted an internal review of all of its laboratories, looking for areas of cost savings and efficiencies. Collaboration between the Agriculture and DEC laboratories in at least some areas was one of the recommendations of that review.

Again, in 2006 the Association of Public Health Laboratories (APHL) was invited "to objectively assess and review the operations of the two laboratories to determine areas of collaboration to improve customer service, to utilize technological resources more effectively and efficiently and, as possible to improve cost effectiveness in the two laboratories".

The reviewers noted that "in the intervening years, the administration of DEC and [VAAFM] have encouraged collaboration between the two laboratories with little visible effect". Among the recommendations of the APHL review were a number of significant opportunities for collaboration:

- Employ the DEC LIMS information management system for all analytical chemistry activities in both agencies' labs.
- Consolidate the sample receiving and accessioning functions into a single area for all analytical chemistry activities in the two laboratories.
- Designate one professional level staff person to be the quality assurance officer (QAO) for all analytical chemistry testing in both laboratories.
- Consolidate metals analysis in the two laboratories.
- Consolidate all "wet chemistry" testing conducted in the two laboratories.
- Consolidate all organic analytical services in the two laboratories.

These recommendations were considered for implementation at the time, but the physical limitations of the Waterbury site and the cost of renovation to implement inhibited their immediate adoption.

In 2009 a proposal was made to the Vermont General Assembly to close the DEC lab and to outsource all laboratory testing. At that time, it was determined that outsourcing would not create economic savings and could significantly increase risks to the State of Vermont.

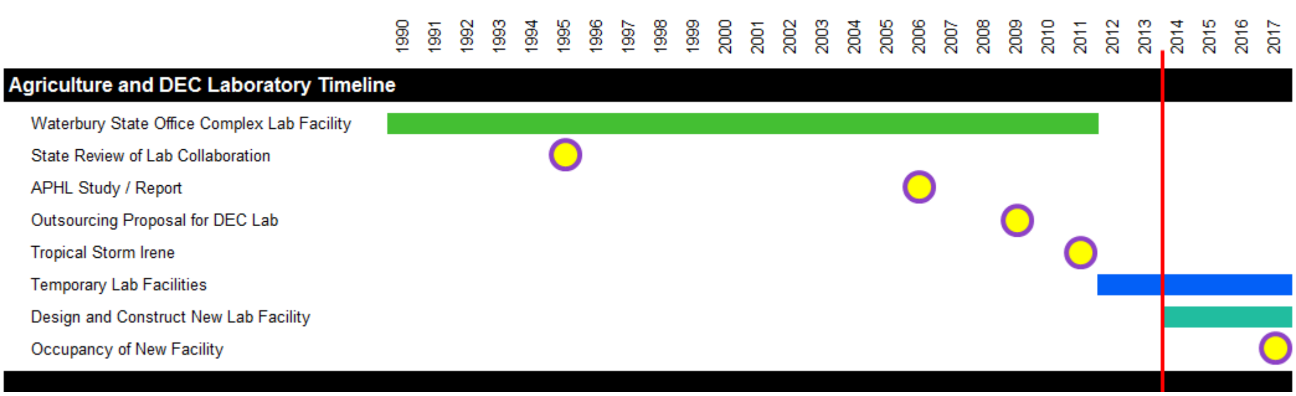
Finally, as previously mentioned, in 2011 Tropical Storm Irene caused significant flood damage in Vermont resulting in significant damage to the facility in Waterbury that housed the two laboratories. The State of Vermont, utilizing FEMA disaster relief funds at least in part, has an opportunity now to replace these two laboratories and is seeking to make decisions on the new facility's design, operation and governance that best serve the needs of the citizens of the State.

Since early 2012, the labs have been operating in temporary space, most significantly the Hills Building at the University of Vermont. The lease there expires in August, 2015, but is extendable to August, 2017. A permanent replacement facility has not yet been identified,.

### Problem Statement

The State of Vermont wishes to make a decision based on cost effectiveness and risk mitigation as to whether to build a new laboratory facility for VAAFM and DEC, or to instead outsource all, or a significant portion of the work done by these laboratories to commercial laboratory firms.

The decision needs to consider not only initial cost, but



how best to provide the high quality of services that the citizens of Vermont require as well as to allow for laboratory services growth in the foreseeable future. It is desired that this be accomplished with the use of a "Lean Production Management" approach that emphasizes efficiency and productivity while simultaneously improving quality.

Further, if the decision is to build new laboratory facilities, the State wishes to thoroughly consider the opportunity for collaboration in the operation of those facilities in order to maximize the opportunity at minimal cost. Again, the value generated for the benefit of the citizens of Vermont is paramount.

Thus, there are really three primary options that need to be analyzed:

1. Outsourcing all or most of the laboratory services previously performed by these two laboratories to commercial laboratories.
2. Building a new "co-located" laboratory facility very similar to the previous facility at Waterbury but with shared common services (shipping/receiving, sample receiving, glassware washing, office areas, meeting rooms, etc.)
3. Building a new "collaborative" laboratory facility that incorporates all opportunities for combined services envisioned by the 2006 APHL review as well as additional opportunities (microbiology, improved work flow, standardized equipment leasing, improved BSL capability, etc.)

Over each of these three primary options there is layered another set of secondary considerations:

1. Should some services not be included in the new facility for cost effectiveness? Since "wet" lab space is more expensive than "dry" lab space, does it make more sense to utilize another location for those services so as to optimize the potential for growth of wet lab facilities in the future? More detailed options for siting specific lab programs in alternative spaces are outlined in the Section 4 of this report.
2. How would location impact usability of the facility and cost of construction? (i.e. if facility is built within a 10 mile radius of Montpelier, would that mean that BSL-3 capability will need to be planned for now or in the future, as compared to a decision to build adjacent to the new Department of Health lab? How will the location near Montpelier positively impact coordination with State departments?)
3. What is the impact of growth of services over the foreseeable future to the cost of operation of each primary option?

Again, above these are considerations for future opportunities that must be considered as well:

1. What additional types of laboratory testing may be desirable for the State of Vermont to have available in the future? What capabilities or space allocations should be designed for in this respect?
2. What would the impact be of a regional model, where the State of Vermont offered some services as specialties to other states, etc. within the region in exchange for receiving other specialty services from its partners, or economic compensation? Are there any similar opportunities not currently offered in the private sector that the State could benefit from?

## Defining Issues

***Cost of Acquisition*** is always a key concern with any such decision. Yet in this case it is probably not the deciding factor. Based on the preliminary space plans for a new facility, a traditional focus on the cost of acquisition will most likely not prove decisive. The difference between the cost of construction of a new "co-located" laboratory (Option 2) and a new "collaborative" laboratory (Option 3) will almost certainly only be an incremental percentage (i.e. 10%). If the available budget cannot be increased to accommodate the additional acquisition cost for a co-located laboratory, however, additional parts of the lab may need to be excluded from the new facility in order to fit the project into the budget.

Further, since funding for a portion of the cost of construction of a new laboratory will probably be from funds associated with the replacement of the Waterbury complex (i.e. FEMA, Insurance, etc.), most of the potential life-cycle cost benefit to the State for "outsourcing" (Option 1) these services as compared to building a new laboratory is eliminated. In point of fact, the findings in 2009 of increased cost for outsourcing would quickly wipe out any perceived short-term benefits related to acquisition. Also, outsourcing will most likely be considered inappropriate for the State, based not only on potential cost increases, but increased risk that the core missions of VAAFM and DEC to protect human and animal health, safeguard environmental resources, and foster commerce and economic development will be compromised.

***Cost of Operation*** is another significant factor. If an effective governance model can be developed for a new "collaborative" lab (Option 3), it probably can offer significant cost advantages in operation compared to Options 1 or 2. Further, based on an analysis of the data from 2009 on an increased cost to outsource lab services, either Option 2 or Option 3 would seem to be beneficial choices for the State.

***Providing for Best Use of Resources*** is the government's obligation to the citizens of Vermont. Here, the ideal solution would be one that can demonstrate that it provides a highly efficient use of resources and optimizes productivity while maximizing the quality of services to Vermont. In other words, the decision that results from this study must reinforce the perception of the State's citizens that their resources are being used wisely, now and in the future.

***Emergency Response*** capability is an important criteria for both VAAFM and DEC. Frequently in the past situations have arisen (disease outbreak, pollution incidents, pesticide contamination, etc.) that have required an immediate priority response. Several examples are detailed in Appendix B of this document. The decision that results from this study must adequately address the need of both VAAFM and DEC to provide additional emergency and priority services when required.

***Location*** has been stated as preferably within a 10 mile radius of Montpelier. This appears reasonable considering the large amount of interaction with various State agencies/departments; particularly with respect to interaction with the DEC. However, it does create some potential cost impacts.

Currently, the only required bio-containment safety level (BSL) for lab services is for some areas of Microbiology lab services to be housed in BSL-2 lab spaces. This is not burdensome with respect to cost of construction or operation.

However, when looking towards growth in lab services in the foreseeable future, it is reasonable to assume that a higher level of biocontainment may be required at some point. This would most probably be best described as a BSL-3 lab area.

If the new lab is to be built within a 10 mile radius of Montpelier, this issue means that quite possibly space needs to be allocated for the future installation of a BSL-3 lab area, though not installed at this time.

As an alternative, if the new lab facility was constructed near the new Department of Health (DoH) and University of Vermont (UVM) lab in Colchester, the BSL-3 facilities there could potentially be utilized when BSL-3 containment is needed. However, as an offset to this cost is the potential cost increase associated with site acquisition and construction cost in Colchester, as well as the issue of functional communication with State agencies and departments located in the Montpelier area.

At a minimum, some agreement as to the use of BSL-3 facilities at DoH needs to be discussed. Such an agreement could preclude BSL-3 facilities needing to be included in the design of the new lab.

***Regional Model*** – a consideration for future growth, probably will not weigh heavily in favor of any particular model as regards construction of facilities. Both Options 2 and 3 would be able to benefit from future opportunities for trading of expertise with other regional partners. It would have little if any bearing on Option 1, Outsourcing. Growth allowances that reasonably should be built in to either Option 2 or 3 would accommodate a regional model. Further, regional solutions would not significantly reduce the size of the lab to be constructed due to other factors already mentioned. While negotiations regarding regional solutions need to move forward, the timing of such discussions will of necessity be after the decision needs to be made as to facility budgeting and planning. Any benefits of those discussions will most likely impact the useful life of the facility from a growth of services perspective in future years.

***Governance*** will most likely be the defining factor between a new "Co-located" laboratory (Option 2) and a new "Collaborative" laboratory (Option 3).

A new "Co-located" facility would be relatively easy for VAAFM and DEC to manage once it is occupied. With very few changes, it would be "business as usual" for what they have been doing since the mid-1990's. Minor changes as regards shipping/receiving, sample receiving and glassware cleaning would be needed but those ancillary services would be easily manageable. Co-located office areas, hoteling stations and meeting rooms again pose little in the way of feasibility issues.

However, a new "Collaborative" facility would require significant restructuring of lab governance. Yet at the same time, if the governance can be resolved, it is by far the best solution and presents the greatest opportunities for cost-effectiveness and growth in the future. However, a further concern is that these issues must be addressed prior to making the commitment to build the facility. If there is not the commitment from all parties to work collaboratively in the new facility it will most likely be considered inadequate for operation utilizing the old co-located model for operations.

Some specific governance issues:

1. *Funding* – VAAFM's lab receives a significant amount of its funding from General Funds, Special and Federal Funds; while DEC's lab is funded by a per capita assessment of each division within the department and some General Funds. These differences need to be reconciled in some manner in order to establish a future funding mechanism for a collaborative lab going forward. This issue should be relatively simple to resolve, however. One very effective approach that has been used by other state and municipal jurisdictions would be for it to utilize a "Cost Allocation for Services" model. In point of fact the DEC has developed and used such a model in previous years. Essentially the lab would be operated as a business and a

cost schedule would be developed for all labor hours and standard test procedures. A billable rate would be assigned to all staff categories based on wages, benefits, facility cost, management overhead, materials, etc. If staff time was requested by a client agency this billable rate would be used to provide a bill to that agency or department for the service requested. Similarly, a rate schedule could be developed for all standard tests performed by the lab that would include all costs and overhead associated with performing that test. Thus, each agency or department would be billed appropriately based on their utilization of lab services. At the end of the budget year cycle a reconciliation process could also be implemented that would adjust for overcharges or undercharges to the respective clients based on the actual cost to operate the lab. The actual usage data based on hours and tests would allow a fair and rational distribution of any net or loss. Further, a process could be implemented through the rate schedule to build reserves for future capital expenditures that the lab might need.

2. *Workforce administration* – If a collaborative lab is to function, it really needs to have all employees budgeted in a manner that they can be tasked on the work based on priority of the work and availability of staff, not based on which department an employee works for. Probably this means a model where all employees are seen as being part of one organization and pay group. This could be arranged by having all employees assigned to one or the other agency, or setting up a joint lab management organization with common job descriptions. A joint lab management organization would have to be very lean if it were to prove cost effective as an administrative model. Also it might require additional authority from the Legislature to function as compared to a simple transfer of staff from one agency to the other, and the set-up of a lab administration model within that agency that considers the needs of all client agencies and departments.

3. *Lab Administration* - Lab management, quality assurance and general facility services will need to be organized as one entity. Again, this needs to be worked out in advance. Also it goes hand in hand with the funding model. Some type of organization with a Lab Director who reports to a joint commission composed of client departments from both agencies may well be a workable solution. This can be envisioned as very much akin to standard procedures by many government entities related to vendor management. Essentially the lab is considered to be a separate cost/revenue center that manages the relationship with the clients and the quality of services delivered.

4. *Office of the State Chemist* as opposed to a collaborative lab operated within VAAFM or ANR. Primarily for political reasons it appears that re-structuring all State of Vermont lab services in a new state agency such as an Office of the State Chemist is not feasible at this time, even though it may offer long-term benefit. Such an effort would probably take significant energy away from the workable solution of a collaboration between VAAFM and ANR. In addition, it would most likely not be agreed to in a timely manner by all relevant parties. The DoH will be completing their new lab in Colchester in late 2014. It does not appear that a viable case could be made to DoH, near term, for a new combined governance model under a State Chemist. If it could be made, it most probably cannot be accomplished in a timely manner in order to allow VAAFM and ANR to go forward with funding a new laboratory in early 2014. There are similar issues with the State Forensics Laboratory. Primarily due to their "chain of custody" issues they would not be truly receptive to a new governance model, and again not in a timely manner.

5. *Management of SOPs / Quality Assur*ance - Again, some form of vendor management model may well be a viable solution for this.

6. *Laboratory Information Management System (LIMS)* – VAAFM will need to embrace the use of the LIMS for their information management going forward. DEC has repeatedly made the case of why information consistency is important to them. LIMS as the new interagency standard will have to be addressed. If the decision is made to proceed with the collaborative model, a consultant with expertise in LIMS should be retained to advise on whether to expand or replace the existing LIMS system, and whether to own the system or contract for it as a service.

7. *Interaction with Departments and Agencies* – The current labs, particularly the DEC lab, have a very complex relationship with client departments and outside customers. The VAAFM lab has a very strong regulatory role with industry in the State, as well as significant outside clients. While a number of these "silos" need to be opened up to some extent, ultimately a process must be developed to react to all of these customer demands in a timely and appropriate manner. Prioritization of work must occur in such a manner that it fairly considers the needs of both VAAFM and DEC. Potentially this means establishing a new combined matrix for time to complete tests, based upon test being run, rather than agency or client source. Of course, priority treatment will also need to be defined for special situations (disease outbreaks, etc.) and consistently applied as well.

# 3. Laboratory Business Model

## Summary

The cost model developed below considers three Primary Options (Outsourced, Co-located and Collaborative). Following a detailed analysis of the process, a careful analysis of the costs, liabilities and benefits of Outsourcing is considered first.

Parallel to that, the model develops budget estimates for the existing programs at VAAFM and DEC that consider also the impact of service disruptions as a result of Tropical Storm Irene in 2011. One result of that storm has been that the availability of lab services has been severely stretched due to lack of quality facilities.

Following this parallel process, the opportunities, risks and benefits of the other two primary options (Co-located and Collaborative) are analyzed in detail.

Relevant adjustments for secondary considerations, consideration of future opportunities, and a risk/sensitivity review follow.

The business model concludes with a review of issues related to creation of a governance model for the Collaborative Lab.

In brief, the conclusions are:

- Of the three Primary Options (Outsourced, Co-located and Collaborative) only the latter two appear to meet all of the needs identified by the State of Vermont.
- Specifically, the Outsourced model does not appear to be more cost effective than the other two options, nor does it appropriately address all issues related to quality and response time.
- Further, the Outsourced model does not appear to handle well the need for research and analysis with respect to new services or growth in services. This appears also to be an issue in emergency response when needed.
- The Co-located model (Option 2) does adequately address all of the above issues and would be a responsible solution for the State of Vermont. It would be the easiest to implement of the three options because it would essentially mean "business as usual", in a new facility modeled after the one in Waterbury that was damaged during Tropical Storm Irene and subsequently demolished. However, programmatically it would suffer from the same functional weakness of redundant services between VAAFM and DEC. In addition it would only marginally implement the recommendations of the 2006 study by APHL for improved operations.
- The Collaborative model is the best choice overall for improved functionality, growth, efficient cost of construction, and reduced operational cost. A significant benefit of such a solution is the ability to implement proven production workflow enhancements commonly referred to as "Lean Production Management".

**In conclusion, the Collaborative Lab model (Option 3) is the preferred solution. Its benefits are:**

1. Reduced cost of construction by approximately $1,700,000.
2. Reduced cost of operation, including:
   - Reduced staffing costs by approximately $250,000 per year as compared to Co-located model.
   - Reduced "fee for space" for facility charges by BGS of about $30,000 per year.
3. Best use of space for current needs and future growth.
4. Best operational management of work flow and demand to manage growth and peak/emergency situations.
5. Opportunity to implement "Lean Production Management" techniques.
6. Opportunity to implement all recommendations of the 2006 APHL study.
7. Alignment with strategic initiatives of the State of Vermont for the delivery of services.
8. Enhanced perception of "best use of resources" on the part of VAAFM and DEC from the viewpoint of the citizens of Vermont.
9. No significant increase in operational budgets to VAAFM and DEC as the new facility goes into operation.

## Cost Model for Three Primary Options

As a first step in developing a cost model for VAAFM-DEC lab functions it is necessary to determine what the combined operating costs for laboratory services should be if growth in services had continued along a normal path, and had not been interrupted by Tropical Storm Irene. Comparing this estimate to the actual budgets then allows an estimate to be made of un-met service needs within the State of Vermont as a result of the loss of facilities. Further, this estimate also allows us to project a reasonable path for growth of services in the future.

Parallel to this process is the need to develop an estimate of what these services would reasonably cost if outsourced to commercial laboratories. While the recent studies performed by the State during 2009 did not find a service provider with the full range of capabilities at the ANR DEC Lab, sufficient cost information appears to have been received to make an estimate of what those costs would be if services were available for all tests. Please note also, that risks associated with quality assurance, data management and emergency services would enter into the decision to outsource as well as cost.

Related to both of these steps is consideration of the design and construction costs for a new lab facility. While the cost of acquisition will be important to the State overall, they appear to not be directly relevant to the Cost Model for VAAFM and ANR. This is due to the State's use of a "Fee For Space" (FFS) model for facility cost allocation. This FFS model is essentially a full lease of space to the Agencies by the State's Building & General Services Department. This approach essentially allows the State to depreciate a facility's design and construction cost over a 50 year period, while paying off the bond cost in a 20 year period. The aggregated cost of this approach, as well as facilities maintenance and utilities cost is then converted into a cost/square foot "lease" rate that is then included in agency and departmental budgets. Both VAAFM and ANR have such FFS rates already included in their operating budgets. Thus the decision for a new lab facility is based primarily on program needs and efficiencies, not on the cost of acquisition.

From the results of the two above processes it then becomes possible to develop an initial operational cost model of the three primary options discussed earlier:

- Outsourcing all or most of the laboratory services previously performed by these two laboratories to commercial laboratories.
- Building a new "Co-located" laboratory facility very similar to the previous facility but with shared common services (shipping/receiving, sample receiving, glassware washing, office areas, meeting rooms, etc.)
- Building a new "Collaborative" laboratory facility that incorporates all opportunities for combined services envisioned by the 2006 APHL review as well as additional opportunities (microbiology, improved work flow, standardized equipment leasing, BSL-3 capability, etc.)

With respect to un-met service needs, some clarification is needed. This is an estimate of the difference in services that would reasonably have been provided in the intervening years by the laboratory if Tropical Storm Irene had not occurred. It is not an estimate of the potential growth in services from new or innovative efforts. It is simply an estimate of un-met demand for the types of services provided prior to the storm.

The impact of these un-met service needs is different on each of the three primary options:

- In the Outsourced Model the cost for these needs is included in the total cost estimate, since costs are based on Pre-Irene estimates of the numbers of lab tests.
- In the Co-located Model, the impact of these needs would be in addition to the current actual expense estimates, since additional staff would be required to meet this requirement.
- In the Collaborative Model, the impact of these needs would be absorbed within the greater efficiency of operations due to a lean business process. No, or minimal, additional expense is anticipated. Adequate staff and equipment is already included in the estimate.

*Outsourced Model*

With respect to the DEC Lab, productivity reports were provided for Fiscal Years 2009, 2010, 2011, 2012 and 2013. Data from FY 2010 and 2011 was considered most relevant in considering the "normal path" of budget growth due to increased services. 2009 appears to have been an exceptional year, either due to one or more major studies that were going on in the region at that time, or based on budget reductions in following years. Utilizing the data from 2010-2011, it appeared reasonable to estimate what lab costs were for at least the primary lab testing services that were handled at the Waterbury facility.

Thus, careful consideration was given to the revenue from testing during those two years. Further, utilizing the data from the reports for FY 2011, 2012 and 2013 allowed an approximate model to be developed not only of budgets for the DEC Lab in these years but also for "un-met service needs" during these periods.

As previously mentioned, parallel to this is the process of developing a cost estimate for what these same services would cost if outsourced to a private commercial laboratory. Again, two documents provided allowed for a relatively accurate determination of what the actual costs for tests might be.

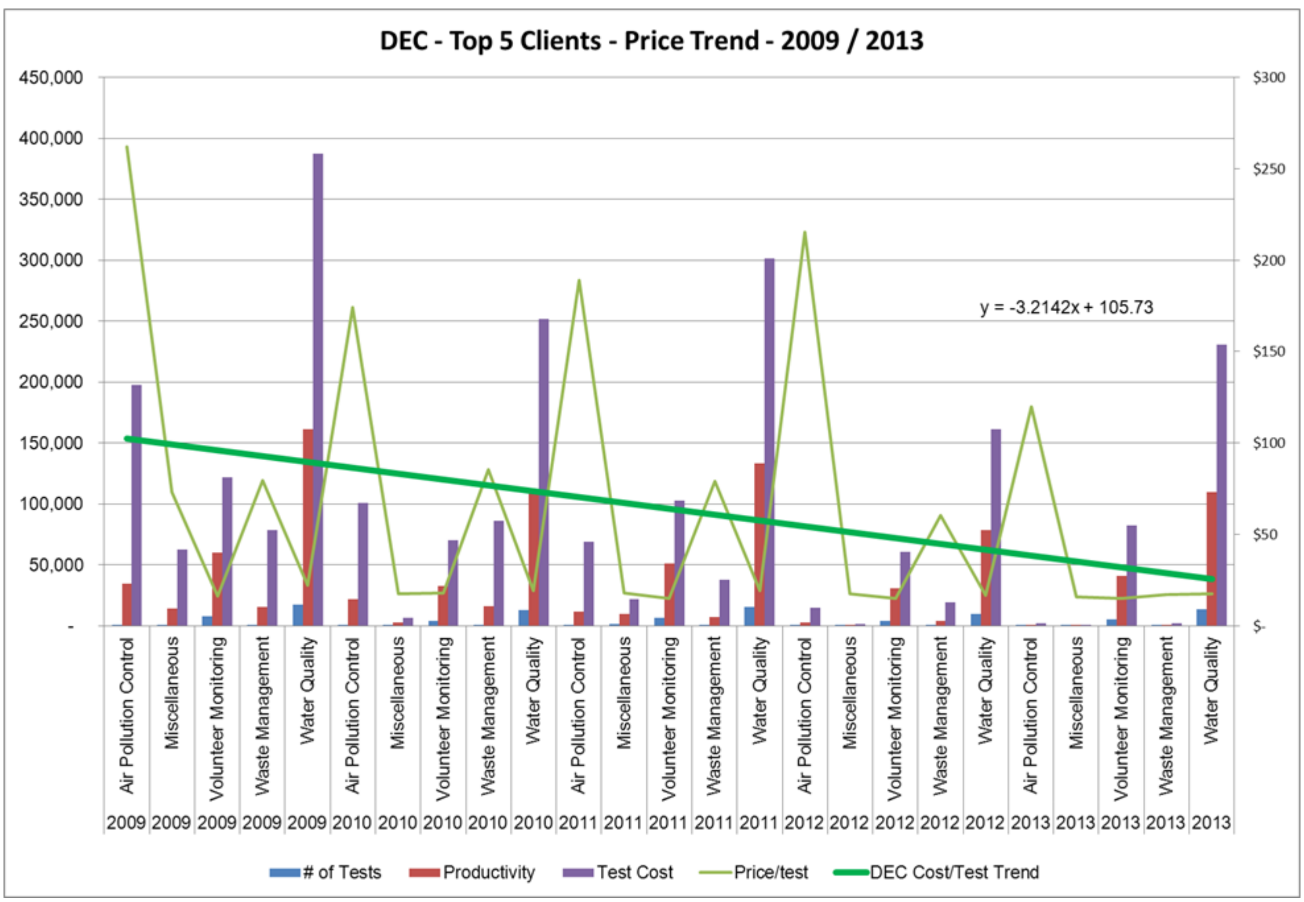
In 2008 and 2009, as a response to the RFP, several firms provided cost information on commercial lab testing. Some firms provided multiple pricing scenarios as well. No firm was apparently able to provide 100% of the testing needs of DEC at that time. In reviewing these results, a careful analysis was performed considering all matching results. Then an average price was determined, as well as a high limit price and a low limit price. For the purpose of this analysis in the operating cost model, the average commercial laboratory price was considered most relevant, instead of the lowest price. This is due to several conditions:

- Over time, unless a client is willing to continuously re-bid contracts and change vendors as required, it is usually not feasible to continuously achieve the lowest price available for any particular service. Hence, when considering cost and price for multi-year periods, average price is a better indicator of achievable results.
- When any service is contracted for, it is always necessary to consider how best to balance the need for cost savings, with quality and time constraints. The State Labs have consistently acknowledged the need for quality as well as timeliness. Thus it is reasonable to assume that some compromise on price for the services will be inevitable.
- In addition, since no one vendor can provide all testing needs, it seems realistic that some testing will have to be sourced at a higher cost than the pricing available through quantity discounts and bulk pricing.

Based on this approach it was found that in 2008, the DEC Lab's pricing model for lab tests was actually 10% lower than the average commercially available price for similar services. In fact, when a comparison was made with the overall budget for that year for the DEC Lab, its total cost for these tests was actually 20% lower than the average commercial price. (In 2008 it appeared that a revision to the pricing model used by DEC could have done a better job of indicating the actual productivity of the lab then it was actually showing. In point of fact this appears to have been adjusted in future years, perhaps even more than was realistic). Two tables on this page and the following page highlight these results.

From the DEC Lab analysis in 2008 and 2009 it can be seen that testing overall at a commercial laboratory would appear to cost more than comparable testing performed by the DEC Laboratory.

However, there are additional costs as well, if an outside lab were to perform all of these tests. In a memo reviewing the RFP responses from the commercial laboratory firms entitled, "Comments on the Proposals submitted to replace VTDEC Laboratory services Water Quality Division perspective - May 28, 2009", a member of DEC's Water-



| Description | 2008 # of Samples | 2008 DEC Price/Test | DEC Price Quote | DEC Price vs Average Vendor Price | Average Vendor Quote | Vendor Price Variance | Average Vendor Price | DEC Price vs Low Vendor Price |
|---|---|---|---|---|---|---|---|---|
| Air Toxics Metals | 100 | $ 176 | $ 17,600 | -22% | $ 21,500 | 21% | $ 215.00 | 3% |
| Alkalinity | 576 | $ 20 | $ 11,520 | 31% | $ 7,920 | 82% | $ 13.75 | 63% |
| Alkalinity - Gran | 164 | $ 32 | $ 5,248 | 38% | $ 3,280 | 0% | $ 20.00 | 38% |
| BOD - Total Uninhibited-5 day | 3 | $ 62 | $ 186 | 63% | $ 70 | 8% | $ 23.25 | 71% |
| Chemical Oxygen Demand | 133 | $ 14 | $ 1,862 | -39% | $ 2,584 | 54% | $ 19.43 | 0% |
| Chloride Colorimetric - Water | 1,543 | $ 10 | $ 15,430 | -3% | $ 15,871 | 46% | $ 10.29 | 25% |
| Chlorophyll-a - Fluorometric | 1,858 | $ 24 | $ 44,592 | -67% | $ 74,320 | 88% | $ 40.00 | 17% |
| Coliform, E. coli, Colilert - MPN | 1,592 | $ 16 | $ 25,472 | -49% | $ 37,867 | 89% | $ 23.79 | 25% |
| Coliform, E. coli, Colilert - Presence/Absence | 3 | $ 16 | $ 48 | -25% | $ 60 | 10% | $ 20.00 | -13% |
| Coliform, Total, Colilert - MPN | 22 | $ 16 | $ 352 | -13% | $ 396 | 0% | $ 18.00 | -13% |
| Coliform, Total, Colilert - presence/absence | 3 | $ 16 | $ 48 | -13% | $ 54 | 0% | $ 18.00 | -13% |
| Color, Diss. - Spect. | 124 | $ 10 | $ 1,240 | 0% | $ 1,240 | 0% | $ 10.00 | 0% |
| Conductivity | 393 | $ 10 | $ 3,930 | 18% | $ 3,218 | 47% | $ 8.19 | 55% |
| Dissolved Oxygen | 509 | $ 12 | $ 6,108 | 2% | $ 5,981 | 28% | $ 11.75 | 17% |
| Gasoline Oxygenates and Aromatics | 48 | $ 50 | $ 2,400 | -50% | $ 3,600 | 0% | $ 75.00 | -50% |
| IC Anions | 449 | $ 28 | $ 12,572 | -7% | $ 13,442 | 80% | $ 29.94 | 63% |
| Ignitability - Flash Point | 8 | $ 34 | $ 272 | -25% | $ 340 | 6% | $ 42.50 | -18% |
| Mercury - Solid | 234 | $ 96 | $ 22,464 | 58% | $ 9,343 | 100% | $ 39.93 | 90% |
| Mercury - Water | 63 | $ 24 | $ 1,512 | -17% | $ 1,768 | 25% | $ 28.06 | 58% |
| Mercury-Dissolved | 7 | $ 24 | $ 168 | -57% | $ 264 | 19% | $ 37.67 | -25% |
| Metals,Target Analyte List | 441 | $ 176 | $ 77,616 | 3% | $ 75,323 | 84% | $ 170.80 | 77% |
| Metals,Target Analyte List-Dissolved | 166 | $ 176 | $ 29,216 | 2% | $ 28,685 | 82% | $ 172.80 | 77% |
| Method 8015 - Solid | 3 | $ 110 | $ 330 | 32% | $ 225 | 0% | $ 75.00 | 32% |
| Method 8015 - Water | 16 | $ 65 | $ 1,040 | -15% | $ 1,200 | 0% | $ 75.00 | -15% |
| Method 8015-Gasoline Range Organics | 10 | $ 80 | $ 800 | 21% | $ 633 | 18% | $ 63.33 | 44% |
| Method 8021 - Water | 406 | $ 80 | $ 32,480 | 11% | $ 28,826 | 13% | $ 71.00 | 19% |
| Method 8082 - Water | 1 | $ 300 | $ 300 | 49% | $ 153 | 37% | $ 153.33 | 58% |
| Method 8260 - Solid | 1 | $ 200 | $ 200 | 41% | $ 119 | 55% | $ 119.00 | 65% |
| Method 8260 - Water | 103 | $ 140 | $ 14,420 | 2% | $ 14,163 | 35% | $ 137.50 | 14% |
| Nitrate + Nitrite - Water | 1,021 | $ 20 | $ 20,420 | -10% | $ 22,462 | 36% | $ 22.00 | 25% |
| Nitrogen, Ammonia | 81 | $ 20 | $ 1,620 | 8% | $ 1,485 | 36% | $ 18.33 | 25% |
| Nitrogen, Filtered - Persulfate | 6 | $ 20 | $ 120 | -10% | $ 132 | 0% | $ 22.00 | -10% |
| Nitrogen, Total - Persulfate | 3,665 | $ 20 | $ 73,300 | -42% | $ 104,086 | 76% | $ 28.40 | 13% |
| Nitrogen, Total Kjeldahl | 78 | $ 32 | $ 2,496 | 14% | $ 2,145 | 27% | $ 27.50 | 30% |
| pH | 218 | $ 6 | $ 1,308 | -22% | $ 1,594 | 37% | $ 7.31 | 25% |
| Phosphorus - Digested | 5,636 | $ 16 | $ 90,176 | -4% | $ 94,202 | 50% | $ 16.71 | 38% |
| Phosphorus - Filtered/Digested | 1,394 | $ 16 | $ 22,304 | -28% | $ 28,477 | 96% | $ 20.43 | 38% |
| Silica (SiO2) - Filtered | 264 | $ 10 | $ 2,640 | -30% | $ 3,432 | 54% | $ 13.00 | 0% |
| Solids, Percent | 420 | $ 10 | $ 4,200 | -39% | $ 5,850 | 79% | $ 13.93 | 0% |
| Solids, Total Suspended | 1,092 | $ 20 | $ 21,840 | 29% | $ 15,470 | 76% | $ 14.17 | 50% |
| Solids, Total Volatile | 324 | $ 20 | $ 6,480 | -1% | $ 6,565 | 38% | $ 20.26 | 25% |
| Strontium - Water | 31 | $ 16 | $ 496 | -25% | $ 620 | 50% | $ 20.00 | 38% |
| Target Analyte List Metals | 11 | $ 176 | $ 1,936 | -6% | $ 2,057 | 2% | $ 187.00 | -5% |
| TO11 - Aldehydes in Air | 352 | $ 100 | $ 35,200 | -40% | $ 49,280 | 0% | $ 140.00 | -40% |
| TO15-SIM | 967 | $ 400 | $ 386,800 | 0% | $ 386,800 | 0% | $ 400.00 | 0% |
| Turbidity | 2,186 | $ 10 | $ 21,860 | -16% | $ 25,295 | 73% | $ 11.57 | 20% |
| Uranium in Water | 31 | $ 16 | $ 496 | -213% | $ 1,550 | 0% | $ 50.00 | -213% |
| **Grand Total** | **26,756** | **$ 62.66** | **$ 1,023,118** | **-10%** | **$ 1,103,946** | **37%** | **$ 59.04** | **17.47%** |
| **Comparison to 2008 DEC Budget** | | | **$920,970** | **-20%** | | | | **-2.40%** |

**Table of DEC Vendor Prices 2008 - 2009**

# Laboratory Business Model

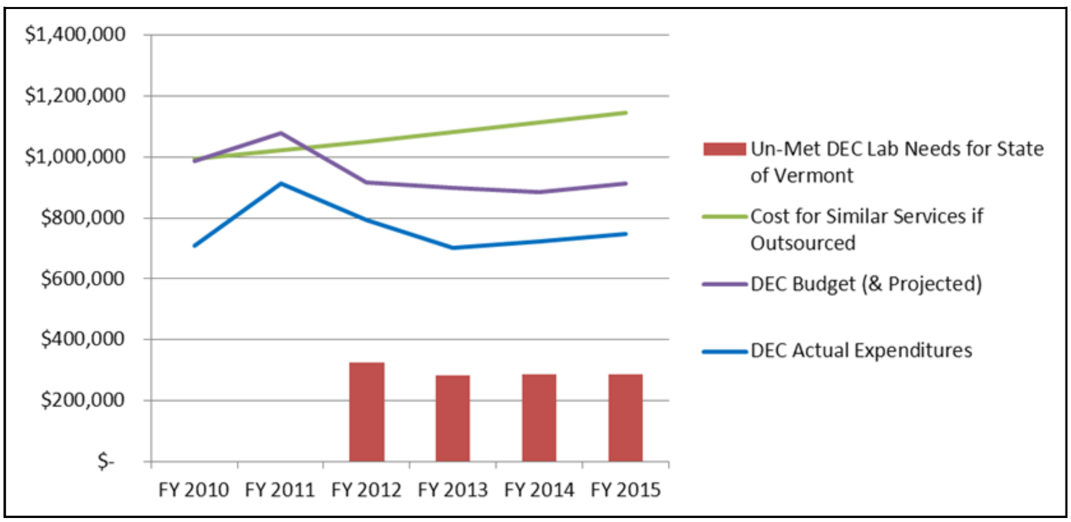
## Cost Model for Three Primary Options

shed Management Division details some of the additional costs. A table from that document is included below:

| | Cost |
|---|---:|
| Sample handling | $6,400 |
| Shipping costs | $9,600 |
| Increased oversight/Data review | $6,400 |
| Data upload | $3,200 |
| Contract management | $9600 |
| Split samples analysis | $36,000 |
| Proficiency samples | $3,600 |
| Total Additional costs | $74,800 |

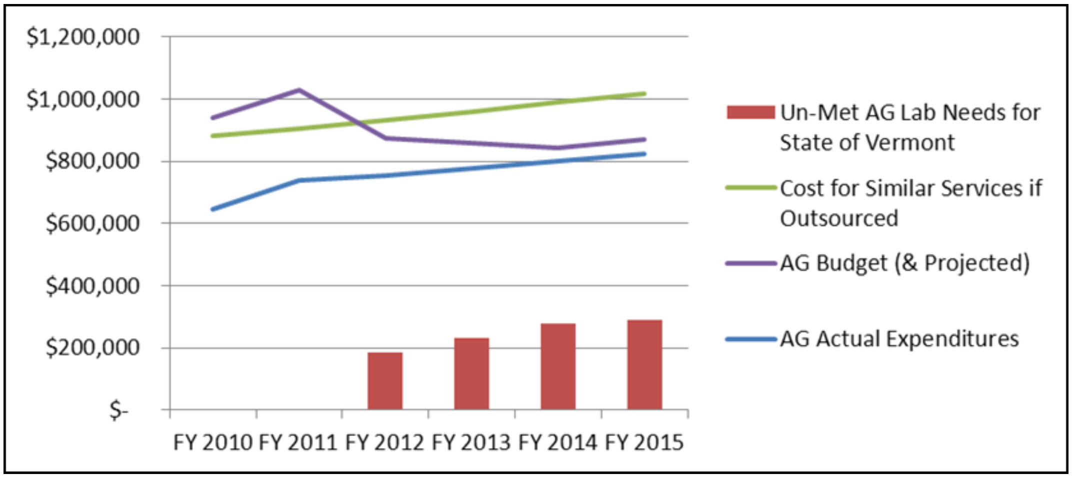
Further, additional costs would need to be reasonably included as well:

1. Lab Services Management/QA/Analysis (3 FTEs) – The need for management of lab services will not entirely go away if lab testing is outsourced. In addition, quality assurance will become even more critical than it is currently. Also, analysis of lab results will still be needed at a local level even if testing is outsourced. In addition, overall management of the services, fulfillment, test scheduling for quick turn-around and any number of other items will still need to be managed. It is estimated this will take approximately 3 FTEs to accomplish.
2. LIMS management and IT support will probably still require 0.5 FTE in an outsourced environment.
3. Benefits, taxes and overhead for these employees and services must be considered as well.
4. Facility Space for this business unit will require approximately 1200 SF, along with utilities and other services
5. General Furniture, Fixtures and Equipment (FF&E) to include workstations and general IT support will be required as well.




| DEC Lab | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 |
|---|---:|---:|---:|---:|---:|---:|
| Budget Estimate (No Storm Irene) | $986,744 | $1,078,385 | $1,241,041 | $1,184,416 | $1,170,213 | $1,197,171 |
| Lab Test Estimate (No Storm Irene) | $ 577,480 | $ 593,984 | $ 610,960 | $ 628,421 | $ 646,380 | $ 664,853 |
| Lab Test Actuals | $ 577,480 | $ 593,984 | $ 284,664 | $ 344,270 | $ 361,484 | $ 379,558 |
| Un-Met DEC Lab Needs for State of Vermont | $ - | $ - | $ 326,296 | $ 284,151 | $ 284,897 | $ 285,296 |
| DEC Budget (& Projected) | $986,744 | $1,078,385 | $914,745 | $900,265 | $885,316 | $911,875 |
| DEC Actual Expenditures | $708,114 | $911,826 | $794,416 | $702,994 | $724,084 | $745,806 |
| | | | | | | |
| Lab Tests Only | $ 623,102 | $ 640,910 | $ 659,226 | $ 678,067 | $ 697,445 | $ 717,378 |
| Additional Field Handling/Mailing Etc. | $ 74,800 | $ 77,044 | $ 79,355 | $ 81,736 | $ 84,188 | $ 86,714 |
| Lab Services Management/QA/Analysis (3 FTEs) | $ 156,000 | $ 160,680 | $ 165,500 | $ 170,465 | $ 175,579 | $ 180,847 |
| LIMS Mgmt & IT Support (.5 FTE) | $ 26,000 | $ 26,780 | $ 27,583 | $ 28,411 | $ 29,263 | $ 30,141 |
| Benefits, Taxes, Overhead, etc (40%) | $ 72,800 | $ 74,984 | $ 77,234 | $ 79,551 | $ 81,937 | $ 84,395 |
| Facility Services (1200 SF) | $ 24,000 | $ 24,720 | $ 25,462 | $ 26,225 | $ 27,012 | $ 27,823 |
| FFE /Year including general IT | $ 16,000 | $ 16,480 | $ 16,974 | $ 17,484 | $ 18,008 | $ 18,548 |
| Cost for Similar Services if Outsourced | $ 992,702 | $ 1,021,598 | $ 1,051,335 | $ 1,081,939 | $ 1,113,433 | $ 1,145,846 |

**DEC Lab Budget, Expenditures, Projection**




| VAAFM Lab | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 |
|---|---|---|---|---|---|---|
| Budget Estimate (No Storm Irene) | $ 940,882 | $ 1,028,263 | $ 1,059,111 | $ 1,090,885 | $ 1,123,611 | $ 1,157,319 |
| Budget Actuals | $ 645,540 | $ 736,724 | $ 754,276 | $ 777,447 | $ 800,770 | $ 824,793 |
| Un-Met AG Lab Needs for State of Vermont | $ - | $ - | $ 186,882 | $ 232,462 | $ 279,443 | $ 287,827 |
| AG Budget (& Projected) | $ 940,882 | $ 1,028,263 | $ 872,229 | $ 858,422 | $ 844,168 | $ 869,493 |
| AG Actual Expenditures | $ 645,540 | $ 736,724 | $ 754,276 | $ 777,447 | $ 800,770 | $ 824,793 |
| | | | | | | |
| Lab Tests Only | $ 594,141 | $ 611,121 | $ 628,587 | $ 646,551 | $ 665,029 | $ 684,035 |
| Additional Field Handling/Mailing Etc. | $ 74,800 | $ 77,044 | $ 79,355 | $ 81,736 | $ 84,188 | $ 86,714 |
| Lab Services Management/QA/Analysis (2 FTEs) | $ 104,000 | $ 107,120 | $ 110,334 | $ 113,644 | $ 117,053 | $ 120,565 |
| LIMS Mgmt & IT Support (.5 FTE) | $ 26,000 | $ 26,780 | $ 27,583 | $ 28,411 | $ 29,263 | $ 30,141 |
| Benefits, Taxes, Overhead, etc (40%) | $ 52,000 | $ 53,560 | $ 55,167 | $ 56,822 | $ 58,526 | $ 60,282 |
| Facility Services (900 SF) | $ 18,000 | $ 18,540 | $ 19,096 | $ 19,669 | $ 20,259 | $ 20,867 |
| FFE /Year including general IT | $ 12,000 | $ 12,360 | $ 12,731 | $ 13,113 | $ 13,506 | $ 13,911 |
| Cost for Similar Services if Outsourced | $ 880,941 | $ 906,525 | $ 932,853 | $ 959,945 | $ 987,825 | $ 1,016,515 |

**VAAFM Lab Budget, Expenditures, Projection**

When all of these items are considered, a more complete comprehension of the total cost of outsourcing lab tests emerges. The table on the previous page summarizes these costs and compares them to what services would be for similar periods if performed by the DEC Lab. FY 2010 through 2015 are shown based on a combination of actual data and estimates.

Utilizing a similar process, and the comparison between the VAAFM Lab budget and the DEC Lab budget to estimate data for escalation, a comparable table and chart can be produced for the VAAFM Lab. Table and chart are above.

As previously mentioned, the "un-met lab needs" in this series of tables and charts vary in their impact on each one of the three primary options. (They are included in the Outsourced Model and for a Collaborative Model, but would be additive to the costs shown for the Co-located Model).

As a third step, the budgets for these two labs can now be combined to produce an estimate of what the overall budget would look like for a new Co-located lab (Option 2). While this budget is at this point only a very rough order of magnitude, it does provide a starting point for developing an operating cost model of what the costs and benefits would be of a new laboratory facility to replace the one lost at Waterbury. In addition, as discussed elsewhere, the potential for a "Collaborative Lab" (Option 3) could easily reduce these operating costs for the same level of services by another 10% or more.

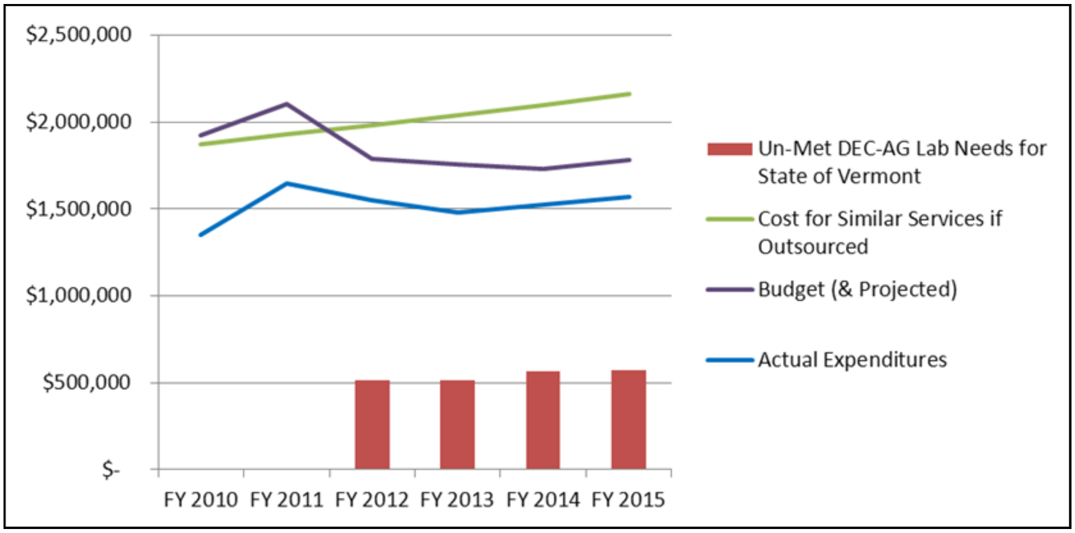
Further, the significant cost difference between the performance of these services in house by VAAFM and DEC versus the outsourced model provides an excellent opportunity to fund such a laboratory and pay for it out of the operational savings so generated. The combined budget model for a Co-located facility is located on the next page.

In conclusion, an Outsourced laboratory service model is not cost-effective for laboratory services even when considering the cost of construction of a new laboratory facility. In addition, there are significant risk and quality assurance issues that would seem detrimental to the mission and goals of the State of Vermont.

# Laboratory Business Model

## Cost Model for Three Primary Options






| DEC - VAAFM Lab | FY 2010 | FY 2011 | FY 2012 | FY 2013 | FY 2014 | FY 2015 |
|---|---|---|---|---|---|---|
| Budget Estimate (No Storm Irene) | $1,927,626 | $2,106,648 | $2,300,152 | $2,275,300 | $2,293,824 | $2,354,491 |
| Budget (& Projected) | $ 1,927,626 | $ 2,106,648 | $ 1,786,974 | $ 1,758,687 | $ 1,729,484 | $ 1,781,368 |
| Actual Expenditures | $ 1,353,655 | $ 1,648,550 | $ 1,548,692 | $ 1,480,441 | $ 1,524,854 | $ 1,570,600 |
| Un-Met DEC-VAAFM Lab Needs for State of Vermont | $ - | $ - | $ 513,178 | $ 516,613 | $ 564,340 | $ 573,122 |
| | | | | | | |
| | | | | | | |
| Lab Tests Only | $ 1,217,243 | $ 1,252,031 | $ 1,287,813 | $ 1,324,618 | $ 1,362,475 | $ 1,401,413 |
| Additional Field Handling/Mailing Etc. | $ 149,600 | $ 154,088 | $ 158,711 | $ 163,472 | $ 168,376 | $ 173,427 |
| Lab Services Management/QA/Analysis (5 FTEs) | $ 260,000 | $ 267,800 | $ 275,834 | $ 284,109 | $ 292,632 | $ 301,411 |
| LIMS Mgmt & IT Support (1 FTE) | $ 52,000 | $ 53,560 | $ 55,167 | $ 56,822 | $ 58,526 | $ 60,282 |
| Benefits, Taxes, Overhead, etc (40%) | $ 124,800 | $ 128,544 | $ 132,400 | $ 136,372 | $ 140,463 | $ 144,677 |
| Facility Services (2100 SF) | $ 42,000 | $ 43,260 | $ 44,558 | $ 45,895 | $ 47,271 | $ 48,690 |
| FFE /Year including general IT | $ 28,000 | $ 28,840 | $ 29,705 | $ 30,596 | $ 31,514 | $ 32,460 |
| Cost for Similar Services if Outsourced | $ 1,873,643 | $ 1,928,123 | $ 1,984,188 | $ 2,041,884 | $ 2,101,259 | $ 2,162,361 |

**DEC - VAAFM Lab Budget, Expenditures, Projection**

Further, it does not appear to provide the robustness required for emergency service issues that often develop rapidly and require innovative and strategic efforts in order to meet the needs of the State. (see ***Appendix A*** for numerous examples).

*Co-Located Model*

As mentioned above, a Co-located model would be a cost-effective solution long term for the State of Vermont as compared to an Outsourced model. It would also significantly mitigate risk related to quality and timeliness with respect to laboratory testing.

Initial planning for such a facility envisions space utilization as being very similar to that at the old laboratory facility at Waterbury. VAAFM would have its own lab spaces and DEC would have theirs. Both would share common services (shipping/receiving, sample receiving, glassware washing, office areas, meeting rooms, etc.) as much as feasible. Staffing would also be similar to that at Waterbury.

Initial estimates of Net Assignable Square Footage (NASF) are 23,450 square feet. NASF is the measure that Buildings & General Services (BGS) uses in the determination of Fee For Space (FFS) for facility charges to department budgets. For 2014, the FFS rate is $13.46 per square foot.

Gross Square Footage (GSF) is estimated at 39,083 square feet. GSF is used to estimate cost of construction. Current rough estimates of construction cost are based on a laboratory construction cost of $450/square foot.

Thus, the annual cost for space (FFS) and the construction cost for a new Co-Located Laboratory Facility are estimated at:

| Co-Located Model | $Ft^2$ | $\$/Ft^2$ | Total Cost |
|---|---|---|---|
| FFS (NASF) - Annual | 23,450 | $ 13.46 | $ 315,637 |
| Construction Cost (GSF) | 39,083 | $ 450 | $ 17,587,350 |

The largest single item in the annual operating budget for such a facility would be Personal Services, the cost for the

| STAFF (FTEs) INCLUDED IN LABORATORY BUDGET | Before Tropical Storm Irene | | | F. Y. 2013 | | | Co-located Model | | |
|---|---|---|---|---|---|---|---|---|---|
| | LS/LM | Admin | Temp | LS/LM | Admin | Temp | LS/LM | Admin | Temp |
| | | | | | | | | | |
| **STAFF INCLUDED IN LABORATORY BUDGET** | | | | | | | | | |
| | | | | | | | | | |
| **VAAFM LAB** | | | | | | | | | |
| Lab Supervision | 1.0 | | | 1.0 | | | 1.0 | | |
| QA/QC, Safety, Waste Mgt. | | | | | | | 1.0 | | |
| Chemists | 3.0 | | | 3.0 | | | 3.0 | 0.5 | |
| Microbiologists | 3.0 | | | 3.0 | | | 3.0 | 0.5 | |
| **AAFM LAB STAFF SUBTOTAL** | **7.0** | **0.0** | **0.0** | **7.0** | **0.0** | **0.0** | **8.0** | **1.0** | **0.0** |
| **DEC LAB** | | | | | | | | | |
| Lab Supervision | 1.0 | 1.0 | | 0.5 | 1.0 | | 1.0 | 1.0 | |
| QA/QC, Safety, Waste Mgt. | 1.0 | | | 0.5 | | | 1.0 | | |
| Metals Analysis | 1.0 | | | 0.5 | | | 1.0 | | |
| Inorganic Chemistry and Microbiology | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 |
| Organic Chemistry | 1.0 | | | 1.5 | | | 1.5 | | |
| **DEC LAB STAFF SUBTOTAL** | **6.0** | **1.0** | **2.0** | **5.0** | **1.0** | **2.0** | **6.5** | **1.0** | **2.0** |
| **COMBINED LABORATORY BUDGET STAFF SUBTOTAL** | **13.0** | **1.0** | **2.0** | **12.0** | **1.0** | **2.0** | **14.5** | **2.0** | **2.0** |
| Permanent | **14.0** | | | **13.0** | | | **16.5** | | |
| Permanent + Temporary | **16.0** | | | **15.0** | | | **18.5** | | |

| STAFFING COST | FY2011 | FY2012 | FY2014 |
|---|---|---|---|
| VAAFM LAB | $ 605,409 | $ 609,126 | $ 806,657 |
| DEC LAB | $ 532,132 | $ 399,963 | $ 489,204 |
| **TOTAL LAB STAFF COST** | $ 1,137,541 | $ 1,009,089 | $ 1,295,861 |

**Staffing Cost - Co-located Model**

staff. Currently DEC spends 63% of its average expenses on Personal Services, and VAAFM spends 76%.

Staffing at the Waterbury facility, current staffing (in temporary quarters), in a new co-located model, and the estimated associated costs are outlined in the table at the top of this page.

Thus, it is estimated that Personal Services cost for a new Co-located Laboratory would be approximately $158,000 higher than the staffing cost for the Waterbury facility. Part of this cost is the impact of un-met needs previously discussed as well as inflation.

It should also be noted that combined Personal Services actual cost for VAAFM and DEC Labs in 2013 was $1,009,089. The current estimate for a Co-located Laboratory would therefore require an increase above current budget levels for Personal Services of approximately 28%. This includes a cost of living increase of 3%.

*Collaborative Model*

As mentioned above, a Collaborative model would be an even more cost-effective solution long term for the State of Vermont as compared to an Outsourced model. It would also significantly mitigate risk related to quality and timeliness with respect to laboratory testing.

Another significant benefit of such a solution is the ability to implement proven production workflow enhancements commonly referred to as "Lean Production Management".

These techniques have been successfully implemented in many industry sectors from healthcare service delivery to automobile manufacturing. Today, most major pharmaceutical laboratories and many commercial test laboratories routinely use these techniques to reduce cost of operations as well as to significantly improve quality. Further these techniques dramatically reduce production errors and improve safety. One well known source that discusses the foundations for this approach is "The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer", by Jeffrey Liker.

Initial planning for such a facility envisions space utilization as being significantly improved as compared to that at the old laboratory facility at Waterbury. VAAFM and DEC would combine all similar lab operations based on type of lab tests instead of based on departmental or agency function. Both would share common services (shipping/receiving, sample receiving, glassware washing, office areas, meeting rooms, etc.) as much as feasible. Staffing would be greatly reduced in this model and would be similar to the changes made by necessity during the critical period after Tropical Storm Irene.

Initial estimates of Net Assignable Square Footage (NASF) are 21,225 square feet. NASF is the measure that Buildings & General Services (BGS) uses in the determination of Fee For Space (FFS) for facility charges to department budgets. For 2014, the FFS rate is $13.46 per square foot.

# Laboratory Business Model

## Relevant Adjustments for Secondary Options



Gross Square Footage (GSF) is estimated at 35,375 square feet. GSF is used to estimate cost of construction. Current rough estimates of construction cost are based on a laboratory construction cost of $450/square foot.

Thus, the annual cost for space (FFS) and the construction cost for a new Collaborative Laboratory Facility are estimated at:

| Collaborative Model | $Ft^2$ | $/$Ft^2$ | Total Cost |
|---|---|---|---|
| FFS (NASF) - Annual | 21,225 | $ 13.46 | $ 285,689 |
| Construction Cost (GSF) | 35,375 | $ 450 | $ 15,918,750 |

The largest single item in the annual operating budget for such a facility would be Personal Services, the cost for the staff.

The Personal Services costs associated with a new Collaborative Lab (shown below) compare favorably with the current estimated labor cost for VAAFM and DEC Lab functions, and also when compared to the similar cost for a Co-located Lab facility. The current estimate for a Collaborative Laboratory would require an increase above current budget levels for Personal Services of only the cost of living which is estimated at 3%. They would also be 25% less than the Co-located Lab model.

This estimate includes adequate staff to meet the un-met service needs previously discussed as well.

Thus, a Collaborative Lab facility would create savings per year compared to a Co-located Lab facility of about $250,000 in Personal Services cost and about $30,000 in FFS Facility charges from BGS. There would be additional savings due to increased efficiencies due to lean processes which should create total savings close to the dollar value of the "un-met service needs" estimate. It would also be almost $1.7 million less expensive to build.

Another way of stating this is that the Collaborative model can restore services to the pre-Irene levels, address management deficiencies and even accommodate some growth without adding to current staffing levels. To do the same with the Co-located model requires adding several positions to the current staff and probably equipment as well.

### ***Relevant Adjustments for Secondary Considerations***

Over each of these three primary options there are layered another set of secondary considerations:

***Should some services not be included in the new facility for cost effectiveness?*** Since wet lab space is more expensive than dry lab space, does it make more sense to utilize another location for those services so as to optimize the potential for growth of wet lab facilities in the future?

Once a "footprint" is established for a new lab facility, it will probably not be cost effective to add additional space to the building, short of a major addition. In light of this, it makes sense to plan adequate space into the facility for future growth of services. Such future growth space quite often gets value engineered out of projects, due to the significant cost and marginal use during the first 5-10 years of a building's life.

| STAFF (FTEs) INCLUDED IN LABORATORY BUDGET | Collaborative Lab | | |
|---|---|---|---|
| | LS/LM | Admin | Temp |
| **COLLABORATIVE LAB** | | | |
| Lab Leadership incl. QA/QC, Safety, LIMS | 2.0 | 1.0 | - |
| Inorganics and Nutrients Lab | 1.0 | - | 1.0 |
| Metals Lab | 1.0 | - | - |
| Nonautomated Analysis and Nutrients Lab | 1.0 | - | 1.0 |
| Organics Lab | 4.0 | - | - |
| Microbiology Lab | 2.0 | - | - |
| Molecular Biology Lab | 1.0 | - | - |
| Animal Pathology Lab | - | - | - |
| **COMBINED LABORATORY BUDGET STAFF SUBTOTAL** | **12.0** | **1.0** | **2.0** |
| Permanent | **13.0** | - | - |
| Permanent + Temporary | **15.0** | - | - |

| STAFFING COST | FY2014 |
|---|---|
| COLLABORATIVE LAB | $ 1,039,362 |
| **TOTAL LAB STAFF COST** | $ **1,039,362** |
| **ANNUAL STAFF COST SAVINGS - COLLABORATIVE LAB** | $ **256,500** |
| Annual % Change from Current Budgets (includes 3% escalation) | 3% |
| Annual % Savings versus Co-Located Lab | -25% |

**Staffing Cost - Collaborative Model**

A specific opportunity exists in the new lab models for future growth by building in "Flexible Space" at this time that can cost-effectively be upgraded at a later date. The Space Program in ***Section 4*** segregates lab space into Tier 1, which is critical to the functionality of the lab, and Tiers 2 and 3, which are less critical. Including the Tier 2 and Tier 3 functions in the facility, while designing their space to be upgradeable to accommodate future growth of Tier 1 functions is a cost effective way to both:

- currently house the Tier 2 / Tier 3 functions in the new facility, avoiding the need to house them elsewhere, and
- provide space for future Tier 1 growth if needed

The opportunity to house Tier 2 and Tier 3 Lab facilities within this new lab facility provides a unique opportunity to plan for growth, while still making good economic use of all space during the early years at the new facility. If growth necessitates the use of this space for Tier 1 lab functions in the future, these Tier 2 / 3 functions can be most cost effectively relocated to a different site at that time. In the interim, the opportunity for excellent collaboration between Tier 1 staff and Tier 2 / 3 staff will further increase the efficiency and productivity benefits to the citizens of Vermont.

In this scenario, the "Flexible Space" utilized by the less intensive Tier 2 and Tier 3 labs would be designed in such a way that it can be economically upgraded to more intensive Tier 1 space in the future. This would probably take the form of providing for later installation of additional HVAC, fume hoods, power, lab gasses, etc. but not actually installing those systems initially in those areas.

This strategy would be especially beneficial with respect to the Collaborative Lab model. It would of course provide additional space for future growth. However, such utilization of upgradeable space by Tier 2 and Tier 3 labs would also act as a safety net for the Tier 1 space if governance issues are not fully resolved and the new lab is not as collaborative as envisioned, during actual operation.

***How would location impact usability of the facility and cost of construction?*** (i.e. if facility is built within a 10 mile radius of Montpelier, would that mean that BSL-3 capability will need to be planned for now or in the future, as compared to a decision to build in Colchester? How will the location near Montpelier positively impact coordination with State departments?)

Current thinking by the project study team is that BSL-3 capability is not needed for current functions. Most probably this applies for the foreseeable future as well. Thus it does not appear cost-effective to build in upgrade capacity for BSL-3 into the space plan for this facility. From a practical point of view then, this means that BSL-3 space, if needed, will have to be found at the new UVM and DoH Lab in Colchester.

There are three logical scenarios for the location of the lab:

- Locate within a 10 mile radius of Montpelier
- Locate adjacent to the new DoH Lab in Colchester
- Locate on or near the University of Vermont or the Vermont Technical College campus.

Each of these choices has pros and cons. Locating near Montpelier would have the benefit of improving communication between all Departments utilizing the lab services, thus reducing "windshield time". It would also be more centrally located for Departments providing services throughout the State.

However, a Montpelier location would not be conducive to the future possibility of sharing lab resources with DoH or other State lab facilities. Such an opportunity would have significant benefits to efficiency and productivity. In addition, it is foreseeable that the area around the DoH Lab in Colchester and the UVM research facility could well develop into a "technology park" type of environment within 5-10 years. That could provide significant opportunity for the growth of lab space (or the lease of lab space) in the future.

A location near the DoH Lab in Colchester would best optimize the potential benefits and minimize the risks mentioned above. In addition, a location near the DoH Lab and the UVM research facility could provide an opportunity to utilize existing BSL-3 biocontainment facilities if needed in the future.

Locating near a University campus would have similar pros and cons to the above discussion. The two likely candidate areas would be Burlington (near or on the UVM campus) or Vermont Technical College. The UVM Burlington campus would have very similar benefits to the Colchester site. Vermont Technical College has two campuses; one in Williston and one in Randolph. Williston is not feasible due to lack of available land. Randolph would appear to offer few benefits as a site location. It has been considered previously by VAAFM as part of a combined teaching/regulatory model but VTC has not been approached regarding the concept. If VTC were to create a 2 year lab tech program, for example, the lab could serve both purposes. However neither of the VTC sites would appear to be close enough to the DoH Lab to encourage the growth in shared resources between the labs in the future. In addition, the location would be less likely to see the type of "technology park" growth that may well occur around the UVM campus in Burlington or in Colchester.

One other point regarding locating actually on either university's campus is that siting and expansion would have to be carefully orchestrated with their campus master plan. This could well mean location and growth opportunities would not be ideal either now or and the future.

The potential future needs should be carefully weighed when considering site options. While a location near the Colchester site of the DoH Lab may not be ideal as regards interaction with other departments and field personnel, it may be the lowest risk option for growth in services looking to the next 5 to 20 years. In addition it may well provide the best opportunity for collaboration with other State lab services.

***What is the impact of growth of services over the foreseeable future to the cost of operation of each primary option?***

With respect to the Outsourcing model, growth in services would almost be immaterial. Staffing changes would be minimal as quantity of samples increased. Thus, for established processes, simple growth in quantity would not present an issue. The addition of new services could be problematic however. Investigation and research needed to develop new services or resolve new needs would not be readily achievable in an outsourced model. Such activities would necessitate analysis and consultation services which might no longer exist within the State's diminished internal resources. This could be a significant risk.

With respect to the Co-located and the Collaborative Options, growth in services could be handled more robustly. Both of these options will make use of some outsourcing of lab tests on a continuing basis; so all of the capacity growth needs would be equally well handled by each of these options. In addition, however, each of these options has the potential for growth of internal capacity as well. Further both would have the potential for developing new tests and SOPs for internal trials based on new research and analysis. Both of these options would significantly reduce the risk from needing to develop new analyses and techniques as compared to the Outsourced model.

In addition, the Collaborative Option would probably offer a slightly better path for growth of services than the Co-located Option simply because of its better alignment around scientific discipline and equipment. Also, its greater capability through Lean processes to handle "un-met service needs" should translate into a better ability to handle future growth. Further the growth potential of underutilized space (Tier 2/3 space discussed above) probably would make it more flexible structurally to the development of growth based new techniques.

## ***Consideration for Future Opportunities***

Future opportunities do exist for new services. The impact on facility design and capacity is discussed above. What has not been discussed is the impact such opportunities might have for the State of Vermont, it citizens and industries.

While this report cannot predict with confidence the economic value of such future opportunities, nevertheless, it can confirm that they do exist and should be planned for. Such opportunities and challenges for the State's citizens and industries will have a significant impact on the growth and development of Vermont, as compared to other states within the region.

A functional and credible lab facility and program that supports the environmental quality and agricultural health of Vermont's industries is vital to the State's continued success. To maximize the potential for such future opportunities the State needs to be able to effectively partner with industry and citizens for the common good. That mission and goal would be significantly challenged utilizing an outsourced model for lab services that significantly limited research and analysis around new needs, developing agricultural needs, and growing environmental awareness and concerns.

Related to the above, growth in market share and product types for the dairy, meat and other agricultural industries within Vermont is likely to occur. Such growth would necessitate an increase of testing at the Lab as well as new types or applications of testing. The ability to adapt to these changes is critical to the future of the citizens of the State.

In addition, opportunities may well exist for additional "fee for service" opportunities in partnership with existing local industries and partnerships as well as new client relationships. While these future opportunities cannot be easily characterized at present, it is reasonable to assume that they exist and should be planned for.

Another area of future opportunities has to do with the development of regional partnerships with other states and municipalities. Developing relationships between VAAFM and DEC with other states offer the high probability in the future of the exchange of services on a regional basis. Current examples of this are the efforts in air quality at DEC and in maple sugar hydrometers at VAAFM. Both of these efforts recognize specialized capabilities that have been developed by the state labs that are recognized as "Best in class" by other regional partners. This of course is a two way street. Due to Vermont's position and expertise it now has the opportunity to partner with other states to leverage their special expertise as well. This is a direct benefit to Vermont and also promotes growth of agricultural industries and the well-being of its citizens. Again, both the Co-Located and the Collaborative models would support this approach. The Outsourced model would not, or only very marginally.

Some specific opportunities that are being discussed and considered by VAAFM and DEC are:

***Agriculture***

1. Food Safety- water analysis, crop monitoring, facility monitoring: This program could serve a wide variety of clients including crop producers, raw agricultural commodity producers, certified organic crop and food producers, food web distributors, and processors. This is a timely consideration given impending federal food safety rules. This type of service could differentiate Vermont products in the marketplace and serve as a source of income supporting laboratory functions.

2. Soils analysis – becoming the state resource for all required nutrient management plans (NMP) soils analysis: Vermont's Accepted Agricultural Practices, the medium farm permit program, the large farm permit program and the golf course permit program all currently require, or soon will require, soils analysis. This is a possible opportunity to investigate as a fee based program. The concept of a regulatory agency serving in this function should be researched.

3. Organic certification- soils and crop monitoring: Beyond the food safety concept, there is a need on the part of certified organic growers and certification entities to have a program to monitor organic operations for compliance with approved materials criteria. The state's pesticide lab has the knowledge and skills to provide this type of fee based service.

4. Arbovirus and vector born disease monitoring: With the presence of Lyme disease, West Nile Virus and Eastern Equine Encephalitis in Vermont, it is critically important to have the capacity to monitor the presence of these diseases in a variety of media from mosquitoes to livestock and wildlife. The future will also bring the possibility of other disease concerns resulting from tick or mosquito vectors including Babesiosis, Anaplasmosis, Powassan virus, St. Louis encephalitis, and Rocky Mountain Spotted Fever. The laboratory could serve as the center of a robust disease surveillance program.

5. Feed – nutritional analysis, mycotoxins, feed adulteration: The current feed program no longer serves the needs of Vermont's feed consumers. This program could expand beyond the current protein, fat and fiber program to include a complete nutritional analysis, including energy, mycotoxins and adulterants, such as heavy metals, pesticides, and other contaminants.

6. Fertilizer and Compost: The ability to monitor ingredient streams for adulterants and/or the ability to provide quality certifications for products produced in Vermont.

7. Weights and Measures: There has been growth in the maple industry throughout all maple producing areas. With this growth there has been a considerable increase in the number of hydrometers tested. Other states that do not require testing have been voluntarily having Vermont test and certify hydrometers. This year hydrometers have been tested for dealers in New Hampshire, Connecticut and Michigan.

   The weights and measures laboratories in the northeastern part of the US are in transition with new personnel and upgraded facilities. Some jurisdictions have been having difficulty attaining NIST certification of traceability. For this reason, the Vermont facility has seen an influx of weights from out of state service companies. This may be a short term trend as other state labs attain certification or may continue to evolve for the foreseeable future.

   In the past, there has been some discussion among some of the labs about creating or concentrating in more of a regional manner in regard to weights and measures labs and their functions. One facility might have the ability to concentrate on small mass, another on large volume transfer, and another on large mass. Vermont has been specializing more on hydrometers and large mass. This seems to be fitting our model relatively well and may provide for steady long term growth of services

8. Plant Industry:

   - Regulatory and compliance services – Should GE labeling become the norm in Vermont, the opportunity to provide GE identification services may present itself, especially as demand for non-GE foodstuffs and animal feed increases. Also, consumers will want to verify the non-GE nature of their own inputs, and even if this niche is one that VAAFM doesn't want to exploit, the opportunity for certification for private labs may become available.
   - GE seed testing – if the VAAFM lab is equipped to analyze for the presence of GE markers in foods and feeds, the lab could also be called upon to verify the presence of GE traits in seeds sold in Vermont. Seed labeled GE has to contain the trait; if the trait is missing, then the consumer of the seed has a cause of action against the manufacturer making claims as to the quality of their seed, much the same way they would if seed did not meet specified germination or purity statements.
   - Hemp testing – although the law no longer requires testing of cannabis for verification of THC content, the possibility that this service will be

requested remains, especially if there are farmers in Vermont exposed to federal prosecution under the controlled substances act.

- Plant Virus Screening – Plant certification schemes are increasingly dependent on molecular techniques to verify the health of plants produced for interstate and international commerce. Seeds and other propagative materials (tubers, bulbs, rhizomes, cuttings) are often required to have DNA analyses performed to verify the absence of viruses, phytoplasmas, and related organisms as prerequisites for shipment to other states or countries or as part of a generational health program (seed potatoes). Right now, samples have to be sent out of state for these services. An in-state PCR facility could address these needs faster than outside labs.

***Environmental Conservation***

1. Air Pollution: Add PAH and metals analyses of air samples and expand the VOC-air analyses.
2. Waste Management: Provide analytical support in water, soil, and possibly air samples (metals, VOCs, and possibly TPH, semi-VOCs, and PCBs) to the hazardous waste program and the sites management section, which provides oversight of investigation and cleanup where a hazardous material releases has contaminated the environment. This function will likely not be a large volume because the need for these analyses is typically on a limited and emergency basis.
3. Air Toxics: Analyzing other New England states' air toxics samples (regional laboratory expertise).
4. Increasing "in kind services" allowing for matching grants: The DEC laboratory analyzes thousands of water samples collected by volunteer groups from Vermont's lakes, ponds, rivers, and streams. Leveraging this volunteer resource allows the agency to obtain invaluable water quality data that would not otherwise be collected. Also, this program helps facilitate a partnership between the state and local communities to address challenging water quality issues. There is not a commercial laboratory model that can replicate this service. It is estimated that over 6,600 tests are performed annually.

## Risk and Sensitivity Review

The primary risk factors that could affect the outcomes of this analysis (ranked based on impact) are:

***Estimate of Un-met Needs After Tropical Storm Irene***

An estimate is provided in this analysis and report of the un-met needs for analysis and testing as a result of the destruction of facilities resulting from Tropical Storm Irene and the diminished capacity in interim facilities that has resulted from 2012 to the present. The estimate was based on a projection of the growth in services from 2008 through 2011 with an emphasis on 2011/2012. During this same period there was significant downsizing in State and municipal government due to macro-economic conditions (i.e. Great Recession).

Due to these mitigating conditions, the estimate on un-met services may be under-reported at this time. Consensus among lab staff experienced with the work load prior to Tropical Storm Irene is that the estimates within this report are conservative. Actual un-met demand is probably higher than estimated.

The estimated amounts of what the budgets would be is included in the tables above as "Budget Estimate – No Storm Irene". Please note that the un-met needs figure is included in the budget estimates for "Cost of Similar Services if Outsourced", but not in "Budget (& Projected)", or "Actual Expenditures" data in the tables and charts above. The impact of these un-met needs would differ for the Co-Located and Collaborative Models. Since the impact would vary it is discussed separately for each Option.

The current estimate in this report on un-met needs is approximately $500,000 per year. It is believed that either the Co-located Option or the Collaborative Option would allow for these needs to be met in the near future following construction of a new lab with capacity at least equal to the old lab at Waterbury. Yet the cost associated with meeting these needs in each option would be different. Both options would also allow for future growth by better utilization of space and by the use of outsourcing for additional capacity where quality and timeliness concerns are adequately addressed.

However, the risk related to current un-met needs may be underestimated. The effect of this would be to underestimate the future size of the facility needs.

With respect to an Outsourced model this risk would most likely only be recognized retroactively when departmental and client budgets were exceeded for testing.

With respect to a Co-located model, this risk would impact different labs disproportionately. In other words, some departments would see a greater demand for increased services than others. Thus, budgeting for these demands would be difficult and would most likely happen when client/departmental budgets are exceeded.

With respect to a Collaborative model, the impact of this risk would be readily tracked by the growth in service requests for specific test types regardless of industry or client. This should make tracking of the growth in service needs more quickly apparent and easier to quantify. Thus, this model would appear to be more responsive to this type of risk. It would also make it more predictive of future service growth needs and thus better able to budget appropriately going forward. In addition, its greater efficiency and productivity would optimize the use of lab space and “flex space” (space currently assigned in the models to Tier 2/3 activities but that could economically be upgraded for Tier 1 use) to minimize the need for additional construction in the future.

In conclusion, while the analysis in this report is sensitive to the amount of un-met needs, the recommended options appear to allow for adequate resources to compensate for a reasonable increase beyond that currently estimated.

***Staffing Cost for New Facilities***

Estimates of staffing at the Waterbury facility are based primarily on interviews with key staff present during that period, and are believed to be a reasonably reliable accounting of how many people were on the laboratory payroll on a full-time or part-time basis. The estimates are also based on budget and expense data from that period, which provides total budget and expense data for personnel but no headcount information. It was also reported that one position was purposely left unfilled in the immediate aftermath of Tropical Storm Irene, due to reduced laboratory capabilities.

Staffing estimates for the current period are based in part on interviews and budget/expense records as well. However these estimates are probably more accurate than those for the earlier period. Yet, the diversity of work locations adds difficulty to the accuracy of these estimates as well.

The estimate for a new Co-located and a new Collaborative Lab are based on the space planning interviews and staffing requests in the most recent meetings with the various departmental labs. To some extent, staffing has been estimated as a take-off from space allocations also. These estimates may inaccurately reflect job title or work location within the lab facility but are probably fairly accurate as to total head count of FTEs.

The most likely source of error in these calculations is the staffing position estimate for the Waterbury facility. If these estimate figures are high, the impact would be to overestimate the cost of staffing for the Co-located model. If these figures are low, the impact would be to underestimate the staffing cost for the Co-located model.

The Collaborative model is based on the current staffing estimate. As such there is proportionately a very low risk of its estimate being inaccurate.

With respect to staffing costs, however, both models are based on a comparison with FY 2013 costs. Thus the significance of any error is greatly reduced.

In conclusion, while the analysis in this report is sensitive to previous staffing levels, the recommended options are based primarily on a cost comparison with current staffing levels and should accurately reflect the change from current resource use. The historical comparison to pre-Irene levels is a best approximation but has minimal impact on the overall results.

***Growth in Service Needs in the Future***

Future growth in services, above the level provided at Waterbury, has been estimated at 3% per year. This is in agreement with the current growth rate in the United States GDP of 2.8%.

Accelerated growth in the economy of the State of Vermont could mean this estimate is conservative. However, as a long-term estimate it is probably appropriate.

***Need for BSL-3 Lab Capabilities***

At present, none of these estimates include BSL3 capability. Such capacity, if desired would require a revision of construction costs and staffing requirements.

***Cost of Construction***

Cost of construction at present is a square foot cost estimate based on $450 per square foot. It does not attempt to consider regional differences in construction cost within the State of Vermont. It is at best an order of magnitude estimate, for consideration of differences between the two new lab models. It is not intended to accurately depict actual construction costs, or site differences.

## ***Opportunities and Concerns***

Primarily the opportunities and concerns are focused around three key areas:

- Is the joint operation of a laboratory facility by two State Agencies feasible?
- Would a partnership with a higher education institution be a realistic alternative?
- Are there governance examples from other States that would prove useful?

Each of these topic areas is discussed below in some depth.

*Organization of Multi-Agency Laboratory*

The consideration of governance of a multi-agency lab only really applies to the adoption of the Collaborative model (Option 3). No change in current governance would be required for Option 1 or 2.

As Option 3 offers the best economic opportunity for VAAFM/DEC lab services for the State of Vermont a thorough discussion is appropriate. There are several viable approaches to such a situation:

- Formation of a new State Laboratory Department (Office of the State Chemist) that would include all lab functions (DoH, VAAFM, DEC and the State Forensics Lab).
- Formation of a new inter-agency commission by Legislative action to operate a lab for VAAFM and DEC
- Joint Operation of a new lab solely for VAAFM and DEC as an inter-agency effort.
- Operation of a new lab solely for VAAFM and DEC by one or the other of the agencies/departments.

*Consideration of State Laboratory Department*

Primarily for political reasons, it is believed that restructuring all lab services in a new state agency such as an Office of the State Chemist is not feasible at this time. Even though it may offer long-term benefit, such an effort would probably take significant energy away from the workable solution of collaboration between VAAFM and ANR. In addition, it would most likely not be agreed to in a timely manner by all relevant parties. The DoH will be completing a new lab in Colchester in late 2014. It does not appear that a viable case could be made to DoH, near term, for a new combined governance model under a State Chemist. If it could be made, it most probably cannot be accomplished in a timely manner in order to allow VAAFM and ANR to go forward with funding a new laboratory in early 2014. There are similar issues with the State Forensics Laboratory. Primarily due to their "chain of custody" issues they would not be truly receptive to a new governance model, and again not in a timely manner.

However, if VAAFM and ANR were to build a new laboratory near the site of the new DoH lab in Colchester it could lead to greater collaboration among the agencies in the future.

*Formation of a new inter-agency commission by Legislative action*

Such a management model, though potentially beneficial long term, would pose similar issues of feasibility to that of an Office of the State Chemist without having the future capability to expand the management to include other Agencies' laboratory facilities. Even though it may offer long-term benefit, such an effort would probably take significant energy away from the workable solution of a collaboration between VAAFM and ANR. In addition, it would most likely not be agreed to in a timely manner by all relevant parties.

*Joint Operation of a new lab solely for VAAFM and DEC as an inter-agency effort*

This is a highly feasible solution that appears capable of implementation solely with an approved Memorandum of Understanding between the two agencies/departments.

Functionally it might prove the most beneficial model for equitably managing needs and services between VAAFM and DEC. Most likely it would take the form of a jointly approved Lab Director who reports to a Board of Governance composed of primary lab users in VAAFM and DEC. Such a Board could also provide guidance on SOPs, billing procedures, staffing issues, etc. Quarterly meetings of the Board of Governance would probably be appropriate.

In addition, such a model could foreseeably grow to include other State agencies or departments if additional opportunities for collaboration were to develop in the future.

*Operation of a new lab solely for VAAFM and DEC by one or the other of the agencies/departments*

If it proves unfeasible to jointly operate a new lab, than the next best alternative would be for one or the other of the two agencies/departments to agree to operate the lab for the benefit of both. While in some ways this may prove simpler to gain authority for and funding approval, it may prove more difficult in application. Some of the issues that may develop are:

- Assignment of work based on need and request date.
- Lab personnel from one agency/department would need to be transferred to the other agency/department
- Billing management
- Approval of SOPs, etc.

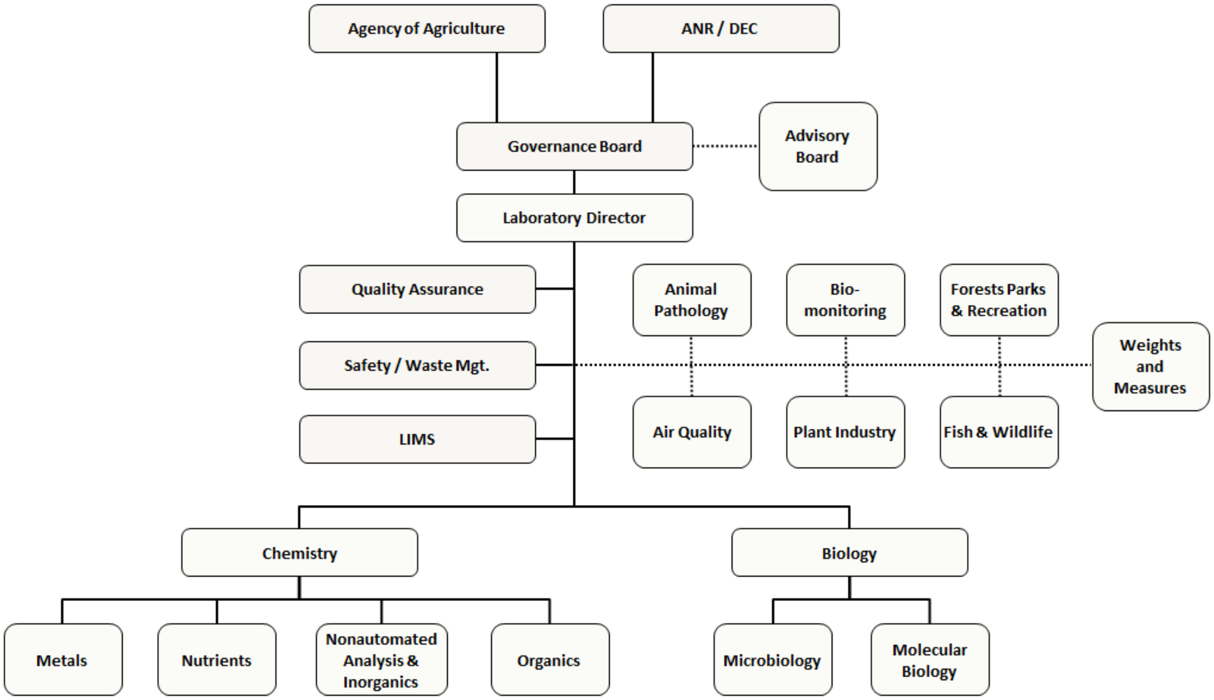
*<u>Governance of Multi-Agency Laboratory</u>*

Much of what is written below would apply equally to a lab operated jointly by both agencies/departments or operated within either one.

A new "collaborative" facility poses significant governance challenges. Yet at the same time, if these issues can be resolved, such a facility poses the greatest opportunities for cost-effectiveness and growth in the future. It is by far the best solution if the governance issues can be resolved. However, a further concern is these issues must be addressed prior to making the commitment to build the facility. If there is not the commitment from all parties to work collaboratively in the new facility it will most likely be considered inadequate for operation utilizing the old co-located model for operations.

*Administrative governance*

Administrative governance must include a mechanism to consider and resolve needs of all client departments equitably. Yet at the same time it must not be cumbersome or costly. A Board of Governance, composed of key internal clients from both agencies/departments is probably the most effective way to resolve these issues. However, day




**Collaborative Lab Functional Chart**

to day operation requires one person who would be in charge of all operations. Thus a Lab Director for all lab functions is needed as well. Essentially this is a "CEO" for the lab who would manage all operations and report to a "Board of Directors" who would handle policy and governance issues at a macro level, basically the same way that most corporations are managed.

One possible organizational structure discussed by VAAFM and DEC is shown on the following page.

The Board of Governance would not be full time positions, but instead representatives of client departments who meet periodically, perhaps quarterly, to address issues brought to them by the Lab Director, client departments, personnel, etc. The Board would have overall responsibility for approving policy, budgets, etc. The Lab Director would have overall authority for all operational decisions and adjustments to policy in between Board meetings.

The Board could, if desired, exert formal approval down to the level of SOPs, work prioritization, etc. as a matter of policy or approach.

A possible adjunct to the Governance Board could be an Advisory Board that would draw on constituents for the lab, such as farmers and environmentalists. Such a group could help the Governance Board better understand emerging issues and trends/directions in agriculture and the environment that may impact future growth in services or changes in needs. The DEC is already doing this, but more informally.

*Revenue and Cost Models*

A model will need to be developed to allocate cost between the client agencies as well as other lab customers. Currently VAAFM and DEC use significantly different methods to allocate costs. In addition, budgets in both agencies include general funds, external funds (federal, regional, grants etc.) and some fee-based services to individuals and municipalities. Also, some testing is regulatory required even though related to a specific client/service. In addition, significant emergency response services occur for both VAAFM and DEC.

One good method to allocate services performed for various departments and clients would be to estimate the costs of providing lab testing services based on the time required to perform specific units of tests of various types. This would then allow for the allocation of lab costs to various departments within the agencies, as well as external customers, based on the percentage of work load they burdened the lab with. Such a method could also allow for the regular adjustment of general funds and other similar budgetary amounts appropriately to the lab based on work load.

In point of fact, DEC has had such a model in the past. Up until about 2009 all costs for testing were allocated by DEC to its various clients and departments based on "productivity" and "work time units". This model would need significant re-characterization from its current implementation, but would be a good starting point. One point of note, a new time study should be conducted, as most of the original data in this model is from the early 1990's. (See ***Appendix F***). Significant changes in process and procedure have occurred since. then Also, it would appear that significant adjustments have been made to this revenue/cost model since 2009 (due to its partial subsidy with General Funds) that may not be consistent with the original data driven framework that was constructed. A further consideration that needs to be included in this revenue and cost model is an appropriate allocation for the capital replacement of lab equipment.

*Staffing*

Currently not all lab personnel are classed similarly since they work for different agencies/departments. In order for staff to see their workload as independent of the client department it will be necessary to rationalize job titles and pay classes. This will most likely involve some negotiation between the agencies/departments and the Vermont State Employees Association. Ultimately the goal will need to be to have all employees performing similar tasks to be similarly classed and paid. This will need to occur so that a common identity can be established within labs; thus ultimately allowing for a better leveling of workload and prioritization.

*Priority management; workload management*

One of the more complex pieces of developing a collaborative model will be workload management and prioritization. Every agency/department will feel that their work, to some extent, should be a priority. There must be a process for resolving these issues as a matter of policy that seems fair and equitable to all involved. Resolving concerns in this area and managing policy may be one of the appropriate functions of the Board of Governance. Closely linked with this must be an emergency procedure where issues related to disease outbreaks, contaminated spills, disasters, etc. can be expedited before routine testing.

*Contractual models and fee for service opportunities*

As mentioned above, a cost allocation model based on lab/test time will probably be the most efficient means for the division of costs between the various agencies/divisions. This same model would also allow the pricing appropriately to outside customers (municipalities, other States, Federal etc.) for lab services provided.

*Consideration of higher education partnership*

It has been suggested that a partnership with a higher education institution or system may be feasible and beneficial. While this is a viable option, there are significant issues relative to location, availability of BSL-3 resources, and integration with campus master plans, as mentioned previously. The relationship established with UVM in response to the Tropical Storm Irene issues has been beneficial and should be explored as an opportunity for long term partnership. Similarly, opportunities with other higher education institutions are potentially beneficial.

One other benefit that may exist is the availability of students as part-time/temporary staff at the lab. Skilled labor would be a significant benefit potentially of a campus location. In addition the opportunity to consult with university staff on research initiatives may be of benefit as well.

In conclusion, opportunities with higher education institutions should be explored. However, significant constraints may exist with respect to coordination with the university's master plan, competition with campus programs for appropriate sites, and location specific issues as regards to coordination with other State departments.

*Examples of Other State Regulatory Lab Models*

Please refer to ***Appendix E*** for a review conducted by State of Vermont personnel into the operational model of other states in the region, including their experiences with outsourcing efforts.

## Conclusion and Recommendations

Of the three Primary Options (Outsourced, Co-located and Collaborative) only the latter two appear to meet all of the needs identified by the State of Vermont. It also risks the loss of essential monitoring partnerships and long term data crucial to policy decision making.

Specifically, the Outsourced model does not appear to be more cost effective than the other two options, nor does it appropriately address all issues related to quality and response time.

Crisis response would most likely be significantly slower in this model as well, since an in-house lab facility has a greater ability to respond effectively and immediately to emergencies. Also, if the crisis is of a national impact (i.e. pet food adulteration) commercial facilities may be overwhelmed with other clients before Vermont is able to obtain their services.

Related to this is the issue of research on unanticipated issues. Often in years past, the problems that consistently became the most important issues that the lab addressed were completely unknown at the start of the year. Nimble response is the key to success in addressing these critical issues.

Further, the Outsourced model does not appear to handle well the need for research and analysis with respect to new services or growth in services. This may also be an issue in emergency response when needed.

Lastly, it appears to be a program that other states have tried to implement in the past with only marginal success.

The Co-located model (Option 2) does adequately address all of the above issues and would be a responsible solution for the State of Vermont. It would be the easiest to implement of the three options because it would essentially mean "business as usual", in a new facility modeled after the one in Waterbury that was damaged during Tropical Storm Irene and subsequently demolished. It would be more functional than the old lab, and better able to adapt to needed growth in the future. However, programmatically it would suffer from the same functional weakness of redundant services between VAAFM and DEC. In addition it would only marginally implement the recommendations of the 2006 study by APHL for improved operations.

The Collaborative model is the best choice overall for improved functionality, growth, efficient cost of construction, and reduced operational cost. A significant benefit of such a solution is the ability to implement proven production workflow enhancements commonly referred to as "Lean Production Management". Today, most major pharmaceutical laboratories and many commercial test laboratories routinely use these techniques to reduce cost of operations as well as to significantly improve quality. Further these techniques dramatically reduce production errors and improve safety.

The one significant challenge to implementing the Collaborative model is that a major change in governance will be required for it to be successful. So far during this study, representatives from VAAFM and DEC have consistently expressed their willingness to make these major changes. It is assumed that this willingness will continue and develop further as a program for construction of a new lab continues.

In summary, the significant benefits of a Collaborative Lab model (Option 3) are:

1. Reduced cost of construction by approximately $1,700,000.
2. Reduced cost of operation, including:
    - Reduced staffing costs by approximately $250,000 per year as compared to Co-located model.
    - Reduced "fee for space" for facility charges by BGS of about $30,000 per year.
3. Best use of space for current needs and future growth.
4. Best operational management of work flow and demand to manage growth and peak/emergency situations.
5. Opportunity to implement "Lean Production Management" techniques.
6. Opportunity to implement all recommendations of the 2006 APHL study.
7. Alignment with strategic initiatives of the State of Vermont for the delivery of services.
8. Enhanced perception of "best use of resources" on the part of VAAFM and DEC from the viewpoint of the citizens of Vermont.
9. No significant increase in operational budgets to VAAFM and DEC as the new facility goes into operation.

# 4. Space Needs and Operating Model

## Space Programming Methodology

The space programming effort focused on identification of the spaces needed in a new facility for VAAFM and DEC. Space needs were identified and quantified for two options:

- the Co-located option, which is generally based on the governance and operating model in place in the Waterbury facility prior to Tropical Storm Irene, and
- the Collaborative option, which establishes a new combined governance model and organizes the labs by the type of science being done, rather than by the identity of the "customer" that needs the test results.

The process included detailed interviews with lab users to confirm the type and volume of analysis being conducted, the equipment and space required, opportunities for synergy, requirements for isolation, and other needs. Interviews included discussion of the ways in which the Waterbury facility met the needs of the users, and the ways in which it fell short. Interview notes were compiled and shared with lab users for review and comment. The edited interview notes are included in this report as ***Appendix C***. The proposed space allocations are based on:

- the outcomes of the interviews,
- an analysis of space usage in the Waterbury facility, which was derived from the original design drawings for the facility, and
- tours of existing facilities in Burlington, Berlin, and Montpelier to document how space is currently being used.

The proposed space programs on the following pages outline the programmatic requirements in both tabular and graphic form. The collaborative program requires approximately 10 percent less space than the co-located program, which is consistent with the operating efficiencies outlined elsewhere in this report. Both of the space programs incorporate all of the labs that were located in the Waterbury facility, as well as a proposed Animal Pathology Lab.

The labs have been characterized as Tier 1, Tier 2, and Tier 3 as follows:

- The labs identified as Tier 1 are the analytical or "wet" labs. Along with the core space and the administrative space, these are the labs that are fundamental to the operation of the proposed facility.
- The labs that are identified as Tier 2 are generally "dry" labs and not as intrinsic to the operation of the lab. It is still significantly advantageous to operating efficiency if they are located in the same facility, so they should be included if at all possible. "Dry" labs typically do not require the same intensity of lab services as "wet" labs.
- The lab identified as Tier 3 (weights and measures) is more independent of the other labs. It is also the only lab that is adequately housed currently. It should be included in this facility for space efficiency, but could also remain in its current location in Berlin if that space can be leased for the long term.

These programs only provide an overview of space requirements. A more detailed effort to precisely define the needs of each lab will be required at a later point in the process.

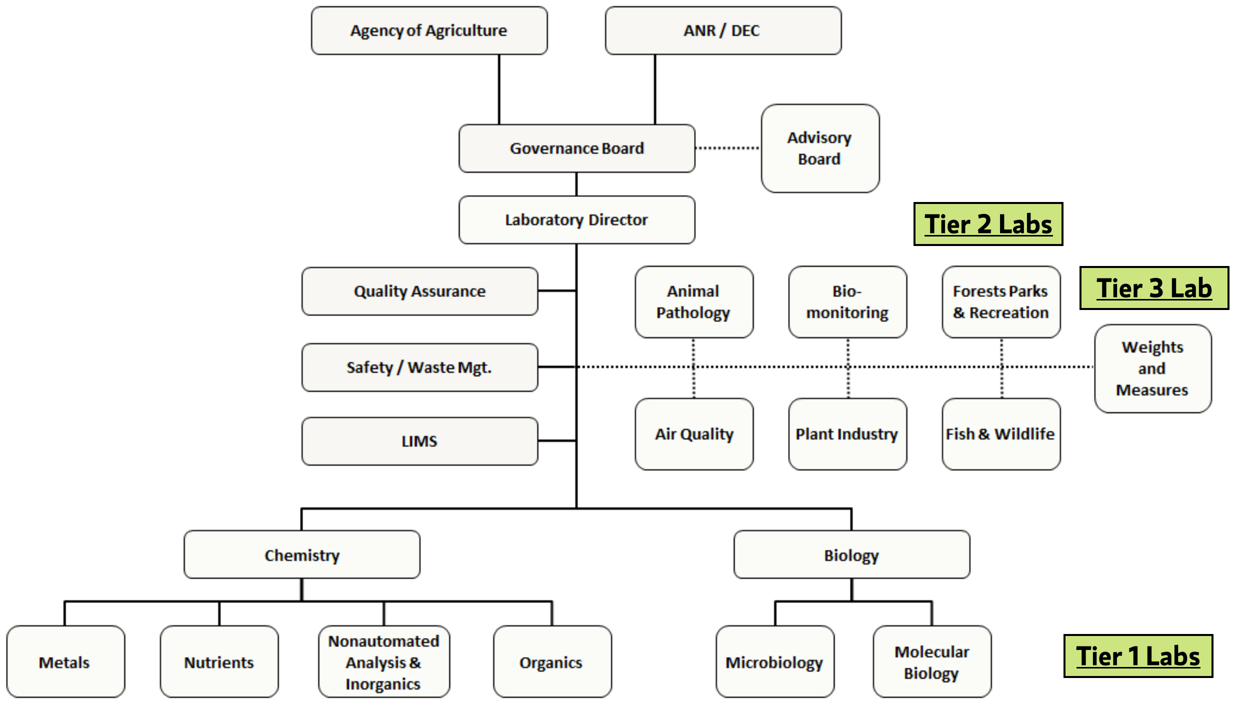
## Administrative Organization

*Safety, Quality Assurance, and Waste Management*

Previously at the Waterbury facility, neither VAAFM nor DEC employed a dedicated Safety or QA officer. These functional roles were, in part, covered by staff with other responsibilities (i.e. "wearing different hats"). In many cases, having staff performing multiple duties is perfectly acceptable. Where this model of operation falls short is often in the category of safety, including waste management. Ideally, the proposed laboratory facility, operating with approximately the same number of personnel as there were in Waterbury, would have an individual dedicated to overall safety of the laboratories. This would include areas of safety related to 1) biological safety, 2) chemical safety, 3) waste management and 4) and occupational health issues. Previously, waste management compliance resulted in a consent decree and a $110,000 fine against DEC, stressing the importance of focused attention on these issues. The safety officer would serve the laboratory facility independently of any governance issues, meaning the position does not directly report to either agency. Compliance with biological and chemical safety is often regulated by organizations such as Health and Human Services, through the Centers for Disease Control and Prevention, and the Occupational Safety and Health Administration.

Often, many laboratory safety personnel have experience in the fields of quality assurance and quality control. As the safety position may not warrant a dedicated full-time position, it is reasonable to recruit a safety professional with QA/QC experience.

If and when the new laboratory facility enters into a conceptual design phase, we recommend that a seasoned safety professional be involved in the programming effort, or that a laboratory safety consultant be part of the programming and design team. This will provide a greater assurance that safety issues related to the flow of personnel, materials, wastes, etc. will be factored in to the design for compliance and safety.




**Collaborative Lab Functional Chart with Tiers**

*Biosafety Level Recommendation*

Review of the programs currently conducted by both VAAFM and DEC, as well as areas of potential expansion to include future programs, does not necessitate the implementation of BSL-3 facilities or programs. At most, the laboratory functions conducted are considered BSL-2 in nature. The justification for not including BSL-3 programs or facilities for these agencies is based on several considerations. First, as noted, the current and proposed activities of VAAFM and DEC do not require BSL-3 facilities or programs as described by Biosafety in Microbiological and Biomedical Laboratories, 5th Ed. (Centers for Disease Control and Prevention/ National Institutes of Health, U.S.). While VAAFM does provide diagnostic services related to Brucella species (the causative agent of Brucellosis) the amounts of agent isolated for diagnostic purposes remains below the limits required by BSL-3 conditions. It should be noted that this work should be done under BSL-2 conditions, utilizing biosafety cabinets for primary containment. Further, these agents are not cultured beyond diagnostic purposes.

Secondly, it is not out of the realm of possibility that a naturally-occurring outbreak of an infectious agent that poses a threat to human, animal or environmental health could occur in Vermont. This scenario would possibly warrant the use of BSL-3 facilities and operations. However, the Vermont State DoH Lab currently has and operates a BSL-3 lab that would (potentially) be able to serve in an emergency situation. Likewise, as the planning for the new laboratories for the VAAFM and DEC moves forward, it is reasonable to provide for BSL-2-Enhanced (BSL-2+) capabilities. It is not uncommon for emergency response situations that require BSL-3 capabilities to be conducted under BSL-2+ conditions. BSL-2+ facilities would provide VAAFM and DEC with this flexibility.

Finally, the cost of new BSL-3 construction is much higher than traditional laboratory space, even BSL-2+ space. For this reason, and the reasons listed above this analysis revealed that BSL-3 facilities are not required for the proposed laboratory model for VAAFM and DEC.

*Laboratory Information Management System (LIMS)*

The DEC lab currently uses a LIMS developed by Accelerated Technology Laboratories. The VAAFM lab has expressed the intention to implement a LIMS but has not yet done so. Regardless of the governance model elected for the new laboratory, a comprehensive LIMS should be implemented. Due to issues such as security and privacy of data, and chain of custody for enforcement cases, it is recommended that a qualified consultant be engaged to assist in development of a LIMS plan. The current DEC system may or may not prove to be the best solution. It may also be advantageous to consider partnering with the DoH on management of a LIMS, or outsourcing the management to a consultant, to obtain the best value.

*Administrative Organization: Co-Located Model*

In the Co-located model space program, the organization is assumed to be similar to the Waterbury facility, with separate operations for VAAFM and DEC. The program does assume some consolidation of basic building functions such as sample receiving, glass washing, long term storage, and autoclaves. The total space required is projected to be approximately 39,000 gross square feet, which is an increase of approximately 4,000 square feet over the Waterbury facility. The difference is due to several factors, primarily rectifying the shortfall of space in a few of the labs in the Waterbury facility, the addition of an animal pathology lab, and provision of more adequate space for building services such as HVAC systems.

*Administrative Organization: Collaborative Model*

In the Collaborative model space program, the organization is assumed to be a fully integrated analytical lab that provides all Tier 1 laboratory services as a single entity. The Tier 2 and Tier 3 labs are assumed to be administratively independent, but subject to the governance of the collaborative lab in the areas of lab safety and waste management. The more efficient space utilization enables the collaborative lab to be approximately 35,400 gross square feet, or 3,600 square feet less than the co-located scheme. Compared to the Waterbury facility, the space shortfalls have been rectified, an animal pathology lab has been incorporated, and adequate space has been provided for building services, yet the proposed facility is only a few hundred square feet larger than the Waterbury facility .

In general, all of the laboratory work that falls under VAAFM and DEC can be categorized as either biology- or chemistry-based. Structural organization of the laboratory services into biology and chemistry allows for compatibility of core resources, equipment and expertise. These two divisions are not organized in terms of governance, rather they are organized by laboratory type. This division favors the use of the collaborative model described in detail in this report. Our investigation revealed that compatibility among the laboratory programs (i.e. the type of science, analysis, etc. being performed) favors a collaborative model.

On the chemistry side, for example, several programs relay on the use of gas chromatography, HPLC, etc. In a collaborative model, critical instrumentation would be accessible to all programs. As the organizational chart shows, we have divided the laboratory programs into Chemistry and Biology- this chart does not suggest a governance or reporting structure. Rather, this indicates which programs fall into either Chemistry or Biology, and suggests how the new facility would be best configured.

In addition, the collaborative model would provide centralized, core resources that could be shared amongst the programs from both Biology and Chemistry. We envision a central core area that would include central access to shipping and receiving, long-term cold storage, autoclaves and decontamination, sample accessioning, centralized gasses and cylinders, deionized water, and others. This reduces the overall area required to house services and utilities used in all programs.

*Specific Notes for Individual Chemistry Laboratories*

1. Nutrients:
   - Has requirement for substantial bench space for analytical equipment, such as autoanalyzers.
   - Has a requirement for a smaller, dedicated autoclave for sample preparation- ideally, this would be located in/near the lab.
   - Nitrogen is the primary gas needed, but due to low volumes required, there is little need for piped gasses.
   - Is compatible with other areas of Chemistry, such as Non-Automated & Inorganics, as far as space and equipment sharing.
2. Metals Laboratory:
   - Possible to condense functions from VAAFM and DEC to reduce redundancy.
   - HVAC is critical, given the ducting, temperature and humidity control elements of the operations.
   - Sample preparation/ grinding operations need to be done separate from the analytical laboratories, i.e. a separate room.
3. Non-Automated Analysis & Inorganics:
   - Is compatible with other areas of Chemistry, such as Nutrients, as far as space and equipment sharing.
   - Extraction area needs to be separate from analytical (wet) lab areas.
   - Chlorophyll extraction and preparation needs to be performed in a separate room, preferably, since those operations require no light.
4. Organics Laboratory:
   - Possible to consolidate space between VAAFM and DEC, but dedicated equipment for each is required.
   - Extraction space (negative pressure) should be truly separated from analytical space (positive pressure).
   - Has requirement for large Dewars of liquid nitro-

gen.

- Analytical space should be separated into two areas, 1) volatiles and 2) semi-volatiles, to prevent cross-contamination.
- This lab would benefit for a core facility where compressed gasses could be piped in.

5. Air Quality:
   - Requires dedicated environmentally controlled room for gravimetric filter operations. Typically controlled at 20-23 Deg. C, ±2 Deg C / 24 hours and RH 30-40%. ± 5% / 24 hours/day.
   - Gravimetric facility ("AP Balance Room") must be isolated from building exterior entry ways to reduce the fugitive dust/moisture/ temperature/ pressure/ changes.
   - Can be associated with other programs in Chemistry, sharing certain resources, such as GC/MS.
   - Needs to be physically separated from pesticides programs.
   - Should be under slightly positive pressure to prevent outside air contamination.

_Specific Notes for Individual Biology Laboratories_

1. Microbiology Laboratory:
   - Dairy Chemistry should be located adjacent to Molecular Biology Laboratory.
   - Has high demand for fume hood space.
   - Dairy Microbiology operations require clean (positive air-flow) space.
   - BSL-2+ facilities should be strongly considered for this area.
2. Molecular Biology Laboratory:
   - Requires clean (positive air-flow) space to prevent contamination of DNA products.
   - Should be adjacent to Dairy Chemistry (Microbiology) and Plant Industry.
   - BSL-2+ facilities should be strongly considered for this area.
3. Plant Pathology & Entomology
   - Requires a great deal of storage space for equipment.
   - Preferably located near/adjacent to Molecular Biology Laboratory.
   - Flexibility is critical, as seasonal operations dictate day-to-day function.
   - Need to plan for expansion of GMO testing.
4. Watershed Management/ Biomonitoring Laboratory:
   - Need storage space for flammable cabinets and field equipment, including equipment washing & decontamination.
   - Ventilation is critical, given the large volume of flammable solvents used.
5. Animal Pathology:
   - Possible sharing of space and/or resources with Fish &Wildlife (ANR).
   - Should be under slightly negative pressure to prevent potential pathogens from escaping laboratory area.
6. Fish & Wildlife:
   - Possible to share space and resources with Animal Pathology.
   - Requires a darkroom that is separate from the other wet lab space.

## ***Prioritization***

Ideally, a new VAAFM-DEC facility would have the capacity to house all of the labs that were located in the Waterbury facility, as well as an Animal Pathology Lab. The primary business model incorporates this assumption, as do the space programs and the capital construction cost model. It is recognized, however, that some of the labs could be located elsewhere if necessary. The labs identified in the space programs as Tier 1 are the analytical or "wet" labs. These, and the core space and the administrative space are fundamental to the operation of the proposed facility. The labs that are identified as Tier 2 and Tier 3 are generally "dry" labs and not as intrinsic to the operation of the lab, but it is still advantageous to include them in the same facility if possible. Implications of including or excluding the Tier 2 and Tier 3 labs in the facility are outlined below and in the table on the following page:

1. ***Space and Cost Efficiency***: Each lab located elsewhere will require at least as much space in another location as it would require in the proposed new facility. Most likely, more space would be required, as opportunities to share space and resources (sample receiving, conference or office space, lab systems, etc.) with other labs would no longer be available. In the Fee for Space model of cost allocation, the annual cost to the respective agencies would therefore increase. Depending on the alternative location(s) selected for the other labs, the capital cost incurred by Buildings and General Services might be more or less. If a separate new building were required, the cost to BGS would almost certainly be greater.
2. ***Operating Efficiency***: For the Tier 2 labs that provide samples to the Tier 1 labs for analysis, a location in the same facility enhances operational efficiency. A separate location would require frequent transport of samples between facilities, as many of the samples are time sensitive. This will add labor cost every year

| CONSIDERATIONS | Existed in Waterbury | Non Ag/ DEC Lab | Site Location Impact | Site Size Impact | Relationship to Other Labs | Laboratory Environment Needs |
|---|---|---|---|---|---|---|
| **TIER 2 LABS** | | | | | | |
| Air Quality | X | | | Need space on site for trailer storage | Furnishes samples to lab for analysis | Has some laboratory HVAC requirements, including environmentally controlled room |
| Animal Pathology | No (growth area) | | | | | Uses lab equipment and has laboratory HVAC requirements |
| Biomonitoring / Watershed Management | X | | Some preference for central VT location for ease of access for field staff | Need space on site for fleet of vehicles and water craft | Furnishes large volume of samples to lab for analysis, significant transport issue if not at same location | Has laboratory HVAC requirements, uses limited laboratory equipment |
| Fish and Wildlife | X | X | | | Funding and chain of custody issues may restrict interaction with other labs | Uses lab equipment and has laboratory HVAC requirements |
| Forest Biology | X | X | | | Statutory relationship to Plant Industry, and functionally similar | Has laboratory HVAC requirements, uses limited laboratory equipment |
| Plant Pathology & Entomology (Plant Industry) | X | | | Freestanding greenhouse desirable | Statutory relationship to Forest Biology and functionally similar, intermittent access to equipment in other labs is valuable | Has laboratory HVAC requirements, uses limited laboratory equipment |
| **TIER 3 LABS** | | | | | | |
| Weights and Measures | X | | | Large vehicle access | | |

**Tier 2 and Tier 3 Lab Function Evaluation**

throughout the life of the facility.

3. **Safety / Risk Management**: Although the Tier 2 and Tier 3 labs are planned to be administratively separate, co-locating them on the site of the collaborative analytical lab offers better opportunity to assure that safety, quality, and waste management standards are consistently implemented, thereby reducing risk
4. ***Lab Access***: Many of the Tier 2 labs utilize some level of specialized laboratory services, although sometimes on a small scale. These requirements raise concerns for Tier 2 and Tier 3 labs if located elsewhere:
    - This requirement may limit the state's options in finding other space that can accommodate the specialized needs of the Tier 2 labs. Fragmenting rather than consolidating specialized systems will likely make it relatively expensive to procure the necessary space.
    - Some Tier 2 labs may be able to make use of specialized equipment and space in Tier 1 labs if co-located, but would require their own dedicated equipment and space if located elsewhere.
5. ***Future Growth of Collaborative Model***: The current plan is that the Tier 2 and Tier 3 labs will be administratively separate from the collaborative analytical lab, as outlined elsewhere in this report. If they are co-located, however, the option remains open to incorporate them into the collaborative model in the future. This would not be readily possible if they were located on a separate site.
6. ***Long Term Flexibility***: Locating the Tier 2 and Tier 3 labs within the new facility offers a high level of future flexibility for growth in the future. Some possible scenarios include:
    - If growth does not occur, the facility can continue to operate as originally planned.
    - Growth may occur in some areas, while other areas recede due to reduced demand, or due to miniaturization of processes that reduces space needs. With more space under one roof, flexibility to accommodate this is maximized.
    - Growth may occur, and more space may be needed. If the Tier 2 and Tier 3 space is designed to be upgradeable to analytical lab (Tier 1) space, as outlined in Section 3, the choice can be made at that time of which functions may need to be moved to another location, or into an addition.

If any lab has to be eliminated from plans for a new facility, it is recommended that Weights and Measures be considered first. This lab has the least specialized space requirements, and has the least interface with other labs. It is adequately housed in Berlin currently. It can remain there, if the state can continue to lease the building, and can identify a compatible occupant for the balance of the building.

If necessary, Air Quality may be considered for elimination from the new facility as well, due to relatively limited direct interface with other programs. The remaining programs would either:

- Lead to a significant reduction in operating efficiency if not co-located, because they interact closely with the analytical labs (Plant Industry, Biomonitoring, Animal Pathology), or
- Have little impact on the cost of the new facility if eliminated, because their space requirement is so minor (Forest Biology, Fish and Wildlife).

## *Proposed Space Programs*

The space programs on the following pages are generally based on planning modules of 225 square feet for laboratory space and 100 square feet for laboratory support space, equipment space, and office space. It is assumed that all laboratory staff should have access to desk space outside of the laboratory environment.

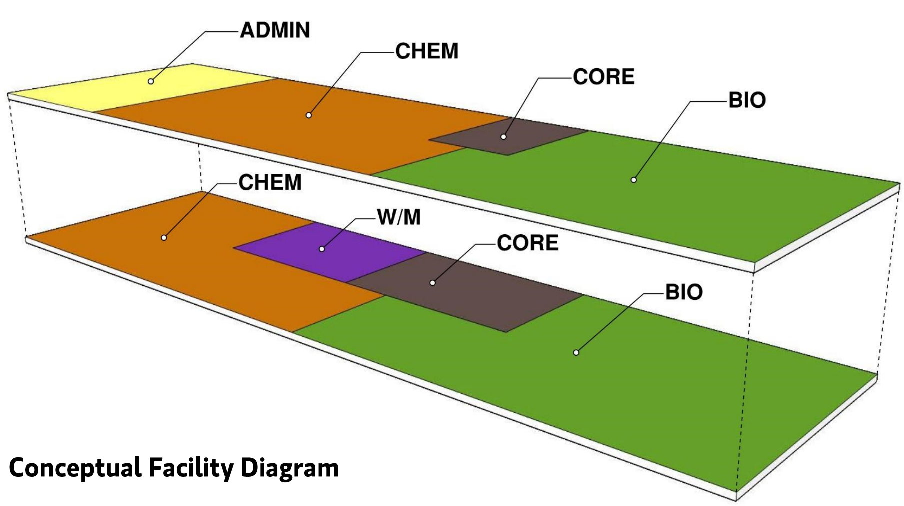
While specific laboratory needs have not yet been finalized, for the purpose of this report laboratory space is assumed to generally include (as needed) chemical fume hoods, biosafety cabinets, bench space, laboratory gasses, space for specialized equipment, and a relatively high rate of ventilation. Laboratory support space would typically encompass a range of specialty rooms such as prep rooms, incubator rooms, darkrooms, etc. that may have unique requirements, but are not outfitted and ventilated as a lab space is. The intent at this early stage of planning is not to define exact requirements for each space, but to initially budget what it may cost to outfit each category of space.

The number of staff to be housed in the facility in each of the models is illustrated in the table on the following page. For both models, it is assumed that the management of the LIMS will be outsourced and will not be the day to day responsibility of the laboratory staff. It should be noted that:

1. The proposed collaborative model enables the lab to return to the service level that existed prior to Tropical Storm Irene, without adding to the current number of personnel.
2. The proposed co-located model would require 3.5 additional personnel (restoring previously eliminated positions as well as adding new) to return to the service level that existed prior to Tropical Storm Irene.

## *Conceptual Facility Diagram*

The diagram below illustrates one effective conceptual layout for a new laboratory facility. This layout maximizes efficiency and flexibility by centralizing a common service core, and consolidating biology labs to one side of the core with chemistry labs to the other side. Administrative space, which is the least sensitive to location, can be placed at one end so that the continuity and future flexibility of the lab space is maintained. While the exact design and layout will be eventually be affected by detailed space programming, and by the specific site selected, this initial diagram can be a useful tool in assessing site viability.




**Conceptual Facility Diagram**

| LOCATION | Before Tropical Storm Irene | | | Current | | | Co-located Model | | | Collaborative Model | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LS/LM | Admin | Temp | LS/LM | Admin | Temp | LS/LM | Admin | Temp | LS/LM | Admin | Temp | |
| **STAFF INCLUDED IN LABORATORY BUDGET** | | | | | | | | | | | | | |
| AAFM LAB | | | | | | | | | | | | | one position lost in budget cuts before Irene |
| Lab Supervision | 1.0 | | | 1.0 | | | 1.0 | | | | | | |
| QA/QC, Safety, Waste Mgt. | | | | | | | 1.0 | | | | | | |
| Chemists | 3.0 | | | 3.0 | | | 3.0 | 0.5 | | | | | |
| Microbiologists | 3.0 | | | 3.0 | | | 3.0 | 0.5 | | | | | |
| DEC LAB | | | | | | | | | | | | | one position lost in budget cuts before Irene |
| Lab Supervision | 1.0 | 1.0 | | 0.5 | 1.0 | | 1.0 | 1.0 | | | | | |
| QA/QC, Safety, Waste Mgt. | 1.0 | | | 0.5 | | | 1.0 | | | | | | |
| Metals Analysis | 1.0 | | | 0.5 | | | 1.0 | | | | | | currently done by lab supervisor |
| Inorganic Chemistry and Microbiology | 2.0 | | 2.0 | 2.0 | | 2.0 | 2.0 | | 2.0 | | | | 2 temp positions are seasonal |
| Organic Chemistry | 1.0 | | | 1.5 | | | 1.5 | | | | | | |
| COLLABORATIVE LAB | | | | | | | | | | | | | |
| Lab Leadership incl. QA/QC, Safety, Waste Mgt. | | | | | | | | | | 2.0 | 1.0 | | |
| Nutrients Lab | | | | | | | | | | 1.0 | | 1.0 | |
| Metals Lab | | | | | | | | | | 1.0 | | | |
| Nonautomated Analysis and Inorganics Lab | | | | | | | | | | 1.0 | | 1.0 | |
| Organics Lab | | | | | | | | | | 4.0 | | | |
| Microbiology Lab | | | | | | | | | | 2.0 | | | |
| Molecular Biology Lab | | | | | | | | | | 1.0 | | | |
| **SUBTOTAL** | **13.0** | **1.0** | **2.0** | **12.0** | **1.0** | **2.0** | **14.5** | **2.0** | **2.0** | **12.0** | **1.0** | **2.0** | |
| Permanent | **14.0** | | | **13.0** | | | **16.5** | | | **13.0** | | | |
| Permanent + Temporary | **16.0** | | | **15.0** | | | **18.5** | | | **15.0** | | | |
| **STAFF NOT INCLUDED IN LABORATORY BUDGET** | | | | | | | | | | | | | |
| Animal Pathology Lab | | | | | | | | | | | | | no staff permanently assigned |
| Watershed Management | 5.5 | | 2.0 | 6.5 | | 1.0 | 6.5 | | 1.0 | 6.5 | | 1.0 | additional position allocated in 2013 |
| Air Quality | 2.0 | | | 2.0 | | | 2.0 | | | 2.0 | | | |
| Fish and Wildlife | 2.0 | | 1.0 | 2.0 | | 1.0 | 2.0 | | 1.0 | 2.0 | | 1.0 | up to 3 temporary positions (1 currently) |
| Forest Biology | 1.0 | | 1.0 | 1.0 | | 1.0 | 1.0 | | 1.0 | 1.0 | | 1.0 | |
| Plant Industry | 3.0 | | 2.5 | 4.0 | | 2.5 | 4.0 | | 2.5 | 4.0 | | 2.5 | 2.5 temp positions are seasonal |
| Weights and Measures | 1.0 | | | 1.0 | | | 1.0 | | | 1.0 | | | |
| **SUBTOTAL** | **14.5** | **0.0** | **6.5** | **16.5** | **0.0** | **5.5** | **16.5** | **0.0** | **5.5** | **16.5** | **0.0** | **5.5** | |
| Permanent | **14.5** | | | **16.5** | | | **16.5** | | | **16.5** | | | |
| Permanent + Temporary | **21.0** | | | **22.0** | | | **22.0** | | | **22.0** | | | |
| **TOTAL STAFF HOUSED IN THE LAB** | **27.5** | **1.0** | **8.5** | **28.5** | **1.0** | **7.5** | **31.0** | **2.0** | **7.5** | **28.5** | **1.0** | **7.5** | |
| Permanent | **28.5** | | | **29.5** | | | **33.0** | | | **29.5** | | | |
| Permanent + Temporary | **37.0** | | | **37.0** | | | **40.5** | | | **37.0** | | | |
| LS/LM: Laboratory Staff / Lab Management | | | | | | | | | | | | | |

**Staff Housed in VAAFM / DEC Lab Facilities**

## CO-LOCATED SPACE PROGRAM

*NOTE: The co-located space program assumes that the governance model will be similar to the model utilized in the previous facility in Waterbury. Certain functions such as sample receiving and some central services are assumed to be shared.*

| Space Name | User Groups | Tier | Space Requirement: Laboratory | Laboratory Support | Equipment and Sample Storage | Lab Office | Other | TOTAL | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **AGRICULTURE LAB** | | | **5,175** | **1,550** | **1,400** | **500** | **750** | **9,375** | |
| Animal Health | | 1 | 675 | | | | | 675 | |
| Dairy | | 1 | 1,125 | 300 | | 200 | | 1,625 | |
| Pesticide Enforcement | | 1 | 675 | 300 | 200 | | | 1,175 | |
| Feed & Fertilizer | | 1 | 450 | 300 | | 100 | | 850 | |
| Meat | | 1 | 450 | 100 | | | | 550 | |
| Plant Industry Lab | Plant Pathology, Entomology | 2 | 450 | | 500 | | | 950 | First floor required |
| Animal Pathology Lab | Animal Pathology | 2 | 900 | | 200 | | | 1,100 | new function |
| Weights & Measures Lab | | 3 | 450 | 550 | 500 | 200 | 0 | 1,700 | First floor required |
| Private Offices | 2 Required | | | | | | 250 | 250 | |
| Administrative Asst. / Reception | | | | | | | 200 | 200 | |
| Conference Rooms | 1 Required | | | | | | 200 | 200 | |
| Lobby | | | | | | | 100 | 100 | |

## CO-LOCATED SPACE PROGRAM

*NOTE: The co-located space program assumes that the governance model will be similar to the model utilized in the previous facility in Waterbury. Certain functions such as sample receiving and some central services are assumed to be shared.*

| Space Name | User Groups | Tier | Space Requirement | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | | | Laboratory | Laboratory Support | Equipment and Sample Storage | Lab Office | Other | TOTAL | |
| **DEC LAB** | | | **5,625** | **700** | **2,000** | **700** | **975** | **10,000** | |
| Metals Analysis Lab | | 1 | 900 | | 100 | 100 | | 1,100 | |
| Microbiology Lab | | 1 | 1,125 | 100 | 100 | 100 | | 1,425 | |
| Inorganic Chemistry Lab | | 1 | 1,125 | 100 | 100 | 100 | | 1,425 | |
| Organic Chemistry Lab | | 1 | 1,125 | 100 | 100 | 100 | | 1,425 | |
| Biomonitoring Lab | Watershed Management | 2 | 900 | 300 | 600 | 300 | | 2,100 | First floor equipment storage required |
| Air Quality Lab | Air Monitoring Program | 2 | 450 | 100 | 1,000 | | | 1,550 | First floor required |
| Private Offices | 3 Required | | | | | | 375 | 375 | |
| Administrative Asst. / Reception | | | | | | | 200 | 200 | |
| Conference Rooms | 2 Required | | | | | | 300 | 300 | |
| Lobby | | | | | | | 100 | 100 | |
| **OTHER ANR LABS** | | | **725** | **100** | **0** | **100** | **0** | **925** | |
| Forest Biology Lab | | 2 | 275 | | | | | 275 | Non DEC space |
| Fish and Wildlife Lab | | 2 | 450 | 100 | | 100 | | 650 | Non DEC space |

## CO-LOCATED SPACE PROGRAM

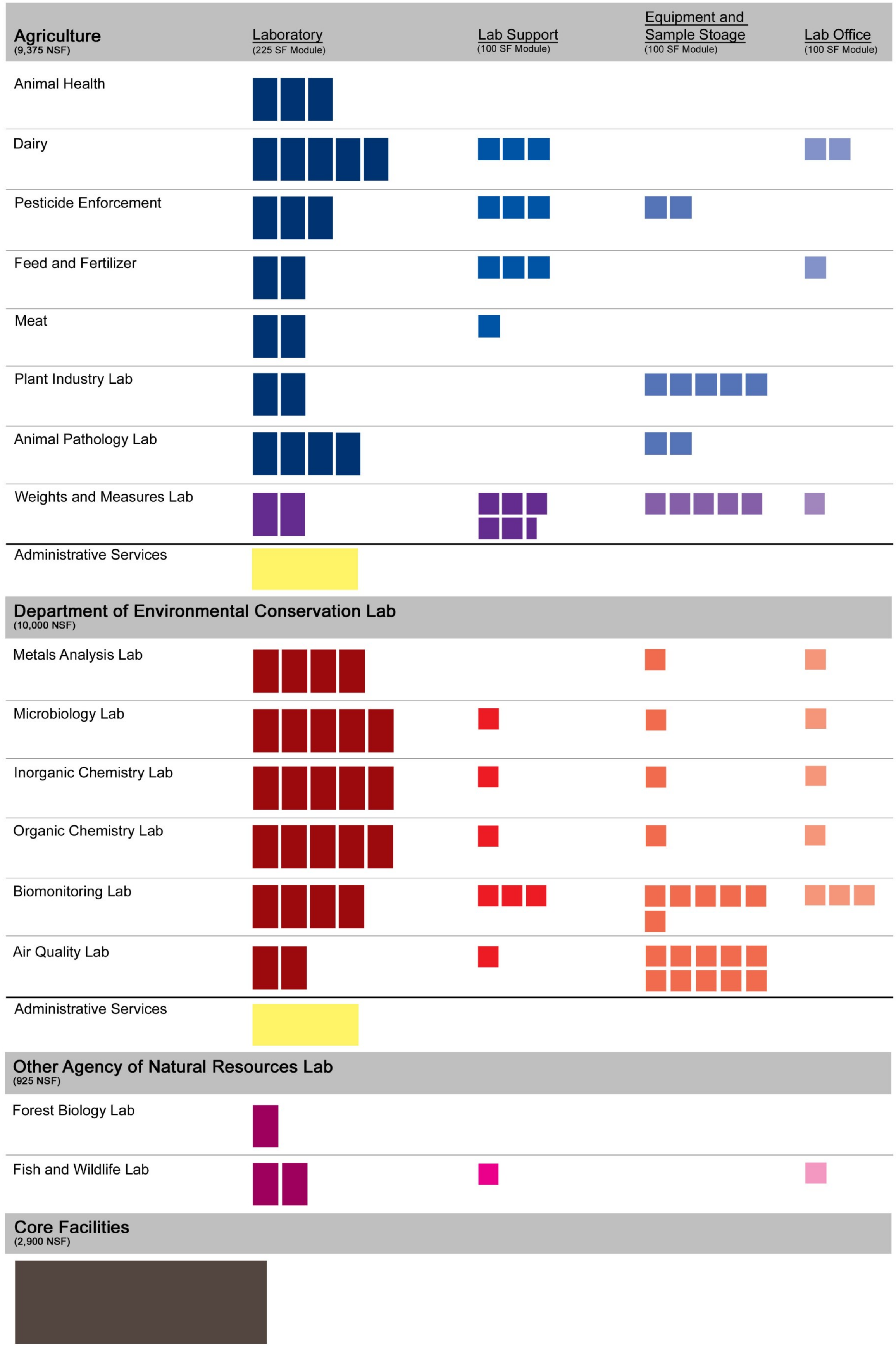
*NOTE: The co-located space program assumes that the governance model will be similar to the model utilized in the previous facility in Waterbury. Certain functions such as sample receiving and some central services are assumed to be shared.*

| Space Name | User Groups | Tier | Space Requirement: Laboratory | Laboratory Support | Equipment and Sample Storage | Lab Office | Other | TOTAL | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **CORE FACILITIES** | | | **0** | **0** | **0** | **0** | **3,150** | **3,150** | |
| Sample Receiving | | | | | | | 500 | 500 | |
| Central Segregated Storage | Includes refrigerators / freezers | | | | | | 400 | 400 | |
| Autoclave | | | | | | | 150 | 150 | |
| Glass Washing | | | | | | | 150 | 150 | |
| Central Lab Services | Deionized Water System / Gas Cylinders | | | | | | 150 | 150 | |
| Locker / Changing Rooms | | | | | | | 500 | 500 | |
| Classroom / Training Lab | | | | | | | 1,000 | 1,000 | |
| Breakroom | | | | | | | 200 | 200 | |
| IT / Server Room | | | | | | | 100 | 100 | |
| **PROPOSED NET ASSIGNABLE AREA** | | | **11,525** | **2,350** | **3,400** | **1,300** | **4,875** | **23,450** | |
| Non assignable area, assumed net to gross area ratio of 60% | Mechanical rooms, corridors, toilet facilities, etc. | | | | | | | 15,633 | |
| **PROPOSED GROSS AREA** | | | | | | | | **39,083** | |

Provide space on site for:

- Freestanding greenhouse for plant lab
- Trailer storage for air monitoring
- Fleet storage for watershed management (including watercraft)

## Co-Located Laboratory Space Program



## COLLABORATIVE SPACE PROGRAM

*NOTE: The collaborative space program assumes that the Tier 1 labs will be included in a new shared governance model. The Tier 2 and Tier 3 labs will be located in the new facility but will not be included in the new governance model.*

| | | | Space Requirement | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Space Name | User Groups | Tier | Laboratory | Laboratory Support | Equipment and Sample Storage | Lab Office | Other | TOTAL | Notes |
| **CHEMISTRY LABS** | | | **4,275** | **800** | **1,800** | **500** | **0** | **7,375** | |
| Nutrients Lab | Acid Rain, Watershed Management, Waste Management | 1 | 900 | | 200 | 100 | | 1,200 | |
| Metals Lab | Feed & Fertilizer, Acid Rain, Water Quality, Hazardous Waste | 1 | 675 | 400 | 500 | 100 | | 1,675 | |
| Nonautomated Analysis and Inorganics Lab | Feed & Fertilizer, Meat, Acid Rain, Watershed Management, Waste Management | 1 | 1,125 | 200 | | 100 | | 1,425 | |
| Organics Lab | Pesticide, Acid Rain, Watershed Management, Waste Management, Air Quality | 1 | 1,125 | 100 | 100 | 200 | | 1,525 | |
| Air Quality Lab | Air Monitoring Program | 2 | 450 | 100 | 1,000 | | | 1,550 | First floor required |
| **BIOLOGY LABS** | | | **4,950** | **800** | **1,500** | **700** | **0** | **7,950** | |
| Microbiology Lab | Animal Health, Dairy, Meat, Water Quality | 1 | 1,575 | | 200 | 200 | | 1,975 | |
| Molecular Biology Lab | Plant Health, Animal Health | 1 | 450 | 400 | | 100 | | 950 | |
| Plant Health Lab | Plant Pathology, Entomology | 2 | 450 | | 500 | | | 950 | First floor required |
| Forest Biology Lab | Forest Biology | 2 | 225 | | | | | 225 | Non DEC space |
| Biomonitoring Lab | Watershed Management | 2 | 900 | 300 | 600 | 300 | | 2,100 | First floor equipment storage required |
| Animal Pathology Lab | Animal Pathology | 2 | 900 | | 200 | | | 1,100 | new function |
| Fish and Wildlife Lab | Fish and Wildlife | 2 | 450 | 100 | | 100 | | 650 | Non DEC space |
| **WEIGHTS AND MEASURES** | | | **450** | **550** | **500** | **200** | **0** | **1,700** | |
| Weights & Measures Lab | | 3 | 450 | 550 | 500 | 200 | | 1,700 | First floor required |

## COLLABORATIVE SPACE PROGRAM

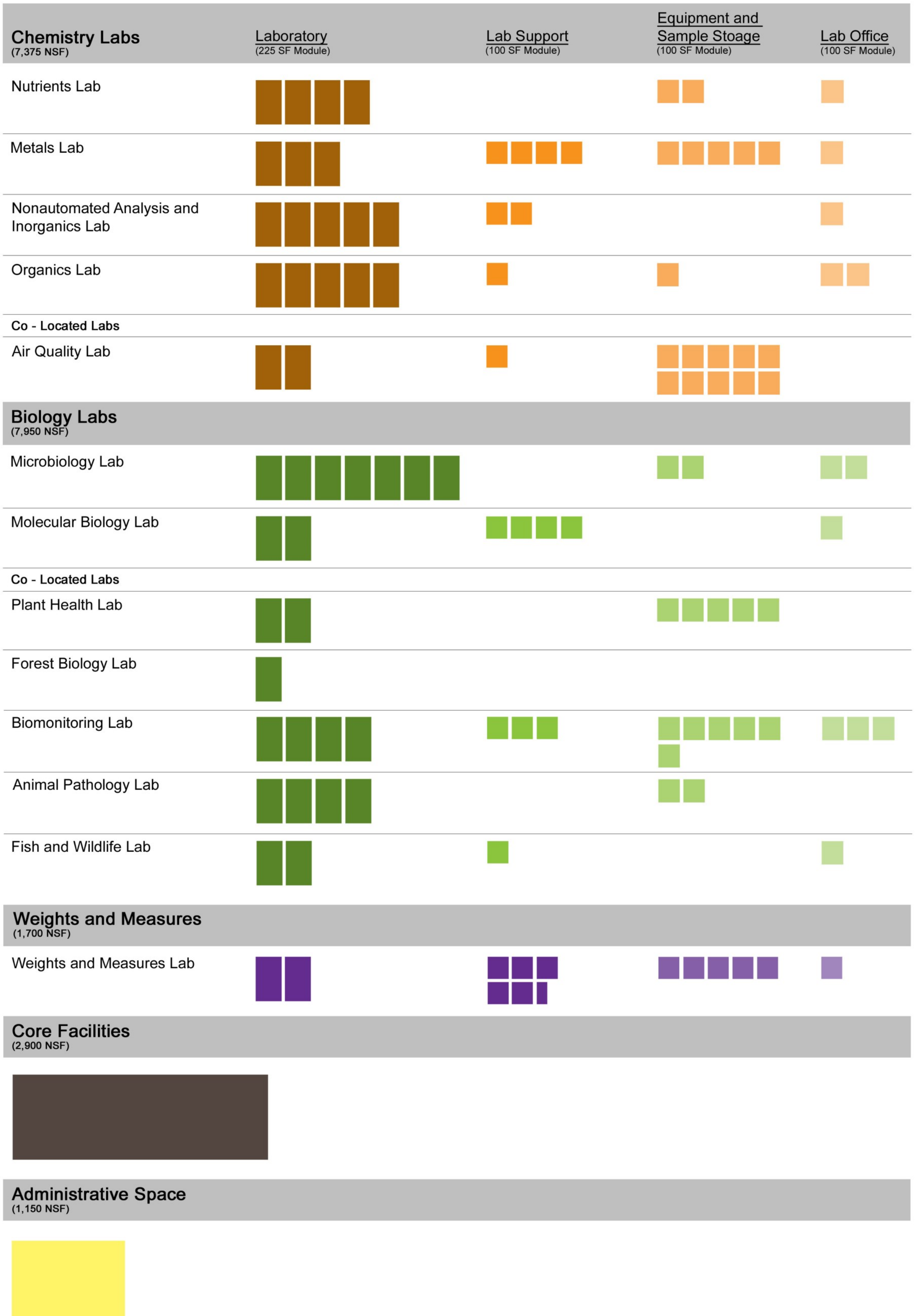
*NOTE: The collaborative space program assumes that the Tier 1 labs will be included in a new shared governance model. The Tier 2 and Tier 3 labs will be located in the new facility but will not be included in the new governance model.*

| Space Name | User Groups | Tier | Space Requirement: Laboratory | Laboratory Support | Equipment and Sample Storage | Lab Office | Other | TOTAL | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **CORE FACILITIES** | | | **0** | **0** | **0** | **0** | **3,150** | **3,150** | |
| Sample Receiving | | | | | | | 500 | 500 | |
| Central Segregated Storage | Includes refrigerators / freezers | | | | | | 400 | 400 | |
| Autoclave | | | | | | | 150 | 150 | |
| Glass Washing | | | | | | | 150 | 150 | |
| Central Lab Services | Deionized Water System / Gas Cylinders | | | | | | 150 | 150 | |
| Locker / Changing Rooms | | | | | | | 500 | 500 | |
| Classroom / Training Lab | | | | | | | 1,000 | 1,000 | |
| Breakroom | | | | | | | 200 | 200 | |
| IT / Server Room | | | | | | | 100 | 100 | |
| **ADMINISTRATIVE SPACE** | | | **0** | **0** | **0** | **0** | **1,050** | **1,050** | |
| Private Offices | 2 Required | | | | | | 300 | 300 | |
| Conference Rooms | 2 Required | | | | | | 400 | 400 | |
| Administrative Asst. / Reception | | | | | | | 200 | 200 | |
| Lobby | | | | | | | 150 | 150 | |
| **PROPOSED NET ASSIGNABLE AREA** | | | **9,675** | **2,150** | **3,800** | **1,400** | **4,200** | **21,225** | |
| Non assignable area, assumed net to gross area ratio of 60% | Mechanical rooms, corridors, toilet facilities, etc. | | | | | | | 14,150 | |
| **PROPOSED GROSS AREA** | | | | | | | | **35,375** | |

Provide space on site for:

- Freestanding greenhouse for plant lab
- Trailer storage for air monitoring
- Fleet storage for watershed management (including watercraft)

# Collaborative Laboratory Space Program



# 5. Cost and Schedule

# Cost and Schedule

## Proposed Budget for New Facility Construction

An overall capital cost model for the construction of a new laboratory facility should include the anticipated construction cost, design and other professional fees, furnishings and equipment provided outside of the construction contract, moving costs, internal project management costs, escalation appropriate to the anticipated date for start of construction, and a contingency for unforeseen conditions.

For this proposed laboratory facility, no design work has been completed, nor has a site or location been selected. As such, the cost model at this time is based on the preliminary space program, historical cost information for similar facilities, and appropriate allowances for unknown conditions such as site acquisition costs. Where applicable, we have reviewed the drawings of the Waterbury lab facility that was destroyed to gain further understanding of the general type of construction that is anticipated. The budget developed to date assumes that there will be no inordinate costs for site preparation (such as rock removal or blasting) or for any environmental remediation on the selected site.

The budget is based on construction in the Montpelier area. If the facility is located near the Department of Health facility in Colchester or on a site on or near the University of Vermont campus, it is likely that the area around the site would be more congested. In that case, a contractor could incur some premium cost to manage the more difficult site logistics.

The proposed budget on the following page projects a total cost of between $14.4 million and $18.1 million dollars, depending on contingencies for unforeseen conditions and the extent of cost escalation. The proposed budget includes:

- Contingencies for unforeseen design and construction issues, and an estimating contingency, that altogether total approximately $2.8 million dollars. These are considered appropriate values to carry at this stage of the project.
- An escalation factor of 7 percent, which is approximately $900,000. This is based on construction starting in two years (spring of 2016), and occupancy of the completed building 14 to 16 months later.
- The proposed budget is based on the size of facility required to accommodate the collaborative model, Option 3.
- A site acquisition allowance of $200,000 that could vary considerably, or may not be required at all if the selected site as leased.
- No allowance has been made at this time for new furnishings or equipment. It is assumed that existing furnishings will be moved. Any new laboratory equipment or instruments that may be required, other than fume hoods, biosafety cabinets, etc. is assumed to be budgeted separately.

## Basis of the Conceptual Construction Cost Estimate

The following outlines the assumptions made about the design and construction of the proposed facility in order to develop a conceptual cost model, including size, general configuration, and primary materials and systems used. The conceptual cost model is assembled from historical costs for each system and assembly that would typically be expected in an analytical lab similar to the proposed facility. In many cases, the systems and assemblies are similar to those that were used in the Waterbury facility that was lost. The detailed construction cost breakdown is included on **Page 56**.

1. Estimate Summary: This conceptual construction estimate includes all normally included construction trade costs as well as pre-construction estimating and design contingencies, builder's construction contingencies, owner's contingencies, general conditions (staff), general requirements, contractor bonds, general liability Insurance, Montpelier building permit fees, escalation (to March 2016), builder's pre-construction service fee and construction manager's fee.
2. Estimate Re-cap: The estimate is organized in seven sections; Core & Shell Building Costs, Tier 1 Laboratory Fit-out, Tier 2 Laboratory Fit-out, Tier 3 Laboratory Fit-out, Core Facility Fit-out, Administration Fit-out and Sitework. The sections are based on the Collaborative Space Program.
3. Sitework costs are based on a utilizing an average unit price for Site Development. This average site development cost (based on historical data) includes Site Preparation, Earthwork, Site Utilities (Electrical, Fire Protection Water, Telephone, Data, Domestic Water, Sanitary Sewer, and Gas +/- 150' from street), Site Paving and Site Improvements. The cost would not include excessive rock excavation, removal of contaminated soils, and excessive earthwork (cut/fills). This cost could vary considerably depending on the actual site selected.
4. Foundation costs are based on the Vermont State Laboratory Building built in 1989, which is similar in size to this conceptual building, in order to determine a "sample" quantity of all components of the foundation system for this type of building. The components include conventional wall and column footings, concrete foundation walls, slabs on grade and composite

## PROJECT COST SUMMARY

| State of Vermont: VAAFM / DEC Laboratory Facility | | | | | |
|---|---|---|---|---|---|
| **BID DATE: 1/1/2016** | | | | **Construction Start: 4/1/2016** | |
| | | | | | |
| **COST CATEGORY** | | | | | **Total** |
| **I** | **CONSTRUCTION (BUILDING)** | | | | |
| | **A.** | Trade Costs | | | $9,434,000 |
| | | General Conditions / OH&P | | | $1,802,000 |
| | | | **I SUBTOTAL** | $318 / SF | **$11,236,000** |
| **II** | **CONSTRUCTION (NON BUILDING)** | | | | |
| | **A.** | Sitework | | | $1,200,000 |
| | **B.** | Site Utilities - included with sitework | | | $0 |
| | **C.** | Hazardous Materials Abatement (none anticipated) | | | $0 |
| | | | **II SUBTOTAL** | | **$1,200,000** |
| **III** | **FURNISHINGS FIXTURES & EQUIPMENT** | | | | |
| | **A.** | Audio Visual Equipment (none assumed) | | | $0 |
| | **B.** | Furnishings (none assumed) | | | $0 |
| | **C.** | Telecom Equipment - included with network | | | $0 |
| | **D.** | Computer (Network) Equipment | | | $100,000 |
| | **E.** | Appliances | | | $1,500 |
| | | Other | | | $0 |
| | | | **III SUBTOTAL** | | **$101,500** |
| **IV** | **FEES & EXPENSES** | | | | |
| | **A.** | Architect | | | $1,125,000 |
| | | Geotechnical | | | $10,000 |
| | | Legal | | | $0 |
| | | Land Survey | | | $10,000 |
| | | Specialty | | | $25,000 |
| | **B.** | Builders' Risk (Owner's Insurance) at 0.3% | | | $37,308 |
| | **C.** | Permits - included above | | | $0 |
| | **D.** | Moving Costs | | | $25,000 |
| | **E.** | Construction Materials Testing | | | $50,000 |
| | | | **IV SUBTOTAL** | | **$1,282,308** |
| **V** | **OTHER** | | | | |
| | | Site Acquisition Allowance | | | $200,000 |
| | | Security during Construction (none assumed) | | | $0 |
| | | Project Management Allowance 3% Constr + Furn Total | | | $376,125 |
| | | | **V SUBTOTAL** | | **$576,125** |
| | | | | | |
| | | **PROJECT COST TOTAL WITHOUT CONTINGENCIES** | | $407 / SF | **$14,395,933** |
| | | | | | |
| | **CONTINGENCIES & ESCALATION** | | | | |
| | **A.** | Estimating Contingency at 5% | | | $472,000 |
| | **B.** | Design Contingency at 10% | | | $990,000 |
| | **C.** | Escalation at 7% (3.5% per year x 2 years) | | | $885,000 |
| | **D.** | Owner's Project Contingency at 10% | | | $1,372,000 |
| | | | **SUBTOTAL** | | **$3,719,000** |
| | | | | | |
| | | **PROJECT COST GRAND TOTAL** | | $512 / SF | **$18,114,933** |

concrete slabs on metal deck.

5. Superstructure costs are based on a two-story structural steel frame designed to be 15 lbs per sqft of building area. The scope includes columns, beams, bracing, moment connections, metal floor and roof deck, metal pan stairs and miscellaneous metals. The entire steel frame is assumed to be spray fireproofed.

6. Exterior enclosure is based on a 2-story building with a footprint of approximately 250'x70'. The building height is 29'-0" with 14'-6" floor to floor and floor to roof height. Exterior wall is comprised of a cold formed metal stud back-up wall, insulation, air and vapor barrier, and brick veneer (equals 75% of total exterior wall), punched windows (equals 15% of total exterior wall), and "special feature" glass walls at the entrance (equals 10% of total exterior wall).

7. Roofing is based on a PVC membrane roof with tapered insulation, aluminum flashing and trim, walkway pads and roofing accessories.

8. Interior Construction and Finishes: The fit-out areas include primarily metal stud / gypsum wallboard partitions, with limited concrete block. The partition and door opening density was based on a study of the 1989 laboratory building, reduced 25 percent. Percentages of ceiling types, flooring and wall finishes were based on the 1989 building's finish schedule which indicated various finishes suited for different types of labs and other fit-out areas. Some of the finishes include: acoustical ceiling system, gypsum wallboard ceiling systems, exposed painted ceilings, allowances for special ceilings, gypsum wallboard soffits, carpet tile flooring, sheet vinyl flooring, vinyl tile, sealed concrete floors, rubber flooring, and ceramic tile floors.

9. Equipment, Furnishings and Special Construction costs includes loading dock equipment, residential equipment, window treatments, lab equipment, lab fume hoods, and lab casework . Allowances are included for visual display boards, signage, wall and corner guards, toilet compartments and accessories, fire protection specialties, and a 200 sqft freestanding greenhouse.

10. Conveying Systems costs include one (two stop) passenger/freight hydraulic elevator with standard cab finishes.

11. Fire Protection costs include a fire protection "central plant" entrance assembly (not including a fire pump), standpipes in the fire stairs and piping mains in the corridors. The fit-out areas include sprinkler fire protection design based on a sprinkler head covering between 110 – 130 square feet.

12. Plumbing costs include a "central plant" (domestic hot water heater, circulation pumps and piping, rainwater drainage system) with plumbing fit-out specific to the areas. The fit-out costs includes plumbing fixtures, water distribution piping, sanitary, waste and vent piping, equipment piping/connections, and "other" plumbing system (DI water, gas, compressed air, etc.)

13. HVAC costs include a central plant for heating hot water systems. The boiler serves roof top air handlers with DX cooling, interior FCUs, VAVs, CUHs and tempered MAUs with insulated supply and return HVAC piping. Other equipment includes exhaust fans, water treatment systems, heat exchangers, condensate recovery systems, etc. The building is fully ducted with rectangular galvanized and stainless steel, insulated, supply ductwork, and exhaust ductwork. The perimeter wall includes base board fin tube radiation in office spaces. A building management system monitors and controls all HVAC systems in the building.

14. Electrical costs include a 1000 amp service entrance with main distribution panels and switchgear. A 250KW, dual fuel, generator (with ATS, conduits and feeders) provides emergency power to the building's life safety systems. The building electrical central plant cost also includes electrical equipment connections, lighting control system, power inverter, tele/data head end system, fire alarm annunciator panel and security head end system. The electrical fit-out includes power distribution panels and feeders, wiring devices, lighting, tele/data drops/outlets, fire alarm devices and wiring, security devices and wiring, and miscellaneous electrical fit-out costs.

### ***Project Development Schedule***

The proposed schedule on the following page outlines the steps required in order to complete a new lab facility prior to the expiration of the lease on the Hills Building at the University of Vermont. The Hills Building lease expires in August, 2015, with two one year extensions available. Given the required occupancy date in the summer of 2017, and the expectation that a building of this nature will require 14 to 16 months of construction, this means that a construction contract must be awarded no later than early 2016.

Assuming authorization from the Legislature in early 2014 to move forward, this allocates approximately 18 to 22 months to complete site selection, architect selection, detailed space programming and planning, design, and production of construction drawings by the end of 2015. This time frame appears to be adequate, but will require that momentum be consistently maintained throughout that period.

**Project: Lab Building Montpelier VT** — *S / L / A / M Construction Services*

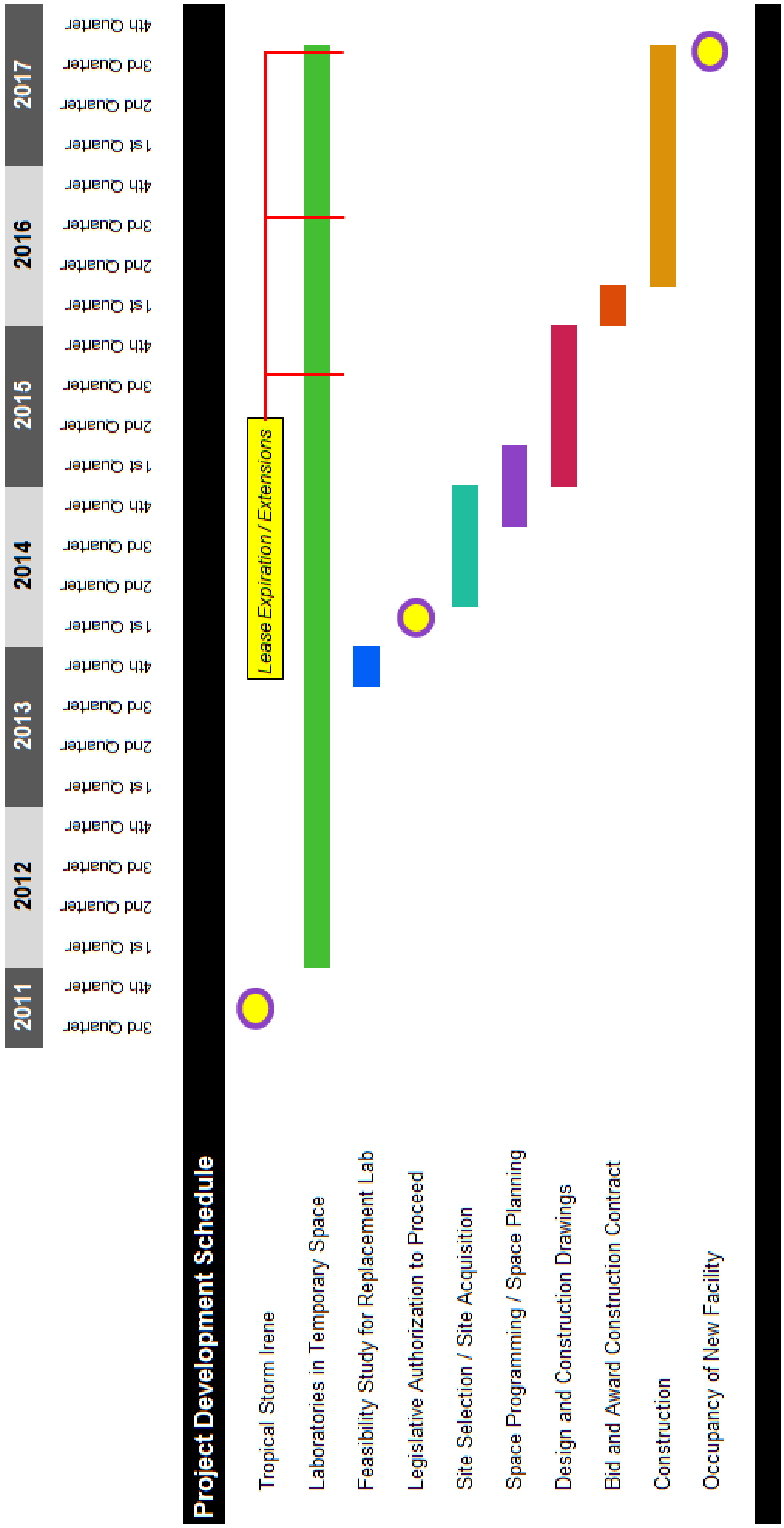
Estimate: Conceptual Estimate
Drawings: The SLAM Collaborative — January, 2014
Dated: December 20, 2013 — Project # 13184.00

| Division | Description (Construction Cost Recap) | Core/Shell 35,375 SQFT | Tier 1 Lab Fit-out 8,750 SQFT | Tier 2 Lab Fit-out 6,575 SQFT | Tier 3 Lab Fit-out 1,700 SQFT | Core Facility Fit-out 3,150 SQFT | Admin. Fit-out 1,050 SQFT | Total 35,375 SQFT |
|---|---|---|---|---|---|---|---|---|
| 01000 | Trade General Requirements | in GCs | in GCs | in GCs | in GCs | in GCs | in GCs | in GCs |
| 02000 | Demolition | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 03000 | Concrete Work | $442,000 | $0 | $0 | $0 | $0 | $0 | $442,000 |
| 04000 | Masonry | $551,000 | $6,000 | $5,000 | $1,000 | $2,000 | $1,000 | $566,000 |
| 05000 | Metals | $1,403,000 | $28,000 | $21,000 | $5,000 | $10,000 | $3,000 | $1,470,000 |
| 06000 | Woods & Plastics | $82,000 | $55,000 | $41,000 | $11,000 | $20,000 | $7,000 | $216,000 |
| 07000 | Moisture and Thermal Protection | $478,000 | $5,000 | $3,000 | $1,000 | $2,000 | $1,000 | $490,000 |
| 08000 | Doors and Windows | $477,000 | $50,000 | $37,000 | $10,000 | $18,000 | $6,000 | $598,000 |
| 09000 | Finishes | | | | | | | |
| | Gypsum Drywall Partitions | $164,000 | $59,000 | $45,000 | $7,000 | $21,000 | $7,000 | $303,000 |
| | Ceiling Systems | $96,000 | $67,000 | $50,000 | $5,000 | $26,000 | $9,000 | $253,000 |
| | Flooring | $70,000 | $82,000 | $37,000 | $4,000 | $30,000 | $7,000 | $230,000 |
| | Wall Finishes | $47,000 | $72,000 | $54,000 | $2,000 | $26,000 | $4,000 | $205,000 |
| 10000 | Specialties | $35,000 | $15,000 | $11,000 | $3,000 | $5,000 | $2,000 | $71,000 |
| 11000 | Equipment | $23,000 | $369,000 | $122,000 | $0 | $250,000 | $2,000 | $766,000 |
| 12000 | Furnishings | $15,000 | $257,000 | $76,000 | $0 | $20,000 | $1,000 | $369,000 |
| 13000 | Special Construction | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14000 | Conveying Systems | $63,000 | $0 | $0 | $0 | $0 | $0 | $63,000 |
| 15300 | Fire Protection Systems | $62,000 | $44,000 | $33,000 | $9,000 | $16,000 | $5,000 | $169,000 |
| 15400 | Plumbing Systems | $256,000 | $200,000 | $150,000 | $39,000 | $47,000 | $12,000 | $704,000 |
| 15500 | HVAC Systems & Equipment | $564,000 | $366,000 | $275,000 | $71,000 | $102,000 | $37,000 | $1,415,000 |
| 16000 | Electrical Systems | $442,000 | $273,000 | $205,000 | $53,000 | $98,000 | $33,000 | $1,104,000 |
| | Sitework | | | | | | | |
| | **Subcontracted Subtotal** | **$5,270,000** | **$1,948,000** | **$1,165,000** | **$221,000** | **$693,000** | **$137,000** | **$9,434,000** |
| **General Conditions & Fees** | | | | | | | | |
| 8.00% | General Conditions & General Requirements | $509,000 | $188,000 | $112,000 | $21,000 | $67,000 | $13,000 | $910,000 |
| 0.00% | Bonds (Subcontractors) | included in unit pri | included in unit pric | included in unit pric | included in unit price | included in unit prices | included in unit price | included in unit prices |
| 1.00% | Bonds (Builder) | $69,000 | $25,000 | $15,000 | $3,000 | $9,000 | $2,000 | $123,000 |
| 1.00% | General Liability Insurance | $64,000 | $24,000 | $14,000 | $3,000 | $8,000 | $2,000 | $115,000 |
| 0.85% | Montpelier, VT - Building Permit Cost | $54,000 | $20,000 | $12,000 | $2,000 | $7,000 | $1,000 | $96,000 |
| 2.50% | Overhead & Profit - Fee | $190,000 | $70,000 | $42,000 | $8,000 | $25,000 | $5,000 | $340,000 |
| 2.00% | Builders Construction Contingency | $122,000 | $45,000 | $27,000 | $5,000 | $16,000 | $3,000 | $218,000 |
| | **Subtotal GCs & fees** | **$1,008,000** | **$372,000** | **$222,000** | **$42,000** | **$132,000** | **$26,000** | **$1,802,000** |
| **Subtotal Construction Costs excluding contingencies** | | **$6,278,000** | **$2,320,000** | **$1,387,000** | **$263,000** | **$825,000** | **$163,000** | **$11,236,000** |

**Conceptual Construction Cost Model (Building Cost Only) Excluding Contingencies**

# Cost and Schedule





# 6. Site and Location Options

# Site and Location Options



## ***Location Issues***

Three possibilities for the location of the lab have been subjected to an initial review as part of this study:

- Locate within a 10 mile radius of Montpelier, on a site to be acquired.
- Locate adjacent to the new Department of Health Lab in Colchester
- Locate on or near a University campus. The two most realistic options appear to be the University of Vermont in Burlington and Vermont Technical College in Randolph.

Each of these choices has pros and cons. The table on the following page compares and contrasts several factors that may ultimately influence a decision. Several of the key issues are discussed further, as follows:

***Centrality of Montpelier***: Locating near Montpelier would have the benefit of improving the lab's access to agency leadership and resources, reducing "windshield time". It would also be somewhat centrally located for Departments that are providing services throughout the State.

***Access to Lab Resources in Colchester***: A site adjacent to the Department of Health and UVM research facilities could have significant benefits to efficiency, productivity, and greater collaboration in the long term. In addition, it is foreseeable that the area around the DoH Lab in Colchester and the UVM research facilities could well develop into a "technology park" type of environment in the future, providing even more significant opportunity for the growth of lab space (or the lease of lab space).

***BSL-3 Access***: The potential future need for BSL-3 capability needs to be considered carefully. A Colchester or Burlington location provides convenient access to existing BSL-3 facilities at the Department of Health lab, if they can be made available when needed. This availability should be confirmed if this is to become a basis for a siting decision. If the lab is located in Montpelier or Randolph, and BSL-3 capability becomes necessary in the future, the available options will likely be a costly addition to the facility, or a willingness to make a trip to Colchester to use BSL-3 facilities there (assuming availability, as mentioned above).

***Campus Issues***: Locating the facility on a college campus may offer access to resources that can be shared, such as classroom and conference space, safety and waste management plans, and perhaps campus central steam or chilled water plants. If any of these are available and can be utilized, it may be possible to reduce the size and cost of the new building accordingly. Conversely, siting and future expansion options could be limited by the campus master plan.

***Site Procurement***: This study generally does not include review and analysis of specific sites for a new facility. In fact, no specific sites have been identified in the Montpelier area, or on or near the University of Vermont or Vermont Technical College campuses. The potential location near the Department of Health lab in Colchester is somewhat clearer. From initial review, there are two potential buildable sites near the DoH lab, one to the north and one to the west:

- The site to the west appears to be adequate to readily accommodate the proposed facility, but it is not clear whether it can be made available. It is owned by the University of Vermont and is reportedly reserved by the university for a new building.
- The site to the north is privately owned and would need to be acquired by the state, or be acquired by the university for lease to the state (as was the land for the DoH facility). This parcel is smaller than the parcel to the west. The parcel appears to be large enough to accommodate the new lab facility as currently envisioned. It is not clear whether it is large enough to accommodate all of the ancillary site requirements, such as parking, outside storage, and shipping/receiving. Further study is needed to confirm the buildable limits of the site, and whether all needs can be accommodated.

The potential future needs should be carefully weighed when considering site options. A location near the Colchester site of the DoH Lab may not be ideal as regards interaction with other departments and field personnel, and it may be more costly initially. If an adequate site can be secured, it may still provide the best opportunity for broader collaboration and the lowest risk option for growth in services looking to the next 5 to 20 years.

**SITE LOCATION EVALUATION**

| LOCATION | Site Within 10 Mile Radius of Montpelier | Co-Locate with Department of Health Lab in Colchester | Locate at Vermont Technical College in Randolph | Locate at University of Vermont in Burlington |
|---|---|---|---|---|
| **EVALUATION CRITERIA** | | | | |
| Annual "Rent" due from lab to BGS (Fee for Space) | | slightly more than Montpelier (to be confirmed) | slightly less than Montpelier (to be confirmed) | slightly more than Montpelier (to be confirmed) |
| Land acquisition cost (borne by BGS) | high initial cost | likely highest initial cost if purchased, or annual lease from UVM | annual lease | annual lease |
| Construction cost (borne by BGS) | | Likely higher than Montpelier | Likely similar to Montpelier (possibly less if campus can provide steam and chilled water from central plant) | Likely higher than Montpelier (possibly less if campus can provide steam and chilled water from central plant) |
| Ability to share safety plan and/or safety officer with another entity | not likely | not likely | TBD | TBD |
| Ability to share waste management plan with another entity | not likely | TBD | same issues would arise as at UVM | doing currently but longer term questionable |
| Ability to share QA/QC officer with another entity | TBD | TBD | TBD | TBD |
| Ability to share LIMS system /management with another entity | not likely | TBD | not likely | not likely |
| "Windshield" time to deliver samples from field | moderate | highest | least | higher |
| Ability to hire and train future workers for replacement of retirees and service expansion | | less difficult | most difficult | less difficult |
| Access to agency leadership, and administrative and program support | best | less | less | less |
| Access to BSL-3 lab space operated by another entity if/when needed | travel to Colchester (if available) ± 40 miles | in adjacent building (if available) | travel to Colchester (if available) ± 60 miles | travel to Colchester (if available) |
| Partnership relationship | N/A | Existing relationship, would expand | No existing relationship | Existing relationship, would be redefined |
| Future expansion | can be accounted for in site selection process | possibly constrained by the campus | possibly constrained by the campus | possibly constrained by the campus |

# 7. Conclusions and Recommendations

# Conclusions and Recommendations



This study examines three options for the permanent replacement of the lab facility in Waterbury that was jointly operated by the Vermont Agency of Agriculture Food and Markets and the Vermont Department of Environmental Conservation. The three options are:

- **Option 1** is to ***OUTSOURCE*** essential laboratory testing to commercial laboratories and/or to public laboratories in other states.
- **Option 2** is to replicate the model that existed in the Waterbury facility as closely as possible, whereby the Agency of Agriculture and the Department of Environmental Conservation would be ***CO-LOCATED*** but maintain separate laboratory operations in the same facility.
- **Option 3** is to consolidate VAAFM and DEC programs in a single ***COLLABORATIVE*** facility operated jointly by the two agencies under a new governance model, in order to maximize efficiency and eliminate duplication.

The three options were selected in an effort to encompass the full range of possibilities available to replace the lab functionality that was lost. The study also considered various secondary issues such as whether to consolidate all functionality on one site or to disperse among other locations, where a new facility might be located, and the impact of foreseeable growth.

The Outsourced model (Option 1) does not appear to be more cost effective than the other two options, nor does it appropriately address all issues related to quality and response time. It does not appear to handle well the need for research and analysis with respect to new services or growth in services. Additionally, for some tests, especially in the environmental field, few if any outside labs have the capability to detect the low levels of contaminants that the tests require.

The Co-located model (Option 2) does adequately address all of the relevant issues and would be a responsible solution for the State of Vermont. It would be the easiest to implement of the three options because it would essentially be "business as usual" with a new facility modeled after the one in Waterbury that was lost. However, programmatically it would suffer from the same functional weakness of redundant services between VAAFM and DEC. In addition, it could only marginally implement the recommendations of the 2006 APHL study for improved operations.

Of the options studied, the Collaborative model (Option 3) is the choice most likely to lead to improved functionality, growth, efficient cost of construction, and reduced operational cost. A significant benefit of such a solution is the ability to implement proven production workflow enhancements commonly referred to as "Lean Production Management". The one significant challenge with Option 3 is that a major change in governance will be required for it to be successful. So far during this study, representatives from VAAFM and DEC have consistently expressed their willingness to make these major changes. It is assumed that this willingness will continue and develop further as a program for construction of a new lab continues.

Thus, the significant benefits of a Collaborative Lab model (Option 3) are:

- Reduced operating cost compared to the Outsourced model (Option 1), and more effective in urgent and emergency situations, where immediate and/or large scale response is needed.
- Reduced cost of construction by approximately $1.7 million, compared to the Co-located model. The anticipated cost for the facility is $14.4 million before escalation and allowances for unforeseen conditions. Assuming construction starting in 2016, the total budget inclusive of these allowances would be $18.1 million, as outlined in ***Section 5*** of this report..
- Reduced cost of facility operation, compared to the Co-located model.
- Reduced staffing costs by approximately $250,000 per year, as compared to the Co-located model.
- Reduced "fee for space" for facility charges by the Vermont Department of Buildings and General Services of roughly $30,000 per year as compared to the Co-located model.
- Best use of space for current needs and future growth.
- Best operational management of work flow and demand to manage growth and peak/emergency situations.
- Most flexibility to adapt to new developments such as growth and changes in testing requirements, and evolving partnerships with neighboring states and with institutions within Vermont. Potential partnerships with other states, with the Department of Health, and with the University of Vermont or Vermont Technical College can be studied further as planning continues.
- Opportunity to implement "Lean Production Management" techniques.
- Opportunity to efficiently implement all recommendations of the 2006 APHL study.
- Alignment with strategic initiatives of the State of Vermont for the delivery of services.

- Enhanced perception of "best use of resources" on the part of VAAFM and DEC from the viewpoint of the citizens of Vermont.
- No significant increase in operational budgets to VAAFM and DEC as the new facility goes into operation.
- All lab functions that existed prior to Tropical Storm Irene can be restored without adding any staff positions.

***Recommendations***

1. Construct a new laboratory facility for VAAFM and DEC and operate it as a collaborative facility with shared governance, with lab functions aligned based on scientific discipline (Option 3). Include all lab functions defined as Tier 1, Tier 2, and Tier 3 in the new facility, and design it for future growth of Tier 1 functions into space initially occupied by Tier 2 / Tier 3 functions.
   - **Provide funding for and immediately begin a process to determine the preferred location and design for the new facility, and to then select and obtain the rights to a specific site. The site for the new facility should be confirmed no later than the end of 2014. Funding should, at a minimum, provide for site selection, acquisition, design and planning costs.**.
   - As part of the site selection process, develop an order of priority among the key factors affecting the decision: proximity to Montpelier, access to BSL-3 space, future collaboration with the Department of Health, and the potential of a higher education partnership.
   - Design the new facility for flexibility and growth, so that the Tier 1 analytical labs can grow into space occupied by the Tier 2 and 3 labs if necessary, and to facilitate changing priorities as state and regional partnerships evolve. Plan for anticipated growth in testing, including areas such as food safety, organic agriculture, GE seed testing, and air toxics analysis.
2. Develop a collaborative governance model for a consolidated and jointly operated laboratory that appropriately shares authority, responsibility, cost and benefits between VAAFM and DEC. If not feasible due to legal constraints on the agencies, then shift all lab personnel to either VAAFM or DEC and implement an appropriate governance model. Implementation of this new model need not wait until the new laboratory facility is complete; in fact, it should be implemented at the earliest reasonable opportunity.
   - With the introduction of the new governance model, implement coordinated plans for laboratory safety, laboratory waste management, and laboratory quality assurance. Require that all occupants of the facility, whether part of the shared governance model or not, be subject to the safety and waste management policies established for the facility. Engage a qualified consultant to participate in the design of the new facility to ensure that these issues are considered in the design.
   - Implement a LIMS (Laboratory Information Management System) throughout the lab (DEC is already using LIMS, but VAAFM needs to bring LIMS online). Consider whether outsourcing of LIMS is advantageous. Engage a qualified consultant to advise on whether to retain or replace the current DEC system, whether and how to interface with the Department of Health system, and how to manage user requirements for security and chain of custody where needed. Implementation need not wait until the new laboratory facility is complete.
3. Include enhanced biosafety level 2 (BSL-2) features in the new facility for future flexibility and ability to respond to a crisis situation. Investigate whether the Department of Health would be willing to provide access to their BSL-3 facility if this becomes necessary in the future.
4. Both as the project develops and after the new facility is complete, continue to explore and upgrade partnerships with labs in other states, and with institutions in Vermont, to develop areas of leadership and specialized expertise in each location.
5. Implement, at a minimum, all major recommendations of the 2006 APHL Study (see ***Appendix B***, page 71).

Other Recommendations:

1. Consider implementing a model where major lab equipment Is leased rather than purchased, as a means of leveling the annual budget and assuring that equipment is regularly upgraded.
2. Continue to monitor the extent of outsourcing, and whether it is cost effective for tests that are done infrequently and require specialized certifications or equipment.
3. Consider establishing a Board of Advisors for the collaborative lab that includes constituent groups.

# 8. Appendices

# Appendix A: Emergency Response Narratives



The examples listed below are a brief overview of the conditions that the labs are regularly required to regulate, investigate and/or resolve. In many instances the demand for information is immediate., and in many cases the need could not have been anticipated Analytical capability is crucial in order to provide accurate information and recommendations that will provide resolution and peace of mind, conserve resources, and prevent financial losses.

***Vermont Agricultural Laboratory***

Over many years the Agricultural Resource Management Division and the Food Safety Consumer Protection Division (FSCP) have responded to a wide variety of situations that have required analytical laboratory services as part of the response and subsequent resolution. Additionally, FSCP routinely uses the analytical services to provide verification sampling to ensure ongoing compliance by the regulated community. The following examples demonstrate the ability of the Agency and Divisions to respond quickly and efficiently to issues that affect growers, consumers, the general public and agricultural service providers. It seems clear that future issues will continue to demand analytical services that are nimble, responsive and fully capable of meeting any demand. Based on past experience it is equally as clear that Vermonters expect this.

1. Neighbor/Orchard 1996-1999: Pesticide drift/contamination case: The neighbor of a large orchard had concerns that orchard pesticides were contaminating their well, pond and large portions of their property through drift. This case was ongoing for a number of years and required the analysis of many water and vegetation residue samples. Sample results led to management changes at the orchard reducing the potential for contamination and allowing the Agency to assess the potential risks on the neighboring property.
2. Lead/Maple: 1994-1998: Analysis of maple syrup for lead content. Older sugaring equipment may contain lead from solder joints thus impacting syrup. Extensive analysis of syrup allowed the Agency to stimulate change within the industry and replace potentially contaminating equipment.
3. Neighbor dispute/herbicide damage: 1995: A homeowner complains that their neighbor is poisoning a hedge along the property boundary. Soils analysis determines that triclopyr (garlon) is present in high concentrations. Subsequent investigation confirms neighbor's use of garlon on the bordering hedge. This case was part of a larger boundary dispute being fought in court.
4. Maple tubing: 1996: Some tubing used to collect maple sap was associated with off flavor syrup. Subsequent investigation determined that phenol and phthalates were responsible for the problems. These compounds were not allowed in food grade containers and equipment and presented potential health issues. Extensive analysis allowed the Agency to determine which types of tubing were suited to this purpose and to steer industry to using appropriate materials.
5. 1996: Benomyl/Simazine: Golf greens were damaged from a fungicide application. Sampling and analysis discovered simazine contamination in the fungicide product. These results allowed the applicator to obtain restitution for the damage. In addition, the case was referred to EPA for investigation of the producer establishment distributing the product.
6. Mis-application/crop damage: 1996: Substantial portions of farm's corn silage crop were destroyed or damaged by the over application of pendimethalin. Laboratory analysis was able to confirm the pesticides used and concentrations used in order for the farmer to seek restitution.
7. School Carpet Contamination: 1997: School maintenance workers sprayed a carpet with diazinon to control head lice. Agency staff collected, delivered, and analyzed carpet samples within 24 hours of receiving the complaint. Letters went home to parents the same day explaining what was used, where it was used, the current levels present in the carpet and associated risks.
8. Organic Farm Drift: 1997: An organic farm's crops were destroyed due to drift from a neighboring aerial application of herbicides. Agency investigation along with laboratory analysis determined the cause of the damage, confirmed the herbicides used and assisted in an insurance settlement for the organic farm. Subsequent sampling preserved the farm's organic certification.
9. Christmas trees/drift: 1997: A neighbor complained that herbicide applications were being made in very windy conditions thus contaminating their property. Investigation and analysis of samples from the site confirmed drift. Subsequent enforcement leads to management changes at the farm to reduce off site movement of pesticides.
10. Railroad herbicide use in no spray zone: 1997: Applicator violated permit by spraying railroad ballast within a well delineated no spray zone. Analysis of vegetation and drinking water confirms the pesticide used in the no spray zone and that the drinking water was not impacted. This case played out in the media and having defensible analytical results allowed the Agency to provide accurate information.
11. Office misuse/diazinon: 1997: Landlord used diazinon inappropriately leading to exposure claims of employ-

ees in office. Sampling and analysis allowed agency to confirm what was used and to provide recommendations for remediation.

12. Clomazone drift case: 1997: Herbicide volatility caused plant damage near the site of application (pumpkins). Sampling and analysis confirmrd the product used and the limits of it's impact on neighboring properties. Subsequent investigation leads to product label changes.
13. School: Drift: 1998: Neighboring corn field treated with herbicides. Investigation includes swab samples of playground equipment and vegetation. Confirmation of drift led to applicator cleaning playground equipment. Analysis of levels found provided information to parents as to the risks associated with detected levels of herbicide.
14. Orchard/Neighbor pesticide/well contamination: 1999-2005: Longstanding neighbor dispute began with allegations that the orchard was contaminating the neighbor's water supply. Investigation and sample analysis of drinking water detects no pesticides. Later complaints of pesticide runoff to neighbor's property are confirmed via sampling and analysis. Enforcement action taken and management changes are made at the orchard. This was a long, ongoing case involving numerous claims and counter claims. Results generated by the laboratory allow the Agency to manage the pesticide risks independent from the other issues at these properties.
15. Large Grocery Chain/Meat Adulteration by Species: 1999: Price Chopper fined on two counts $2002.45 for sales of veal patties which contained greater than 3% pork, [species violation] per Vermont and Federal lab analysis.
16. Larger Grocery Chain/Mislabeling: During a period from 1999 through 2003 Price Chopper supermarkets in Vermont were fined $12,144.07 for ground beef which contained greater than the labeled fat content. During this period approximately 315 samples were analyzed by the Agriculture lab in support of these actions.
17. Larger Grocery Chain/Mislabeling: 2001 P&C Foods fined $752.98 for ground beef that was labeled 80% lean which contained 23.1% fat per Agriculture lab analysis.
18. Retail Stores/Dangerous level of Nitrite in Products for sale: Nitrite sampling of cured meat products produced at retail stores demonstrated excessively high levels of nitrite (restricted ingredient) in products for sale to the consumer. This resulted in the removal of the ability of retail stores to be able to cure product using the retail exemption to inspection, without a third party audit and HACCP plan. The results generated by the laboratory helped to remove potentially harmful food from sale, and prevented it from being produced in the future without stricter oversight.
19. Warrior/Armyworm misuse: 2001: Insecticide misuse on thousands of acres of mixed alfalfa/hay put large amounts of feed at risk of being condemned. Agency sampling and analysis of haylage from over 100 dairy farms demonstrated suitability of feed. Without this analysis all of the feed would have been condemned by FDA. Investigation and analysis of collected samples led to numerous enforcement actions with largest proposed penalties in the history of the pesticide enforcement program.
20. Paraformaldehyde/maple containers: 2002: Imported containers for maple syrup were causing off flavor in the packaged syrup. Laboratory analysis was instrumental in determining that the cause was high levels of paraformaldehyde in the containers. Containers condemned for use.
21. Clarendon Schools/Cancer Cluster: 2004: Unusual numbers of childhood cancers activated residents to determine the cause. Corn herbicide use in the area was a focus of attention especially as it may have impacted a nearby school. Agency sampled school air intakes, filters and numerous water supplies for corn herbicide presence. None detected.
22. Railroad Herbicide use/Monitoring: 1997-2008: As a result of public concerns raised regarding herbicide use within railroad rights of way the Agency began a monitoring program of surface waters near railroads. Results allowed the Agency to recommend management changes to railroads and to modify permits issued for herbicide use.
23. Pet food/melamine: 2007: A national issue resulting in the poisoning of many companion animals was the result of the compound melamine being imported in pet food ingredients. The agriculture lab was able to gear up to analyze for this compound in pet foods collected locally in order to determine potential risks.
24. Allercare recall: Use of a dust mite control product led to allergic reactions by homeowners. Subsequent analysis confirmed the presence of benzyl benzoate; active ingredient. Further investigation determined that fragrances in the product may also be stimulating allergic reactions. Registrant ordered a nationwide recall of the products as a result of this investigation.
25. Carcinogen detected in maple cans: 2008: Maple cans manufactured in China and distributed by Swanton-based company, New England Container Company, contained a human carcinogen. The chemistry lab played a significant role in mitigating the impact of

this issue by providing the laboratory data necessary to prevent further distribution of cans within Vermont's maple industry and ultimately to Vermont consumers. The laboratory data also allowed the Agency to hold the distributor accountable for their actions.

26. Waitsfield Elementary: 2008: Pesticide misuse; an herbicide was used on school grounds during school hours by an uncertified applicator. Investigation and laboratory analysis confirmed compound used and allowed the agency to advise the school and concerned parents regarding risks associated with the presence of the herbicide.
27. East Montpelier monitoring project: 2008: Long term monitoring project resolved issues of shallow groundwater travel and well contamination. This was a complicated investigation that required substantial sampling, analysis and interpretation relative to the local geology. Neighboring farm changed management practices to resolve the problem.
28. Pawlet Elementary School: 2009: Parents of students raised concerns regarding herbicide use on corn near school. Agency investigation and analysis of school water supplies and post application swab samples of playground equipment and air vents determined that risks associated are low. Agency field staff continue to monitor this situation annually.
29. Pesticide dealership: 2010: Pesticide mix and load facility abandoned resulting in potentially serious environmental contamination. Agency sampling and analysis pre and post cleanup assisted in closing the site, allowing for some potential future use, and also allowing for robust enforcement response.
30. Treated Utility Poles/well contamination: 2011: Complaints of foul smelling water led to investigation of new utility poles placed near shallow wells. The combination of recent pole treatment (penta) and excessively wet weather led to the leaching of penta into the shallow groundwater table and thus to neighboring wells. Agency investigation and laboratory analysis provided information to homeowners and the Agency, resulting in alternative water supplies for those impacted and movement of suspect utility poles. This also led to changes in siting of utility poles in the future.
31. Spill Response: Montgomery: 2011: Pesticide applicator rolled truck resulting in a spill to a nearby water course. Agency monitoring of the surface water and laboratory analysis provided information as to the potential impacts of the spill on aquatic organisms.
32. Flooded Feed: 2011: Thousands of acres of corn silage were flooded as a result of tropical storm Irene. Initial responses from FDA suggested that the corn should not be harvested or fed out due to potential mycotoxin and heavy metal contamination. Agency sampling and analysis of the harvested silage allowed on farm use in agreement with FDA, thus saving farmers thousands of dollars in imported feed costs. Silages from numerous farms document metals and mycotoxin levels.
33. Formaldehyde: 2011-2012: complaints relative to formaldehyde foot bath use and application of manure containing formaldehyde to farm fields. Sampling and analysis coordinated with ATSDR due to lab limitations in temporary facilities.
34. Herbicides/Compost: 2012: Compost contaminated with herbicides led to year long investigation and allowed the Agency to assist those impacted. The resulting information obtained also allowed the Agency to impact federal policy regarding product labeling and registration, as well as making recommendations for best management of compost.
35. Bedbug Pesticide Misuse: 2013: Since 2009, hundreds of properties potentially treated with insecticide banned for residential use. Agency staff, state health staff and federal authorities all involved in managing the response. Hundreds of samples obtained and analyzed by Ag and Health laboratories. This case is ongoing but represents the largest pesticide case in the history of the program. More importantly, it demonstrates the need to be able to provide analysis in order to manage a response to protect human health.
36. Monthly Water sampling: Water sampling for monitoring food producer water sources, to prevent adulteration of prepared carcasses and meat and poultry products, and to support regulatory control actions when necessary.

These are the high visibility cases, but in a normal year there are many cases that are quietly resolved simply with the ability to determine if there are contaminants in a meat producing establishment's water supply, in a property owner's drinking water or on their land. The routine monitoring capability is as important as the ability to react to complaints or emergency situations. The Agency is frequently required to mediate differences between competing land uses and landowners that may not be resolved by other jurisdictions. Laboratory resources are critical to providing the needed factual information necessary to resolve these cases. In addition, the Agency is often called upon to provide technical and investigative support to other state agencies and federal entities in resolving issues related to health and the environment beyond typical agricultural scenarios. In the past the laboratory has worked cooperatively with law enforcement agencies to assist with cases involving pesticides.

Perhaps most important of all is how the programs within the Agency use information and data generated by laboratory analytical services to make risk mitigation decisions, compliance determinations, and pesticide management decisions; many of which have national policy implications.

***Department of Environmental Conservation Laboratory***

Originally a water quality laboratory, the Vermont Department of Environmental Conservation Laboratory (DEC Lab) has been at the forefront of modern scientific technology to respond to a wide variety of  needs and to service numerous entities in and outside state government. The DEC Lab accommodates requests by programs in several divisions of the DEC, including Air Quality & Climate, Waste Management & Prevention, Watershed Management, Drinking Water & Groundwater Protection, Geology & Mineral Resources, Facilities Engineering, and Compliance & Enforcement. Additional support and service has been provided to the intra-agency Departments of Fish & Wildlife and Forests & Parks, and non-ANR clients including AOT, AOA, BGS, EPA, Army Corp of Engineers, USGS, UVM, Vermont State Colleges, municipalities and non-profit groups. Listed below are examples of specific services provided by the DEC laboratory that have benefited the entities mentioned above. The benefit and value realized from this unique collaboration of scientists includes custom tailored services and personalized attention to accommodate client's desires (e.g., targeted analytes, limits of detection, data interpretation, and deadlines), and reduced reliance and cost of outsourcing state projects.

1. The Ambient Biomonitoring Network (ABN) program has used the DEC Laboratory to help in determining water quality conditions present within streams in Vermont as part of its bio-assessments. When the biological condition of a stream is found to be impaired the ABN program needs to determine the pollutant responsible for the impaired condition. The DEC Laboratory has supplied high quality data to help determine water contaminants responsible in a wide variety of assessments. Examples include determining the metals responsible for the impairment of the West Branch of the Ompompanoosuc River and then its recovery after superfund mitigation efforts at the Elizabeth Copper mine. Nutrients were found to be the cause of impairment at a number of stream reaches including a tributary to the Stevens Branch below at WWFT, Halnon Brook below a fish hatchery, and Crystal Brook below a failing manure pit. The ABN program has used the DEC Laboratory to help determine the "reference" expectations for different biologically based stream types within Vermont to assess the impairment effects due to human land use within a watershed.
2. In the late 1980s the DEC Lab was requested to build a data base for mercury in the edible section of fish. The data has been used to quantify mercury in fish by location and type of fish. The data has been valuable to the DEC, been used by the Health Department to write health advisories on the consumption of fish, and by the Agency of Agriculture to evaluate its fish farming program. A similar program was initiated to look at PCBs and chlorinated pesticides in fish tissue. As part of a major study of mercury contamination in the northeast, the DEC Lab was instrumental in the development of data to assess sediment and fish tissue mercury concentrations from lakes in the Vermont - New Hampshire Region, and contributing water chemistry measurements. These datasets resulted in a significant enhancement in the State of Vermont's understanding of mercury contamination in its lakes and rivers. The results of the studies were used to issue and improve fish consumption advisories, prepare certain seminal research papers in peer-reviewed scientific literature, and substantiate the need for Vermont's comprehensive mercury legislation, which was signed into law in 2005.
3. The USGS worked with the Lake Champlain Basin Program in 1999 – 2010 to monitor the effectiveness of watershed storm water management practices in the Burlington area. This long-term demonstration project conducted by USGS and DEC staff not only helped to track nutrient (phosphorus) reductions to Lake Champlain, but was one of the few efforts nationally to determine how watershed storm water practices were working in regard to water-quality. These studies evaluated conditions over many years and determined how water quality was changing by providing high-quality, consistent data.
4. The LaRosa Analytical Services Grant is a partnership between the DEC Laboratory, Vermont's volunteer watershed groups, and the DEC Monitoring, Assessment and Planning Program. The project began in 2003 and has since partnered with 31 associations and assessed over 800 sites throughout Vermont. The projects are selected through yearly RFP's and are chosen by a group's ability to assess, investigate, and diagnose a water quality problem of statewide importance. The groups are encouraged to present an action plan for the outcome of their monitoring results. These projects are designed with assistance from department staff and are under the direction of a state required Quality Assurance Project Plan (QAPP). In 2013, 16 LaRosa partners participated with this unique project and serve a vital purpose by generating much needed water chemistry data. Written reports referencing these data are utilized by management to make informed decisions concerning Vermont's waters.

5. Considering the lack of ambient monitoring data for air toxics, the Vermont Legislature mandated in 1993 (Act 92) that an air toxics monitoring program be conducted by the Agency of Natural Resources. This mandate established dedicated funds and directed the ANR/DEC to measure the presence of hazardous air contaminants in ambient air and gather sufficient data to allow the Secretary to establish appropriate standards. The Air Quality and Climate Division (AQCD) immediately began an air toxics monitoring program which involved the collection of ambient air samples at 4 statewide sites assessed for volatile organic compounds (VOC) such as benzene and 1,3 butadiene, as well as carbonyl compounds such as formaldehyde and acetone, and metal compounds such as arsenic and lead. From 1993-2000, the VOC/carbonyl portion of the network was conducted mainly through participation in EPA's Urban Air Toxics Monitoring Program (UATMP) using Clean Air Act (CAA) grant funds. In 1998, the AQCD decided to establish a turnkey in-house program to minimize the reliance on EPA outsourcing and dedicate Vermont State air toxics funds to their intended purpose. The AQCD worked directly with DEC Lab to design an air organics program, specify and procure all of the necessary analytical equipment (for multiple methods) and establish EPA-compliant standard operating procedures. The DEC Lab had all of the components in place by the year 2000 for the AQCD to begin using the DEC Lab for the analytical support for their Air Toxics Monitoring Network.
6. In 2004, EPA established a National Air Toxics Trends Station (NATTS) monitoring network to fulfill the need for long-term air toxics monitoring data of consistent quality. The primary purpose of this 27-site national network of air toxics monitoring stations is tracking trends in ambient levels of air toxic pollutants, regulated under the Clean Air Act, that are associated with a wide variety of adverse health effects, including cancer and neurological effects. Determining levels and trends of these hazardous air pollutants (HAPs) will facilitate measuring progress toward emission and risk reduction goals. Vermont AQCD's Air Toxics monitoring site in Underhill, Vermont is 1 of the 27 NATTS sites and is considered a representative national "background" site for this network. The DEC Laboratory's Organics program played an integral role in establishing and incorporating an additional EPA NATTS method, performance and QA/QC requirements allowing the AQCD to meet NATTS participation/QAPP requirements, and produced air toxics analytical results (VOCs, carbonyl compounds, and metals) of high quality that met all of the established NATTS data quality objectives (DQOs). The most recent EPA NATTS Network Assessment Report (2012) gives Vermont AQCD's air toxics data its highest quality rating over the entire period of NATTS operation.
7. In 2006, the AQCD was awarded an EPA Local-Scale Community Air Toxics Grant for $500,000 to address the lack of ambient monitoring results for spatial and temporal resolution of benzene and other related ambient air toxic compounds. The EPA Grant provided AQCD funds for equipment, staff and analytical costs to perform a 1-year study in Burlington, VT and Manchester, NH. The main study objectives were the validation of a benzene air dispersion model, characterizing the degree and extent benzene impacts populations in small to medium sized urban communities, identify appropriate risk, and evaluate the effectiveness of HAP source emission reduction strategies. The AQCD worked directly with the DEC Lab to hire 2 temporary employees (both subsequently hired as permanent staff) and develop the capacity to process and analyze the significant number of VOC samples collected at Burlington and Manchester. The additional benzene grant VOC samples represented a 700% increase in the number of samples normally processed and analyzed by the DEC Lab in one year. The temporary and permanent DEC Lab staff worked diligently, including nights and weekends to complete the VOC sample processing and analyses within the sample hold times and tight project deadlines. The DEC Lab provided high quality results for 98% of the VOC air samples collected during the one year study which was integral to the ACQD meeting all of its QAPP DQOs and EPA grant obligations. In addition to the DEC's original project responsibilities, numerous Burlington gasoline samples were collected and analyzed for benzene and other VOCs.
8. In 2012 the EPA approved the nation's first TMDL for acid impaired lakes. The VT DEC Lab provided all the water chemistry data to show that reductions in air pollution resulted in improvements northeast water quality. Having a high quality laboratory to provide consistent analysis of trace level pollutants from 1980 – present demonstrated to the EPA that the Clean Air Act has effected results.
9. The Vermont DEC Laboratory has analyzed water samples from Lake Champlain since the 1970s in support of long-term monitoring programs. These long-term data were compiled and reported in a 2012 paper published in the Journal of Great Lakes Research. The results provided important insights into the nature and causes of environmental change in Lake Champlain. Sodium concentrations tripled in the Main Lake region since the 1960s. Chloride increased in the Main Lake by 30% since 1992, but declined in northeastern

regions of the lake during recent years, coincident with reductions in road salt use in Vermont. Total phosphorus concentrations decreased during 1979-2009 in southern and northwestern lake regions, but increased by 72% in Missisquoi Bay where chlorophyll-a concentrations doubled over the period. There was a general lakewide trend of decreasing total nitrogen levels during 1992-2009 that may have been due in part to reductions in atmospheric nitrogen loading to the watershed. No trends in hypolimnetic dissolved oxygen concentrations or depletion rates were found in any of the deep lake regions during 1990-2009.

10. In 1983 the lab found tetrachloroethene in the Williamstown's waste water. It had come from the Unifirst dry cleaning operation in Williamstown. Concurrently the Health Department had begun looking for trihalomethanes in drinking water, and reported detection of tetrachloroethene in the Williamstown drinking water. Subsequent investigations showed tetrachloroethene at the elementary school and other locations in the town. Improper burial of Unifirst waste led to other contaminated sites which fouled other receiving waters. DEC Lab personnel worked in a field EPA Lab with their assigned chemist to categorize the site. Subsequently the DEC Lab provided analysis for 40 VOCs for this and many other sites.

11. In the early 1990s the Waste Management Program needed an analytical method which was more sensitive to volatile aromatic hydrocarbons, typically found in waters contaminated by gasoline spills. The DEC Lab brought a GC coupled with a photo ionization detector (PID) on line, to offer very sensitive detection of volatile aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylenes). Many sites impacted by gasoline spills were monitored and characterized using this analysis. Notable recent sites include Hartland, which has been monitored since the late 1990s, and a spill in Middlebury which occurred in 2007.

12. Landfill monitoring has been supported by the DEC Lab for 40 years. Needed analysis for metals, VOCs and inorganic chemicals have been provided. In the last 15 years direct analysis for the Pawlet, Upper Valley and Morrisville landfills have been provided.

13. The DEC Lab has provided E. coli analysis to support numerous studies and programs. The Agency Enforcement Division routinely submits samples for E. coli analysis and occasionally submits samples for additional analyses. The Lab provided the enforcement officers with sampling kits with written instructions and training. E. coli analysis provided by DEC has enabled the Dept. of Forests & Parks to monitor the quality of its swimming areas. A water quality standard has been set for E. coli which is a key parameter in numerous water quality studies; these include the volunteer monitoring program, the Missisquoi River study, the land use study regarding the housing of cows near waterways, and wastewater treatment permit monitoring. In 2002 the DEC Lab analysis of E. coli in the White River enabled the Department to investigate the Bethel Wastewater Treatment plant.

14. In 1998 the Enforcement Division found 25 drums of material floating in Otter Creek. The DEC Lab analyzed material from each drum and found half of them to be hazardous waste including cyanide and multiple solvent wastes. The case was litigated to and settled by the Vermont Supreme Court.

15. Through its history the bulk of the Lab's work has been to support Water Quality needs and studies. It has provided information for over 30 years archived in a laboratory information management system (LIMS) data base. Since the late 1970's the DEC Laboratory has collected, analyzed and archived data for chlorophyll (a measure of algae in surface water) and phosphorus (correlating to fertilizer usage and runoff). The Watershed Management Division conducted a Lake Champlain assessment of phosphorus in the early 1990s. For the last several years there has been a multi parameter assessment of Lake Champlain. Data bases for Lake Champlain and inland lakes have also been collected and archived.

16. In 2008 EPA contracted with the DEC Lab to provide water quality analysis for a New England wide assessment of approximately 35 lakes. The Lab supports a network of lake/river associations and water districts to provide water analysis to more than a dozen groups. This local state partnership has provided much needed data on numerous water resources at a minimal cost. Wetlands programs have also used the lab for similar assessment.

17. Since 2000 the Geology Division has used the Lab for inorganic and metal analysis of groundwater on a number of tectonic sites. Their results allow the mapping of areas in Vermont. The Army Corp of Engineers has also used the Lab for water quality studies. In 2005-2006 the Geology Division and the Agency of Agriculture tracked nitrate migration in bedrock walls from local farm areas and monitored changes in nitrate concentration in relation to rock formations. Jon Kim (Geology Division) along with Peter Ryan (Middlebury College) worked with undergraduate students on ground water chemistry studies associated with geological mapping.

# A Report on the Laboratories of the Vermont Department of Environmental Conservation and Agency of Agriculture

**Introduction**

The Association of Public Health Laboratories (APHL) was invited by the Vermont Department of Environmental Conservation (DEC) and the Agency for Agriculture to objectively assess and review the operations of their respective laboratories to determine areas of collaboration to improve customer service, to utilize technological resources more effectively and efficiently and, as possible to improve cost effectiveness in the two laboratories. APHL was asked to focus specifically on the analytical chemistry services provided by the two laboratories.

The APHL assessment team was composed of Eric C. Blank, Dr.P.H., Director, Missouri State Public Health Laboratory, Duane Boline, Ph.D., Director, Division of Health and Environmental Laboratories, Kansas Department of Health and the Environment, and Pandora Ray, National Center of Public Health Laboratory Leadership. The review and assessment was conducted February 21-22, 2006.

**Background**

The Department of Environmental Conservation (DEC) and the Agency of Agriculture rely on their laboratories to provide analytical support for regulatory programs in pesticide formulation, registration and use, assurance of clean air and water sources, and assurance of the quality and purity of animal feeds and agriculture products. The regulatory work is highly proscribed by the U.S. Environmental Protection Agency (EPA) for the analytical processes and procedures used in both laboratories. Over time, as both the federal and state requirements became more refined, both laboratories acquired modern, highly advanced instrumentation to meet the needs of their parent agencies. While modern instrumentation improves analytical capabilities and productivity, it comes at a price. It increases direct costs and it leads to more specialization in the people who use these instruments.

The two laboratories are co-located in a building in Waterbury, VT on a campus of state facilities. With the exception of a central core area where administrative support functions are housed, the building is a dedicated laboratory facility. The building is L-shaped with each laboratory housed in a separate wing.

The DEC laboratory has a laboratory director, a Program Services Clerk, seven scientists and a technologist. The Agriculture laboratory has a Laboratory Supervisor, a Laboratory Technologist and six scientists. Three of those scientists are chemists and three are microbiologists. The microbiologists are engaged in state and federal programs overseeing dairy products, animal health and flock and herd disease prevention.

Both laboratories directly support their agencies and consequently have different missions and operational characteristics. For pesticide formulation, regulation and use the Agriculture laboratory is geared to be responsive should there be an event involving possible misuse of pesticide. Because pesticide use is highly regulated, there is also the occasional need for formal chain-of-custody procedures and thorough documentation of analytical methods and processes, some of which may be very specialized for the circumstances. Organic chemistry analytical procedures are used exclusively for pesticides. The analysis of foods and feeds involve both organic and inorganic procedures including tests for heavy metals, nutrients, fiber, fat and protein content.

The DEC laboratory primarily supports clean air and clean water programs. Most of the work is generated through required sampling or monitoring programs and tends to be predictable and somewhat routine. The DEC laboratories engage in organic and inorganic analyses. EPA proscribes the analytical procedures and methods. However, there are occasions such as fish kills, or spills in lakes or streams where additional specialized testing is requested and which may require immediate action or response by the laboratory. Several years ago the DEC laboratory acquired a laboratory information management system (LIMS) to assist them with managing, analyzing and reporting the data they generate from the automated analytical systems.

In 1995, Vermont conducted an internal review of all its laboratories looking for areas of cost savings and efficiencies. Among its findings were the potential for collaboration between the DEC and Agriculture laboratories in the area of metals analysis, and in general collaboration among all the laboratories in developing or obtaining a common laboratory information management system. The report noted that the DEC laboratory had a LIMS and suggested that other laboratories might use it.

In the intervening years, the administrations of DEC and Agriculture have encouraged collaboration between the two laboratories with little visible effect. As state agencies are expected to be more accountable and to effectively utilize all their human and fiscal resources the two departments decided that another review of the operations and functions of the two laboratories was needed. APHL was invited to assess and review the two laboratory operations with a focus on their analytical chemistry functions and look for potential areas where the two laboratories could work cooperatively and collaboratively.

**The Review Process**

Our review began with an entrance interview with, from the Agency of Agriculture, Louise Calderwood, Deputy Secretary; Phil Benedict, Division Director; John Jaworski, Laboratory Supervisor; Nathaniel Shambaugh, Chemist V; Rhonda Mace, Chemist III, and; Brian Wagner, Chemist III. In attendance from the Department of Environmental Conservation were Gary Schultz, Chief of Operations; Harold Garabedian, Assistant Director, Air Quality Division, and; Dr. Gerald DiVincenzo, Environmental Scientist VII (Laboratory Manager). We continued with a tour of both laboratories in which we noted the instrumentation available and in use, discussed with staff the kinds of analyses they performed and their workload in terms of sample numbers or number of analyses. Throughout the tours we also discussed workflow, sample accessioning, tracking and reporting. We interviewed Dr. DiVincenzo and Mr. Jaworski regarding their roles as laboratory managers and the interactions between the laboratories, the programs they support and the role of their positions and the laboratories within the broader missions of their respective departments.

**Observations and Findings**

Our charge was to review the operations and the analytical chemistry services of the two laboratories and recommend potential areas for collaboration and cooperation. In the course of the review and interviews we noted additional underlying factors that may influence and affect any changes that may be considered. We acknowledge that these factors are matters that can only be addressed within and between the two parent state agencies, but these factors are also integral to the way the two laboratories are operated and have been included in this report.

1. The roles or missions of the laboratories within their respective agencies. We noted that there was a more consistent understanding of the role of the laboratory within the Agency of Agriculture administration and the laboratory supervisor. Much of the Agriculture laboratory work is regulatory in nature with the analytical needs clearly defined. Any changes in the regulatory work over time were readily accommodated by improved instrumentation. Consequently, the agency program staff and administration knew what to expect from the laboratory in terms of services and response, and the laboratory staff and management knew what was expected of them and established their operations to meet those needs.

   There did not seem to be as much synergy within the DEC laboratory and the programs it served. While much of the work done in the DEC laboratory is also regulatory, some of the changes over time could not be addressed by improved instrumentation alone. Throughout our visit we noted and were told of the seemingly conflicting demands for labor- and instrument-intensive project specific activities, while still satisfying the more routine needs. This issue also was raised when the matter of response to environmental incidents, such as fish kills or toxic spills was discussed. From the laboratory perspective, these situations require an approach and an allocation of resources, both human and technical that are different than what the current laboratory operation is set up to do. From the agency perspective, the laboratory is viewed as being rigid, and not "customer friendly".

2. "Silos". Both laboratories and their staffs strongly identify with their laboratories and their respective parent agencies. In other words, the two laboratories see themselves as being so different from each other with respect to purpose and customer bases, they don't believe they have much in common. What is more, this trait extended into the individual laboratories. Although staff expressed superficial acknowledgement that the equipment and analyses are similar in the two laboratories, there was also a noticeable perception that while the analysts in the other agency lab were highly competent, their work was distinct from the work conducted in their own respective labs. Even in areas where the analysts use the same kind of instrument for a similar analysis, there were expressions of uniqueness because of the "special methods", the unique nature of the programs being supported, or the plain fact that they used an instrument from a different manufacturer ("Fords versus Chevys").

3. Laboratory Management. Even in small operations, given the imperatives to make the most efficient use of resources and to be able to document that use, it is critical that those vested with management responsibilities devote themselves full-time to that end. This entails continuing, critical evaluation of operational systems and processes; ongoing communication with programs and the administrations of the parent agencies concerning service demands and the fiscal support needed to meet those demands; and looking strategically at the regulatory and technological advancements and changes that could affect the demands for laboratory services in the future, and; problem solving. These functions are in addition to the typical managerial functions associated with personnel, budget, planning and fiscal accounting. For the most part, we noted an emphasis on test management rather than operations management within the laboratories.

4. The physical lay out of the building is a barrier to collaboration. The L-shaped design of the building housing the two laboratories is not conducive to collaborative or cooperative operations. Because each laboratory is housed in one wing of the "L" there are separate shipping and receiving areas, separate sample receiving areas and pathways, separate glassware cleaning and preparation areas. Yet it is these kinds of activities and functions that are the easiest to combine in co-located laboratories because they are common to all laboratories.

5. Current cooperative activities. Despite the strong sense of identity within the two laboratories, and the physical barriers, we observed and were told of some collaborative and cooperative activities. Both laboratory managers were pleased with the sharing of a common source for distilled water piped to all the individual laboratories. The DEC laboratory does nitrate testing for the Agriculture laboratory. The DEC laboratory utilizes an ICP/MS for metals determinations while the Agriculture laboratory performs metals analysis using an ICP/EC. Agriculture samples that require determination at low concentrations are referred to the DEC laboratory for analysis on their instrument.

6. The DEC Laboratory Information Management System (LIMS) is underutilized. That the DEC laboratory acquired a LIMS and has been using it for a number of years is a credit to its organization and management. They do use it for sample receiving and accessioning, quality assurance and reporting, and they have included some management information for cost accounting purposes. Yet we observed within the DEC laboratories hand-written work logs and no central means of tracking samples through the laboratory. We also noted instances where analysts were using spiral notebooks rather than bound notebooks with sequentially numbered pages that are required for legal documentation. Through our interviews we also noted that the full capability of the LIMS to provide management data related to work volumes, work flow, turn-around times for the different analyses and management of quality assurance data had not been explored.

Furthermore we noted that none of the instruments were interfaced with the LIMS, so the raw data had to be downloaded to discs, and re-loaded into the LIMS. It was explained that the DEC IT staff had put the LIMS on the local server and there was reluctance on the part of the DEC laboratory to connect the instruments directly to the LIMS because of the possibility that a computer virus could be transmitted to the instruments from the common server or that the virus protection software could interfere with data acquisition from the instruments. This manual export of data to the LIMS undermines one of the principle functions of a LIMS which is to take raw analytical data and convert it to a form for analysis and reporting according to the specifications and criteria of its programming. While the issue of possible interference with the instrument software system is real, there are solutions that could be employed that will protect both the instruments and the server.

As a separate, but related observation, the Agriculture laboratory, for all its modern, automated instrumentation is still paper dependent. Each analytical area has its own documentation procedure for the pre-analytical, analytical and post-analytical processes and it is all done on paper, much of it manually entered.

7. Staff utilization. We observed that the chemists in both laboratories do all levels of work, from analysis and instrument operation, sample receiving, accessioning and preparation, glassware washing and preparation, even clerical functions such as preparing final reports. The stated value of this was to give the analysts a sense of "ownership" and accountability for the entire analytical process. And, from the laboratory management perspective in both laboratories, the higher-level staff, Chemists and Environmental Scientists, with greater capabilities could be used with greater flexibility than Laboratory Technicians. A concern was also raised that because these laboratories had limited staff sizes there was limited capacity to back-up an analytical area if the principle analyst was absent for an extended period of time. Additionally it was explained that the DEC laboratory was considering having to put a cap or limit on its work- load because the laboratory management did not feel there was enough staff to meet current or anticipated demands.

Given the short time we had talking to and observing the staff we note that we found them to be capable, competent and, to the extent we could tell, proficient at their duties. They are assets for their organizations.

8. Quality assurance for analytical chemistry is duplicated in the two laboratories. Due to the highly regulated and proscribed work in both laboratories, there is a formal and extensive quality assurance process that is part of the laboratory operation. This process requires extensive documentation, data analysis and decision-making. Currently, both laboratory managers perform that function for their respective laboratories. While that arrangement is understandable given the way the laboratories are currently organized and operated, as a practice it is preferable to have the quality assurance function assumed by a staff person that is

not part of the management or specific analytical process. Certain accrediting bodies actually require a quality assurance officer for a laboratory to assure independence in reviewing quality control data. That individual is not a manager with supervisory responsibilities, and generally is not assigned analytical duties in the area or discipline for which they are responsible.

**Recommendations, Notes and Comments**

We were asked to look for areas where the two laboratories could collaborate and also evaluate areas where functions could be consolidated. We have listed our recommendations in order of ease of implementation and more immediate benefits to the more difficult and complicated actions for the parent agencies and laboratories that would result in greater benefits over time. Following our recommendations, we have provided additional comments based on our observations and professional experience that should be considered regardless of the changes that may be contemplated.

**Recommendation 1. Employ the DEC LIMS for all analytical chemistry activities in the Agriculture laboratory.** This will incur additional costs to program the LIMS software to meet the data and management needs of the Agriculture laboratory. There will also be ongoing costs for additional IT support on site at the laboratory building and within the two parent agencies. The current use of the LIMS by the DEC laboratory has been made possible by the dedication of an employee to perform services beyond those required in his position. This is commendable and indicative of the availability and adaptability of skills present in the employees of both laboratories. However both agencies must recognize the need for adequate IT support for the laboratory operations and provide adequate funding for this aspect of laboratory operations. We further recommend that consideration be given to contracting with a consultant to perform a systems analysis for the laboratories to ensure optimal performance that can be achieved through the implementation of electronic data management. In time, the eventual gains in improved workload management, data management, and overall systems management in the Agriculture laboratory and possibly in the DEC laboratory will offset some of these costs. As a related matter, we encourage the two laboratories and the agency's IT staff to work with the vendor to find a better way to transport raw instrument data into the LIMS directly rather than by manual downloads.

**Recommendation 2. Consolidate the sample receiving and accessioning functions into a single area for all analytical chemistry activities in the two laboratories.** Place a dumb terminal in this area, connected to the LIMS and provide a label printer so field staff bringing in samples can log and label them in the sample receiving area. This eliminates the need of having field staff routinely going into the laboratory areas. This recommendation is a natural next step in employing the LIMS in both laboratories. To implement, there will need to be some facility modifications to accommodate additional room for the samples going to the Agriculture laboratory. In the present building configuration, the common receiving area should be in the same wing and close to where pesticide formulation samples are brought in. These samples require separate storage but could still be logged in and labeled through the LIMS, so it seems logical to try and have these two functions in proximity to each other. Cross-trained staff from both laboratories could be utilized to assist with sample receiving tasks. In times when formal chain-of-custody procedures require a physical hand-off of a sample or samples from field staff to laboratory staff, procedures can be incorporated into the sample-reception/accessioning plan so they would also be logged and labeled through the LIMS. These recommendations are consistent with the projected facility security changes that will be required should agroterrorism preparedness become a task required of the Agriculture laboratory.

**Recommendation 3. Designate one professional level staff person to be the quality assurance officer (QAO) for all analytical chemistry testing in both laboratories.** A concern was expressed that an individual from the DEC laboratory would not be familiar with the requirements in the Agriculture laboratory and vice-versa. However, the majority of work in both areas is conducted under specific and detailed methods as proscribed by EPA and should be incorporated into the Laboratory Standard Operating Procedures and Laboratory Test Methods that are required by the EPA. Those documents include quality assurance criteria. Furthermore, as quality assurance criteria are established for project specific analyses it then becomes a simple matter of communicating that information to the QAO. Here too, the LIMS can facilitate the transfer and analysis of raw data and converting that data to usable information. It would be the responsibility of QAO to be familiar with all the applicable methods, standards and criteria for the analytical tests being conducted in both laboratories and to function as a resource for both laboratories on quality assurance issues. This is a common organizational practice in larger laboratories with a comparable variety of procedures and methods. During our discussion of this recommendation, it was suggested that the two laboratories also have a need for a safety officer and a hazardous materials manager. While our emphasis is on the quality assurance functions, we would encourage an evaluation of these other identified needs and an objective determination as to whether one dedicated individual could satisfactorily fulfill them. We cannot make that determination at this time.

The next three recommendations are consolidations of laboratory services based on common analytical areas, skill sets and knowledge. One common advantage to these consolidations is to improve staff utilization and facilitate cross training within specific analytical areas to deal with either surges in work volume or extended personnel absences. Again, we offer them in the order that what we believe would be the easiest to implement to the most difficult.

**Recommendation 4. Consolidate metals analysis in the two laboratories.** Both laboratories utilize similar instrumentation. The nature of the work in the two laboratories is such that the instruments used (ICP/MS and ICP/ES) were selected to meet the analytical requirements of the different programs. Each methodology has advantages that would benefit both agencies by providing access to a broader array of analytical capabilities. Instrument usage would be based on the data needs of the program requesting the service. One instrument would be set up for high concentration levels, while the other would be set up to minimize probable interferences and be used for very sensitive analyses. Sample preparation procedures will vary to ensure that the sample matrix is prepared as required by the method. However, those differences are not so complex that trained, knowledgeable and experienced staff that already use these instruments cannot learn the different methods and procedures. Based on our observations, the two main instruments (ICP/MS and ICP/ES), and the mercury cold vapor analyzer are needed to meet workload demands. However, over time, some cost efficiencies can be realized by going to a single manufacturer for instrumentation. This simplifies maintenance contracts, supplies, software upgrades and any vendor-supplied training. Utilization of single instrument operating software system common to both instruments will improve cross training of staff and simplify the LIMS interface requirements.

**Recommendation 5. Consolidate all "wet chemistry" testing conducted in the two laboratories.** This includes the autoanalyzer area, BOD/COD, mercury, total solids, TDS, pH, conductivity and other ion-specific probes in the DEC laboratory, fat in meat, fiber and protein assays for meats and feeds in the Agriculture laboratory. With the exception of the autoanalyzer area, many of these tests are not be automated and tend to be labor-intensive but require similar skill sets. To go one step farther, a laboratory technician could perform much of this work with oversight by an analyst. This could free the analyst, at least part time, for work in another analytical area, and rotating analysts through this area would assure and maintain testing capacity.

**Recommendation 6. Consolidate all organic analytical services in the two laboratories.** As with the metals analyses, both laboratories use the same kinds of instrumentation but from different manufacturers. However, regardless of the kind of sample, i.e., air, water, or some other sample matrix, the basic methods and operating principles are the same for these kinds of analyses. There are certainly more complexities and variables in organic analysis, but trained, experienced and knowledgeable analysts can readily learn the new applications. Cross training, particularly on the mass spectrometers will be complicated by the fact that the operating systems and software of the two manufacturers are different. Both cost efficiencies and staff utilization will be realized over time with potentially significant gains. We foresee a time when this analytical area utilizes one instrument manufacturer providing leverage for the state in leasing or purchasing contracts and generating costs savings in maintenance contracts, ancillary supplies and vendor-sponsored training. In addition this will allow the laboratory to move to one instrument operating platform which will reduce training time, improve cross training and staff utilization and reduce analytical error rates.

Additional Notes and Comments

1. We note that the manager of the Agriculture laboratory strongly disagreed with the recommendations to consolidate on the basis of analytical areas. He believes they will "cost [his lab] money", and that the institutional barriers are insurmountable. In his opinion, collaborative efforts between state agencies inevitably lose momentum and fail.

2. Implementation of any of the recommendations will require some management and organizational changes in both laboratories. With the consolidation recommendations, those changes will be considerable and will have organizational and fiscal implications for the laboratories and their parent agencies. These aspects are not insurmountable but can get complicated and they cannot be overlooked.

3. Active, consistent and effective leadership from the respective agency's director's offices through the laboratory managers to the staff is essential to making any of the changes work. We note that in 1995 a similar review was conducted with many of the same individuals in place and many of the same conclusions were reached. Yet, the operations of the two laboratories are virtually unchanged. While there are many reasons for this, they can be addressed and overcome with effective leadership.

4. While we were not specifically asked to recommend an organizational structure for consolidating the two laboratories, it is a logical step when considering our recommendations. Respecting the limits of our review, we submit that a consolidation of the two laboratories is a reasonable action to consider with the qualifications previously mentioned in conjunction with strong leadership and an appropriate organizational management structure.

5. If not already done in both laboratories, we encourage management to consider leasing rather than outright purchase of analytical equipment. There are four advantages. First, the leasing costs can be rolled into the operating budget instead of having to request specific appropriations with high price tags. Second, leasing ensures that the equipment meets the latest technical and performance standards. Third, leasing assures that ancillary software is updated as the manufacturer develops it. Finally, leasing negates the need for surplus of outdated equipment. When the costs of ancillary supplies, software upgrades and maintenance contracts are considered, the overall costs to purchase and depreciate an instrument over five years are equal to, and occasionally more, than those same costs under a lease for the same period of time.

6. As noted in our recommendations, in order to implement these changes, some facility renovation may be needed. We also noted some laboratories were not enclosed by permanent walls and had drop-down ceilings thus making them vulnerable to air borne contaminants from other work areas which could affect some of the more sensitive analytical procedures, and could also be considered a safety issue.

7. We encourage that the utilization of staff be examined further regardless of which recommendations may be implemented. We believe that operational efficiency and productivity would increase if the Chemists and Environmental Analysts were permitted to focus on performing the more complex analyses, data review, quality control and assurance, while allowing the technician staff to support those efforts by doing sample preparation, glassware preparation and cleaning, and some of the simpler and routine analyses under the direction of the analytical staff (see the Recommendation 5, consolidation of the "wet chemistry" services of the two laboratories for a specific example). We think this review would be especially important in the DEC laboratory to address the increased demands for project-specific testing while keeping up with the current, regular workloads. Allowing the Environmental Analysts to concentrate on the appropriate level of work for them, and having the Laboratory Technicians doing some of the routine and less complex work may provide adequate staff to meet all current demands.

The APHL review team thanks Dr. Gerald DiVincenzo and Mr. John Jaworksi, and the staff of both laboratories for their time, willingness to discuss difficult issues and their courtesy during our visit.

Eric C. Blank — 3/27/06

Eric C. Blank, Dr.P.H. — Date

Duane R. Boline — 3/28/2006

Duane Boline, Ph.D. — Date

Pandora Ray — Date

Pandora Ray — 3/25/06

8. <u>Quality assurance for analytical chemistry is duplicated in the two laboratories.</u> Due to the highly regulated and proscribed work in both laboratories, there is a formal and extensive quality assurance process that is part of the laboratory operation. This process requires extensive documentation, data analysis and decision-making. Currently, in the Agency of Agriculture, the laboratory manager performs that function. As a practice it is preferable to have the quality assurance function assumed by a staff person that is not part of the management or specific analytical process. Certain accrediting bodies actually require a quality assurance officer for a laboratory to assure independence in reviewing quality control data. That individual is not a manager with supervisory responsibilities, and generally is not assigned analytical duties in the area or discipline for which they are responsible. In the Department of Environmental Conservation the Quality Assurance Officer is a staff person with no responsibility for analyses. This individual implements and keeps the Quality Assurance Plan updated and manages the Laboratory's accreditation requirements.

## DiVincenzo, Jerry

**From:** PandoraRay@aol.com
**Sent:** Sunday, July 02, 2006 2:10 PM
**To:** DiVincenzo, Jerry; eperlman@aphl.org
**Subject:** Responses to Your Questions

Dr. DiVincenzo,

Our apologies for the slight delay in getting back to you. It has been a busy period for the association. Below are the responses to your questions. Hopefully we have adequately addressed them. Please don't hesitate to contact us for clarification.

Warm regards,
Pan

Pandora Ray
APHL Staff Associate

APHL's document "A Report on the Laboratory of the Vermont Department of Environmental Conservation and Agency of Agriculture" based on the review and assessment done on February 21-22, 2006 is being used as a basis for consolidation of the two labs.* The consolidation plan includes the Agriculture microbiology laboratories, which were not part of your assessment.* We are developing model organizations for the Administration to consider and think APHL could help us.* Could you provide the following information?

1)****** Any correspondence or notes on the information sent to you before the assessment which led to some of the conclusions in the report, or some of the assessors opinions, which were left out of the final report.

We reviewed the executive summary of the previous review done in the mid-90s as well some organizational charts at the time of our visit. The only other information that was circulated was the draft report among the three of us, that synthesized our collective notes and observations during the visit.

2)****** A recommended organizational structure * The report states the assessors were not asked to recommend an organizational structure.* The implication is that the team had one in mind and would have provided it if they were asked.

During the exit conference we laid out a suggested organization for consolidation that recommended alignment by analytical area, organic, metals and "wet chemistry" with a dedicated QA officer. The Ag's Microbiology lab could be managed as another area. We recommended that a supervisor/manager head each work unit reporting to the lab director. Other organizational issues that need to be considered, are a safety officer, management of hazardous materials, possibly a LIMS and data manager. These are all important, but they are not necessarily part of consolidation process per se.

3)****** Does APHL have examples of labs which have gone through a consolidation process, their final decisions on organization and whether they were satisfied with the consolidation outcomes?

Virginia and New Mexico are consolidated labs but the timing of the transitions are dated. Our experience is that the in the end, the political mandate to consolidate places a certain obligation on the leadership to make it successful and move on with the work. Debate about the outcome becomes more of a distraction in the face of the mandate.

4)****** Consolidation discussions in the Vermont Agency of Administration include having an appointed Director, who reports to a board.* The Director would be responsible for choosing an organizational structure, managing the laboratory and securing funding and needed support services.* My understanding is that directors, who are political appointees, are an unusual model for government laboratories.* Does APHL agree?

APHL has no formal position on the matter. Many directors however, share a personal opinion is that they should not be appointed. A laboratory's currency is its credibility; grounded in his or her character and integrity without public perception that their first obligation is to who appointed them. Of the handful of states that require the director to be appointed, one option is to hire the director on a contract, and provide that the contract be reviewed/renewed in mid-term. That way, you don't get into revolving directorships which change every election cycle along with health officers, et

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7/5/2006

How managed?

How to pay for services?

How to insure future needs?

How to ensure priority?

What is the institutional support available for bill, and budget, and procurement?

How to address the fact that the Ag Lab budget is not complete (Ag programs indirectly support Ag Lab budget)

What to do with 2 Lab Supervisor positions?

Disparity between workload of 2 labs?

Facility issues – (water system, hazardous waste)

Combined QA & Safety (although may require 1 ½ FTEs).

Move to leasing of major instruments.

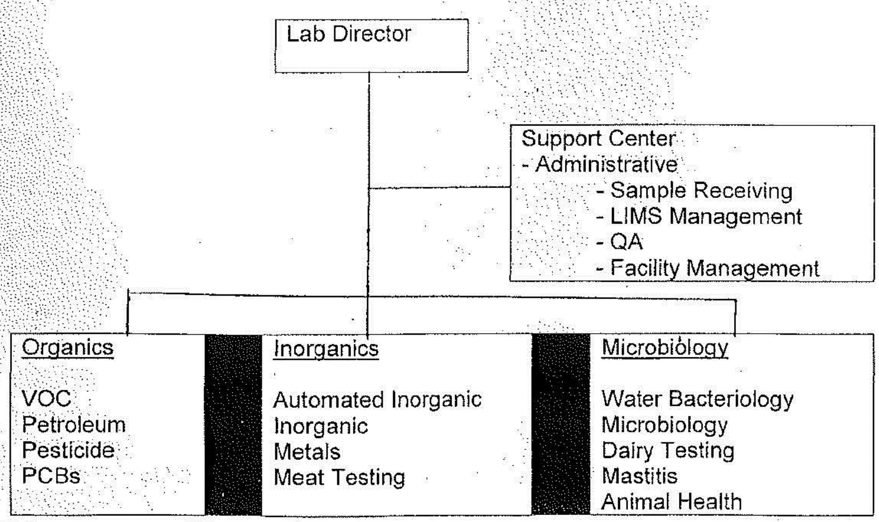
Move to Service contracts on all major instruments.

NELAC certification.

In a consolidated Lab LIMS management becomes full-time job.

Combine Sample Receiving.

No need to do facility rearrangements.



***Lab Title: Inorganics & Nutrients***

Contact: Dan McAvinny, Anne Charbonneau

Description of work activities:

- 99% of tests are surface water, with some ground water samples, and have done soils in the past. Sampling from VT, NY and Quebec.
- Automated nutrient and inorganic analysis- spectroscopic analyses (autoanalyzer)
- Digestion occurs in small, square autoclave- due to volume of samples and frequent use, autoclave ideally would be located in/near lab.
- Ion chromatography- separate instrument and separate test. Occasionally used for drinking water testing.
- Testing for:
    - Phosphorous
    - Nitrates
    - Chlorides
    - Others

Major required equipment:

- Automated colorimetric instruments (autoanalyzers)- had plenty of room at Waterbury facility.

- Ion Chromatograph (bench top unit)
- Floor autoclave, box model for racks of stacked tubes.
- Nitrogen gas cylinders- one cylinder lasts a year- no need to have this piped in from a central tank/cylinder room.
- Sinks on one or both ends of the bench.
- One large fridge.

- TKN may require hot-block either in separate wet lab, or in a hood in the inorganics section .
- Nitrogen combustion analyzer (for Ag)- need H and CO2 gas- would require a little bench space with gas cylinders.

Desired equipment and other resources:

- Fume hood would be nice, but not essential, but is needed if TKN is to be prepped here.
- Hood should be big enough to accommodate TKN (above).
- Can generate up to 60-80 L of waste/week.

Space and/or laboratory requirements:

- Space at Waterbury was sufficient- could handle 3 people.
- Need sufficient bench space for phosphorus analysis, associated with autoanalyzer- 20 ft. of bench space would be nice to have. They have 2 autoanalyzers.
- Waste management- might need space for storage prior to pickup

Safety and regulatory requirements:

- Waste management issues- high volume liquid waste.

Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space):

Internal vs. outsourced:

Data collection/entry/accessioning:

Other info:

- Would be nice to have instrumentation networked to LIMS.

Summary:

- 40 – 50 linear feet of bench space is necessary for optimal set-up of the two autoanalyzers (i.e. 2-3 20' sections of bench space).

- Waterbury had approx. 400 ft2 wet lab space (Compliance Lab, Rm. 255), 400 ft2 digestion lab space (Digest Reflux Lab, Rm. 258), 200 ft2 of other lab space (Special Lab, Rm. 259), 200 ft2 storage/ incubator space (Rms. 256 & 257) = approx. 1,200 ft2 total.
- Should plan for 1,200-1,500 ft2 total.

***Lab Title: Metals Laboratory***

Contact: Dan Needham, Anne Charbonneau

Description of work activities:

- Samples consist of soil, water, feed, fertilizer
- Techniques performed include digestion and analysis, ICP, ICP/MS (higher sensitivity), flow injection/ cold vapor mercury
- Full suite of metals are analyzed.

Major required equipment:

- ICP (Inductively coupled plasma)
- ICP/MS
- Flow injection/cold vapor
- Fume hoods – corrosion issues are important
- Hot blocks located in hood
- Ashing furnace- bench top model, exhausted through canopy hood

Desired equipment and other resources:

- 3-4 fume hoods
- Microwave digester- would replace hot blocks and ashing furnace (large bench top unit, may be coupled with autosampler)
- Lyophilizer/ freeze dryer- wet samples

Space and/or laboratory requirements:

- Waterbury DEC metals lab space was sufficient. Approx. 600 ft2.
- Need grinding area separate from sample prep- air handling/dust suppression important
    - Oven for grinding and oven for sample prep, ideally.

Safety and regulatory requirements: N/A

Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space):

- ICP & ICP/MS could serve both metals (DEC) and feed & fertilizer (Ag)- currently both agencies are using both instruments. Instruments are co-located in same room, but individual instrument chillers (manufacturer specs differ with each instrument) are located in separate room due to noise and heat transfer.
- DEC and Ag could share digestion and sample prep areas.
- Humidity controlled room to deal with dust to deal with soils, fertilizer and feed- located off of sample receiving?
- Flow injection/cold vapor Mercury would need approx. 6 linear feet of bench space that could be in shared digestion and sample prep area. A canopy hood to vent instrument is preferred. Instrument picture not shown.
- Liquid Argon outside tank existed in Waterbury and was used by both DEC and Ag instrumentation and is preferred.

Internal vs. outsourced: N/A

Data collection/entry/accessioning: N/A

Other info: N/A

Summary:

- Should investigate consolidating DEC and Ag functions, given the crossover of use in space and equipment.
- Sample preparation/grinding area is separated from analysis lab area. This could be a room adjacent to the loading dock/shipping-receiving.
- HVAC is an important consideration, given the ducting of the analytical equipment, and the need for temperature and humidity control. Cold Vapor Atomic Ab-

sorption (Mercury) is sensitive to temperature too.

- Should plan for at least 600 ft2 for analysis room, and 400 ft2 for sample preparation/grinding. May require an additional 500-750 ft2 for storage. This needs to be verified on old Waterbury layout.

***Lab Title: Non-Automated Analysis & Nutrients***

Contact: Dan Needham, Anne Charbonneau

Description of work activities:

- Feed and meat are the primary Agriculture samples. Watershed Management Division's surface waters are the DEC's primary samples. Between TSS, Turbidity , Alkalinity, Conductivity and Dissolved Oxygen, the DEC wet chemistry (non-automated) processes nearly 4000 samples for these water quality parameters, annually.
- Fiber: small bench top unit, generates waste that is currently collected.
- Fat extraction: manual, requires ethyl ether- requires hood and water bath- might be better to associate this function with the extraction labs that are currently dealing with volatiles. Used to stand alone.

Major required equipment:

- Fume hood for acetone soak. Reference to the 2000 chlorophyll samples that are extracted into 90% acetone and steeped for 24 hours in fridge, prior to reading on fluorometer?
- Hot block/ plate
- Access to sinks
- Ovens. Multiple ovens needed due to one almost always containing drying TSS filters, at various stages of the analysis.
- Incubator (fridge sized)
- Fridge/freezer combo

Desired equipment and other resources: N/A

Space and/or laboratory requirements:

- Space at Waterbury was sufficient to accommodate these functions.
- Flexible space is good to have.

Safety and regulatory requirements: N/A

- 20 liters of liquid waste generated every 2 weeks (Dissolved Oxygen titrations).

Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space):

- Would be accommodated in the wet lab (DEC)- the space in the DEC wing for wet lab work was underutilized and could accommodate this function as an add-on.
- Works well with chlorophyll extraction and analysis area because both functions require acetone. Separate space for Chlorophyll analysis is needed because it is prepped and analyzed in the Dark.
- Metals extraction area cannot be the same room as the wet lab functions, providing there were dedicated fume hoods for each. Too many samples are being processed between the Wet lab and Metals. I think bench space to lay out work (samples) would be difficult. Wet lab often uses various bench top instruments at the same time and although there is not much sample prep, sink accessibility and bench space becomes difficult already, before adding metals personnel in the same space.
- Fat extraction: manual, requires ethyl ether- requires hood and water bath- might be better to associate this function with the semi-volatile (pesticide) extraction labs that are currently dealing with volatiles. Used to stand alone. High enough volume that is does need a home, but does not necessarily need to be alone.

Internal vs. outsourced: N/A

Data collection/entry/accessioning: N/A

Other info: N/A

Summary:

- Inorganics (Non-Automated Analysis & Nutrients) lab at Waterbury provided sufficient room, and some parts were even underutilized (Rm. 253 and 255 of old Waterbury layout). This was approx. 1,000 ft2.
- Could develop an extraction suite that would accommodate Metals and Organics. Fat extraction could be included with Semi-volatile extraction in Pesticides lab.
- All of these functions would be accommodated by a Chemistry "wing" providing facilities for Metals, Inorganics, extraction, GC/MS, ICP/ ICP/MS, HPLC, Atomic Absorption Spectroscopy. As the Molecular Lab serves multiple disciplines, the Chemistry "suite" would also serve multiple functions.

Questions:

- How much total area did organics require at Waterbury?

***Lab Title: Organics Lab***

Contact: Dan Nielsen, Michael Tefft (DEC); Nat Shambaugh, Candice Barber (Ag)

Description of work activities:

- Occupying some of the same space as Ag. However, Ag and DEC have separate analytical equipment (currently sharing Ag's ICP-OES instrument, and may share DEC's ICP-MS for NOFA soil samples).
- Extraction for TO11- carbonyls (currently in Hills Rm. 227), TO15- cleaning air sampling cans (volatiles in air).
- GC/MS x 2- one is being used for 8260 volatiles in water & soil, semi-volatiles coming; the other is for volatiles in air (TO15).
- Two major VAAFM programs: Pesticide Monitoring (trace level environmental samples, non-regulatory) and FIFRA Pesticide Enforcement (regulate all pesticide use in the state so all concentrations and combinations of the 400 + pesticide active ingredients registered in VT are possible). The enforcement work is generally divided by (formulation strength) product testing versus (trace level) use/misuse samples.
- Non-pesticide support: The VAAFM pesticide lab has supported all divisions of the agency at various times, most commonly helping FSCP division to address issues in the maple syrup industry. There have also been numerous instances of collaboration with VDOH on issues of pesticides (and other organics) and public health as well as working with the Forensics lab on criminal investigations of pesticides and unknown organic compounds.

Major required equipment:

- Fume hoods
- Gas cylinders (secured to wall or bench)
- Liquid nitrogen Dewars – 230 L capacity, requires standard 36" wide door
- Safety shower/ eye wash
- GC/MS, possibly 2
- HPLC/MS/MS
- GC
- HPLC
- HPLC w/ UV detector (Waters)
- Fridge/freezer (at least 2, maybe 3)

Desired equipment and other resources:

- Fridge & freezer space
- Fume hoods (used to have 14, 8-9 being used at a time)
- GC system- would be good for the expansion for 8270 testing
- Snorkel hood- also used for some instrumentation (CFM important consideration; ICP-MS requires 147 CFM, ICP-OES requires 200 CFM)
- Storage space for sampling cans
- Large outside dewers, piped in for nitrogen and argon
- 1xGC, 2xGC/MS, 1xHPLC- need bench space for instruments, as well as extra bench space- did not have this at Waterbury (in the organics main instrument room; some extra bench space in other rooms, e.g., across hall from org. main instrument room)

Space and/or laboratory requirements:

- The space at Waterbury was sufficient- had 4 dedicated fume hoods- GC/MS room was crowded with 2x GC, 2x GC/MS and 1xHPLC (see Waterbury floor plan)
- Some separation b/w extraction and GC/MS spaces- truly separate rooms, not connected by doorway. Separation is critical- the further the better.
- Storage space for cans (used to have a 10'x10' room that help ~100 cans)- plan for expansion. Currently 10 sites with 3 cans each (30 cans), but may expand to include other sites
- Storage space for gas cylinders with piping directly to instruments.
- Need to plan for some expansion of lab.

Safety and regulatory requirements:

- All enforcement work is done under chain of custody so secure facilities are required.

Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space):

- For organics extraction, DEC and Ag could share lab
- Extraction: negative pressure
- Instrumentation : positive
- For Pesticides, high level versus low level samples and solution must be segregated in space.
- Room combos:
  - HPLC room and GC room
  - Volatiles room and semi-volatiles room- makes a lot of sense to keep these separated- contamination issues

- HPLC analysis room should be isolated from areas using acetone.

Internal vs. outsourced: N/A

Data collection/entry/accessioning: N/A

Other info:

- IT infrastructure/ networking issues vs. security- organics lab intranet.

Summary:

- Like Inorganics, organics could have a central extraction room shared by DEC and Ag.
- Volatiles analysis needs to be separated from Semi-volatiles due to cross-contamination issues.
- Organics would benefit from a core facility where interchangeable gas cylinders were piped into the labs.

***Lab Title: Air Quality Lab***

Contact: Ben Whitney, Robert Lacaillade

Description of work activities:

- Consists of 100% air sample collection and operation of continuous air pollution analyzers.
- Data and sample management / processing/shipping.
- Equipment bench testing/certification/calibrations/ referencing/maintenance/repair.
- Two (2) major air monitoring programs:
  - Federally-mandated pollutants, CO, NO2, O2, ozone, SO2, particulates (PM2.5/PM10), and all required meta data (meteorological parameters, flow rates, transfer standards , etc.).
  - Federally/State-mandated hazardous air contaminant (HAC) program for compounds with VT hazardous ambient air standards, contained in the State of Vermont Air Pollution Regulations, Appendix C
- Five (5) monitoring locations around the state, seven (7) personnel for monitoring: 2 field technicians, 1 lab technician, 4 environmental analysts
- Previous facility: served as field operations center for processing and handling particulate and HAC samples, storage for equipment, and backup analyzers, acted as lab area to service and calibrate and reference analyzers and samplers, served as gravimetric analysis room (see floor plan). When this space was originally designed it did not include office space, or other dedicated space for field & lab techs to research, read, perform paper work and database entry etc.

Major required equipment:

- Large commercial fridge
- Large commercial freezer and chest freezer (latter for the sample storage ice blocks)
- Fume hood
- Articulating fume hood for gas and solder fume collection.
- Built-in/central vacuum and pressure lines
- DI water (central to facility, or independent unit)
- Multi-bay lab sink
- Movable shelf racks and shelving for backup analyzers and supporting equipment

Desired equipment and other resources:

- Office space associated with labs.
- Desire to have consolidation of field operations center (sample processing), gravimetric operations, vehicles, backup analyzers, equipment in one location.
- Goal is to have lab be the primary analytical support for hazardous air contaminant operation to include VOC, carbonyl compounds, metals and semi-volatiles.
- Criteria gas pollutants measurement is all on-site at field sites using analyzers. Lab necessary to bench test, reference, calibrate, and service equipment. Part of the efficiency is central location for particle and HAC sample handling, backup analyzer and equipment storage, analyzer/sampler maintenance and calibration, standards storage/maintenance and data collection.
- Desire to have DEC lab perform analysis for semi-volatile HACs analyzed by TO-13A. The Lab does not currently have analytical capability/method for this. Dan Needham indicates an additional ACE Extractor component is necessary. Needham indicates that it would be desirable to have dedicated GC/MS for this work. AQCD currently collects TO-13A samples at one site which is part of an EPA grant supported national network. The EPA grant funds for TO-13A could be diverted to the lab (i.e. $ coming back to the lab) if they build this analytical capacity. Currently there are approximately 70 TO-13A samples/year collected at the one site but semi volatile samples could be collected at other sites in the HAC network bringing the total to approximately 150 samples/ year.
- Metals analysis from particulate filters is also part of the HAC program. In 2008, the DEC metals analyst

(and IO-3.5 program) was cut, but is scheduled to be reinstated at the DEC Lab within 6-8 months. Like the TO-13A example above, EPA provides grant funds for Metals sample analysis for approximately 70 samples per year at one site. These funds will be diverted to the Lab when IO-3.5 capability is reinstated. The goal is to have metals analyses performed on particle samples from other HAC sites bringing the projected total of approximately 150 samples per year.

- Outside wall pass-through for air sampling manifold to connect backup analyzers where manifold system also provides ports for instrumental and blender exhaust.

Space and/or laboratory requirements:

- In general, Air monitoring lab at Waterbury had sufficient work, storage and bench space (except as noted below in d.).
- Storage room had large industrial shelving system that served as an additional shelf space for back up analyzers and calibration equipment. If this was lost, they would not have had sufficient bench space. Consequently, adequate rack or shelving unit for analyzer storage.
- Adequate office space associated with labs.
- Adequate area for temporary equipment storage. In Waterbury, the lab and storage space was tight when equip. came in from the field, immediate storage was a problem. Got tighter when HVAC equip. for gravimetric room was installed in room.
- Loading dock is critical- sampling equip., analyzers and gas cylinders are heavy and bulky.
- Modular lab bench/shelving/hood units on wheels desirable. (See these units in newly renovated MA DEP Lab in Lawrence MA.) Allows flexibility in room and project design.
- Particulate samples need to be refrigerated at 4deg C. TO-13A samples need to be frozen.
- Dedicated environmentally controlled room for gravimetric filter operations. Controlled at 20-23 Deg. C, ±2 Deg C / 24 hours and RH 30-40%. ± 5% / 24 hours Waterbury facility had this ability for the PM 10/2.5 sampling program.

Safety and regulatory requirements:

- All State and Federal waste management regulation must be complied with within the facility.
- Flammable storage cabinet
- Onsite OHSA/DOT compliant compressed cylinder storage. A central cylinder hub for the entire Lab building will not work for AQCD.
- Gravimetric facility for weighing PM2.5 & PM10 filters must meet and maintain requirements listed in 40 CFR Part 50 Appendix L ,Section 8.0 and EPA Quality Assurance Document 2.12 Monitoring PM2.5 in Ambient Air Using Designated Reference or Class I Equivalent Method.

Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space):

- AQCD HAC program relies heavily on chemistry, and there is the possibility for DEC Lab to share analysis equipment (i.e. GC/MS) with other chemistry divisions to meet AQCD needs.
- Gravimetric facility ("AP Balance Room") must be isolated from building exterior entry ways to reduce the fugitive dust/moisture/ temperature/pressure/ changes.

Outsourcing vs. In-House:

- Have internal document identifying the AQCD benefits of utilization of an in-house DEC Lab compared to outsourcing - will be sent by Thanksgiving.

Other info:

- Used to store monitoring trailers for air monitoring, 2 – 8'x 8'x8' monitoring trailers. Would be nice to have space/outdoor storage for these.
- Dedicated accessible space for storage of 75-100 6L canisters (active and backup) used for the VOC HAC sampling and analysis.
- AQCD Enforcement Section – Share AQCD workspace and possible analytical or gravimetric requests.
  - Access to meteorological , air toxics sampling, particulate sampling, support
  - Safe, secure and isolated sample retention and dedicated refrigeration systems.
  - Approved chain of custody procedures and sample storage for enforcement cases.
  - Provide adequate area (propose workshop area) to calibrate and reference enforcement tools such as hand held sampling equipment and systems used to collect data for enforcement or informational purposes.

Summary:

- Storage space is critical- Waterbury did not have sufficient storage space with HVAC equipment installed in store room. Waterbury had approx. 100 ft2 (AP Balance Room, Rm. 144), 100 ft2 (AP High Volume Room, Rm. 145) and 500 ft2 (Air Pollution Storage, Rm. 146) = ~700 ft2 total storage. Would recommend between 1,000 and 1,200 ft2 total indoor storage for new facility.

- Lab and bench space was sufficient, but should plan for expansion for other programs (i.e. TO13, metals). Waterbury had approx. 300 ft2 of lab space (Air Pollution Lab, Rm. 143). Would recommend 500 ft2 total lab space for new facility.
- Air Quality could be associated with other disciplines in Chemistry.
- Site selection is important for outdoor storage of trailers.

***Lab Title: Microbiology Lab***

Contact: Kristin Needham, Wendy Blackman, Romeo Cyr

Description of work activities:

- Dairy:
  - Testing milk and milk byproducts monthly for the entire state- standard plate count (heterotrophic), coliform.
  - Unfished products – looking for enzymatic phosphatase for proper pasteurization. Phosphatase testing is only performed on finished products, occasionally we will provide technical assistance by testing unfinished products.
  - Other analyses- antibiotics, butterfat, proteins, solids, lactose.
  - Raw products- somatic cell count (direct microscope read, flow cytometry).
  - Non-regulated testing of milk- general micro work (i.e. E. coli) within the Dairy program all of the testing is regulated, non- regulated testing would fall under mastitis/technical service
  - Water testing at farms/plants (total coliform) for dairy, meat producers.
  - MPN testing.
  - Certified butterfat component analysis- conducted yearly.
  - Laboratory Evaluation Officer certification of other dairy labs (full service and antibiotic testing labs) within the state, training conducted at the lab, antibiotic split samples prepared and distributed.
- Serology:
  - Serology is combined with dairy culture work (mastitis/technical service) (dirty)- cramped now, but the concept works.
  - Certified for brucellosis, equine infectious anemia, and anaplasmosis –no certification required for the performance enhancing drug testing for State Fair drug testing for horses.
  - Brucellosis- agglutination analysis, ring test.
  - Equine anemia- both AGID, ELISA testing.
  - Anaplasmosis- ELISA.
- Mastitis: sharing serology space currently, have dedicated field technician
  - Culturing, identifying some pathogens Plate reading.
  - Cleaning issues in dairy systems.

Major required equipment:

- Dairy:
  - Flow cytometer
  - Microscope
  - Fume hoods
  - Gas jets (for chem, micro and serology)
  - Big fridge
  - Multiple incubators (for micro)
  - Bench top phosphatase analyzer
  - Bench space
  - Freezer, fridge, storage
- Serology:
  - Plate reader/washer
  - Fume hoods
  - BSC
  - Floor centrifuge
  - Fridge/freezers
  - Incubators

Desired equipment and other resources:

- Ether extraction for butter fats- yoghurts, cheese, ice cream. Would include flame-proof hood, hot plate, 4-digit scale.
- Need additional hood for staining for somatic cell counts.

- Expansion of pathogen testing- more incubators, BSC- would require its own space/room. How much room?

Space and/or laboratory requirements:

- Fume hood space.
- Wet lab training space could double as overflow area.
- Sinks in islands preferred- for dairy micro and chemistry.
- Diary micro needs positive airflow (cross-contamination for air density testing).
- Sample receiving? - need to keep lab clean, need sinks there, need fridge there.
- Dairy chemistry needs to be proximal to PCR/ Molecular lab access.

Safety and regulatory requirements: N/A

Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space):

- Dairy micro needs to be separate from dairy chemistry (FDA mandated), and separate from serology.


- Mastitis and serology can be combined into same room.

Internal vs. outsourced: N/A

Data collection/entry/accessioning:

- All dairy regulatory work is paper records, manually entered into computer records.
- Currently using Access database for serology data entry.
- Global VetLink- Coggins results are reported directly to veterinarians who are on the system, otherwise it is paper-based.
- CAI sells a module for data collection, also exists a multi-state consortium for data collection programtied to regulatory functions.

Other info:

- Autoclave- can we capture a core decontamination area for all of Ag?
- Central DI/RO systems are a possibility for the entire facility.
- Glassware washer- core area with autoclaves.
- Waste storage- need to review Vermont waste management regulations.
- Dairy might need its own separate sample receiving, or dedicated space directly off of sample receiving.

Summary:

- A minimum of three (3) rooms is necessary for lab space: 1) Dairy microbiology, 2) dairy chemistry and 3) serology/mastitis. This equates to 400 ft2 for dairy microbiology (Rm. 217 & 218), 600 ft2 for dairy chemistry (Rm. 215) and a combined 550 ft2 for serology/mastitis (Rms. 213 & 208) on old Waterbury layout. Mastitis moved to Rm. 208 when Rm. 213 was turned into molecular space.
- Should plan for expansion to accommodate future pathogen screening work- this may be in the form of wet teaching labs.
- Dairy chemistry should be adjacent to the Molecular Biology/PCR lab(s).
- Dairy micro involves incubators, hot water baths and clean airflow with minimal foot traffic. Dairy chemistry is where the flow cytometer, butterfat analyzer, phosphatase analyzer and antibiotic tests are performed. Air quality and controlled foot traffic not as critical.

# Appendix C: Space Programming Interview Notes

***Lab Title: Molecular Biology Lab***

Contact: John Jaworski, Kristen Needham, Wendy Blackman

Description of work activities:

- No activity since flood rendered Waterbury unusable.
- Previously, there were four (4) major projects:
  - Project 1- West Nile- mosquito (1200 across state), internal agency and PHL using data, which went to CDC- this will probably not get reinstated, go to VDH instead.
  - Project 2- Plant fungal pathogen (Sudden Oak Death), internal agency, results went to USDA-APHIS-PPQ , testing susceptible nursery stock across state.
  - Project 3- Lyme disease testing in ticks, internal agency – entomology section, some data goes to VDH, Forest and Parks (ANR), obtained from public specimen submissions, field survey sampling, deer carcasses, local vets (dogs).
  - Project 4- Avian influenza, internal VT poultry (tracheal swabs), VT Fish & Wildlife in conjunction with USDA-APHIS-WS for wild bird sampling - Federal funding disappeared, sampling population decreased, not cost effective for VT, dropped NAHLN certifications.
- Potential projects:
  - Expand tick testing for other pathogens
  - GMO testing- would require independent gross preparation area
  - Pathogen screening/testing in raw milk and produce
  - Plant virus screening for nursery stock
  - Emerging zoonotic disease(s)
  - Emerging plant disease (s)

Major required equipment:

- Realtime-PCR, Reverse transcriptase 5-color, 96-well plate platform (preferably FAST)
- Freeze drying- Labconco
- Deep freezers
- BSC (2 )
- Used to have Qiagen M48 automated system, moved to manual system later
- Laminar flow hood
- Nanadrop Spec – for quantification of DNA, specifically for GMO testing

Desired equipment and other resources:

- Space is a big issue
- Another BSC
- Process isolation- critical to keep Feed & Fertilizer work separate from GMO prep/nucleic acid extraction areas
- Need refined flows and processes.
- Fume hood or BSC/fume hood-BSC combo
- Incinerator? Waste management
- LIMS system compatible with VDH- Accelerated Technology Laboratories (currently used at DEC)
- Admin, conference, lunch room, core space (freezers, DI/RO water system, etc.)

Space and/or laboratory requirements:

- GMO likely to expand- need independent dirty prep space with a lot of freezer space
- 4 rooms ideal for molecular lab
- Need to prepare for emergency response and Ag outbreaks
- BSL2 enhanced might be a good move, extra BSC capacity

Safety and regulatory requirements:

- No activity going on now
- Could do tick work, but no mosquito
- No secure areas currently at the University
- Cannot do any EEE work, VDH is capable of doing it- would require BSL3

Segregation (i.e. cross-contamination) vs. compatibility (i.e.

shared equipment and space):

- Co-location for Entomology, Plant Pathology and Molecular labs
- GMO likely to expand- need independent dirty prep space with a large freezer space

Internal vs. outsourced

- GMOs likely to be handled internally, not outsourced, because of potential conflict issues
- Keep in house:
    * GMO testing
    * 4 lab layout for general molecular work
- Waste management?

Data collection/entry/accessioning:

- Access database
- CDC ArboNET online system
- Not sure a full-time QA/LIMS person is needed- QA for all of Ag would be hard to capture in one person.

Other info:

- Would like to see greater flexibility
- Waste management: autoclaved waste went to landfill, UVM bags and transports it for incineration
- Necropsy area?
- Web based reporting is preferred- how feasible across Ag. IT security was an issue working with VDH.
- All data collection is independent- no cohesive LIMS system across the board
- Might need a separate small area for unboxing potential pathogenic samples- shipping receiving design/ops?

Summary:

- The Molecular Lab is more of a lab type than a lab program, as the utilities of the lab would serve across the silos of Ag and DEC divisions. For example, this space would serve Dairy, Fish & Wildlife, Entomology and others, with (RT-)PCR capabilities for molecular diagnostic work.
- Kristen described a four-room lab concept (see questions below).
- Dairy chemistry (see section on Microbiology) ??? needs access to the PCR capabilities, NO, possibility of collocating thermocyclers in Dairy Chemistry room. Having the Molecular Lab Suite proximal to the core services (refrigerators, freezers, autoclaves, RO/DI system) makes sense.
- Preparation area should be under negative pressure using BSCs, and PCR preparation/analysis should be in a clean space under positive pressure.
- Should plan for expansion of Molecular Lab to accommodate growing GMO testing- this would require independent "dirty" sample preparation area.

Questions:

What are the ideal seven rooms for the molecular lab?

- Sample preparation (dirty – GMO homogenization/grinding) BSC???
- Bulk Freezer room – GMO long term storage – retention of Original sample for legal purposes, ideally attached to dirty prep area (could be shared room with entomology and plant pathology freezers)
- Nucleic Acid Extraction (vented BSC)
- Addition of Positive control and sample Nucleic acid extracts to PCR plate (BSC)
- Clean reagent prep (primers/probes/nucleic extraction reagents) - PCR enclosure
- Thermocycler room (could be shared with Dairy Chem)
- Sample receiving, unboxing area with refrigeration - BSC??? - Clean storage area for disposables (pipet tips, PCR plates, etc.)

How much square footage was dedicated to Molecular work at Waterbury? Was this sufficient, or is more needed?

- Square footage may be determined for Waterbury blueprints. Space was insufficient, many non-compatible functions were performed in the same room and using one BSC – space could only accommodate one analyst at a time.

***<u>Lab Title: Plant Pathology, Entomology, Forests Parks & Recreation</u>***

Contact: Tim Schmalz

Description of work activities:

- Plant pathology:
    * Provides diagnostic services to nurseries, greenhouses (producers and retailers)- recommendations for control. Had some diagnostic capabilities in Waterbury. Some fungal culturing, but

most work was done with microscopes. Some ELISA work, and did have access to Kristin's PCR lab. Cooperative work with USDA for regulated pests (i.e. sudden oak death).

  * Seed certification and inspection: do not have a seed lab (subbed to Cornell, will likely stay that way). Was using lab for "dirty" space to sub-sample seeds before sending out.
  * Seed potato certification: mostly field work, but did some virus indexing with ELSIA and immuno-chemistry.
  * Ginseng certification: wild ginseng program in VT. Nice to have space for this, but does not require full wet-lab space.
  * GMO/GE programs: not doing GE certification work, but likely to develop and grow. Almost entirely dependent on Molecular Lab. Could be a good opportunity for fee-for-service. This is a priority consideration.
  * International and interstate plant certification programs- need some lab capacity in VT to certify products are pest-free. Goes back to diagnostic capabilities (above).
- Entomology:
  * Lots of survey equipment, traps, vials, bottles, bags, etc.
  * Current storage space in the in fenced-in area at Berlin warehouse. Need more winter storage than summer storage. Currently have capacity for 6 people at Berlin, but it is tight.
  * Work cooperatively with forest pest program in forests, parks and recreation department (also true of the plant path section).
- Forest & Parks program (different agency):
  * Had wet bench space and a hood (F&P = forest and parks) in room- see layout.
  * Currently located in Essex.
  * Purpose: identify forest pests, insects.
  * Could share space, as they did in Waterbury, with plant path and entomology, although this space was not formally shared at Waterbury.

Major required equipment:

- Need some bench space, DI water, waste disposal.
- Fire protection for sample storage, ethanol, ethyl acetate.
- Dissecting/ compound microscopes and associated materials. (including stains, slides, scope service equipment)
- Deep freezer, ultralow storage. Currently have 3x. (4, including a large conventional/household type chest freezer) May need more later. (Ultra-lows:1 is upright, 2 are chest freezers, 1 large conventional chest freezer)
- Wash sink for traps and equipment, and area for drying.
- Arbovirus program requires bench space (4 people in 2013, expect several more in future)
- 3 large insect cabinets (fridge sized), and 2 smaller cabinets (dorm-fridge sized)
- Cabinet freeze dryer/ lyophilizer
- Storage for lab books, ref materials

Desired equipment and other resources:

- Would be nice to have small greenhouse for periodic tests. Not attached to main building.
- Growth chamber.
- Waterbury was tight, mainly because of storage space. They also have had offsite storage that was always full.
- Existing laminar flow hood may carry over, but it is underutilized. Would be better to borrow occasionally from Microbiology.

Space and/or laboratory requirements:

- Plant path/Entomology (tests pesticides) cannot be close to the Pesticide Residue Lab.
- Plan for continued association with State Apiculturist (1 visit/week, 8 hours). Needs some bench space 1x/week.
- Security is nice to have as well.

Safety and regulatory requirements:

Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space):

- Need proximity to Molecular Lab, but a separate facility would not be out of the question.
- Could operate independently providing the utilities and space was available. But, it was convenient to be collocated with micro, molecular, etc.

Outsourcing vs. In-House: N/A

Other info:

- Flexibility is a big one. Seasonal activities require this. As does the likelihood that new programs will arise, and existing ones will decline.
- Data port access. (or secure WIFI)
- Would be nice to control climate and humidity. (requirement for arbovirus program)

Summary:

- Need to plan for greater flexibility and storage space. Lab space at Waterbury was sufficient.
- Need to plan for expansion of GMO/GE testing capabilities. This is an important consideration.
- Logical to associate Plant Industry with the Molecular Lab.

***Lab Title: Watershed Management and Biomonitoring Laboratory***

Contact: Heather Pembrook, Neil Kamman, Watershed Management Division, MAPP Program

Description of work activities:

- Water Chemistry analysis. Reliance on VTDEC Chem Lab (Dan Needham Supervisor) to produce water chemistry analyses- $250,000-300,000 of testing services/year. See water quality testing on other sheet. Chemistry. There are also non-state affiliated (citizen volunteers) watershed management groups that provide up to 9,000 water samples to chem lab. $125,000/year in throughput. See coolers in sample preservation photos. (in-kind services). Space included sample preservation and receiving area
- Biomonitoring Program. Manage a biomonitoring program, for fish and aquatic insects- for reg. and surface water compliance. Env. Sci. and biologists (currently in Dewey facility). Bench space needed for microscope work. Loading docks and field equipment storage area needs to be proximal. Have written program for footprint data. All bug specimens are archived in ethanol within flameproof cabinets. Have large storage need for these specimens proximal to bench areas. Small chemistry component- ~ 20 feet of bench space. Water samples are preserved with nitric or sulfuric acid for 1-2 nights before they are delivered to UVM Chem Lab for analysis. Small DI system was installed at National Life Dewey Lab for all WSMD users.
- Field work logistic space needs: this is where the gear lives. Warm storage needed for storage and calibration of water testing equipment. Need distilled water, sinks and proper disposal of calibration standards. Equipment? Could include the storage of vehicles and boats. Footprint? Formally part of Waterbury space in biomonitoring. Ideally, would need some dirty storage, and clean space for instrumentation. The former space in Waterbury was way too tight for field logistics. Boat compound needs to holds five 16-20 ft-motor boats, and a variety of canoes and kayaks.
- Decontamination facility: surface water contamination from invasive species. Gear needs to be cleaned. Uses hot water and quat (ammonia). Nets, waders, larger nets, or even boats. Footprint? Currently does not exist, nor did it at Waterbury. 20 or more people would have access to facility, but would like to have some exterior area with racks to clean gear, with wastewater control. Proximal to lab area, where instrumentation, waders, etc. could come in for cleaning. Associated with loading dock, loading dock associated with field gear storage and sample receiving. Chelmsford, MA (EPA region 1 env. Lab site) has a good example of this layout and process (Hilary Snook EPA contact).
- Wastewater permitting program: training of wastewater operators. Waterbury had a training classroom. Fundamental bench test training.

Major required equipment:

- Flammable cabinets- 3'x6' and they have 8 of them.
- Bench space
- Fridge (standard) 3x
- Used fume hoods in chemistry section, but did not have one of their own.
- Built in vacuum and air lines
- Large deep sinks (3+)
- Excellent ventilation to address alcohol fumes
- Distilled Water system (overlap with Chem Lab system)

Desired equipment and other resources:

- Dedicated fume hood would be nice, but as long as they have access to a shared one, they are fine.
- Increased interest from watershed community for other water-based environmental contaminants, increase in capacity for analytical chemistry to allow analysis of new generation contaminants. GC-type work. Might require clean space.
- Direct mercury analyzer.
- List coming from Heather, developed from Water

Quality Monitoring Strategy workgroup which included Chem Lab's director.

Space and/or laboratory requirements:

- Would like to have consolidated model that would bring everything above to one facility (i.e. lab and storage space).
- Laboratory space they had at Waterbury was sufficient (refer to blueprints for bench and floor square footage).
- Sample archiving space was not sufficient- it needs to be stored in flammable cabinets, which take up a lot of room.
- Loading dock for storage and delivery of gas cylinders is required.

Safety and regulatory requirements:

- Waste management- liquid waste, ammonia.

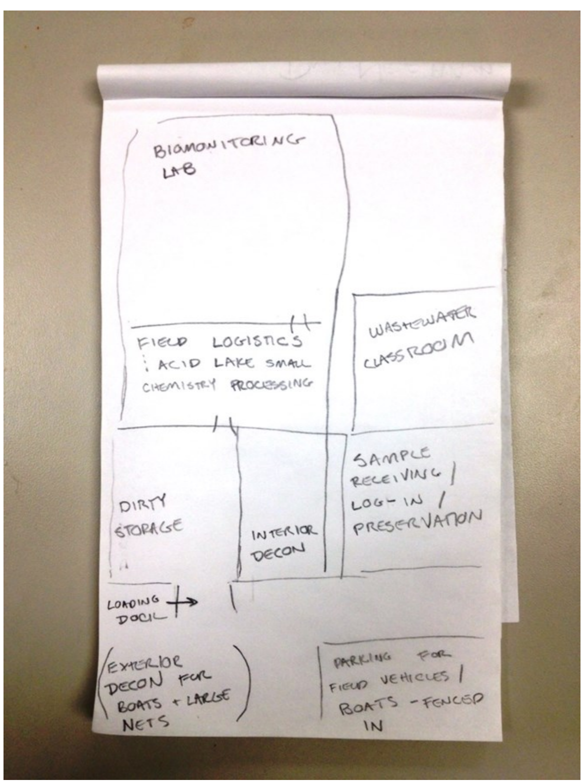
Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space): N/A

Outsourcing vs. In-House:

- Outsourcing would result in lost efficiency, and the in-kind services portion would suffer.

Other info:

- Information is coming from DEC regarding the cost analysis and usefulness (i.e. a business case, justification, to keep the Watershed lab) of the lab programs.




- Central Vermont would be ideal location. Colocation and location are equally important.
- Old facility was lacking in taxonomy storage space.
- Bench top data entry. Currently networked to LIMS. User laptop computers. Excel based, then to database. Biomonitoring is independent of LIMS, and would like to keep it that way.

Biomonitoring Work Flow example: (Diagram Below)

- Return from field, back up to loading dock, unload gear
- Decontaminate gear at inside and outside Decon area: outside for boats and large nets, inside for waders and small nets. Store waders and other "dirty" equipment in dirty storage area.
- Transfer coolers with water samples to sample receiving and log in room. Acidify or preserve as necessary. Login samples.
- Move water sampling multi-probes into clean storage area/field logistics area.
- Move trucks and boats to adjacent parking area for field vehicles/boats.

***<u>Lab Title: Animal Pathology</u>***

Contact: Katherine McNamara, Kristin Haas, Shelley Mehlenbacher

Description of work activities:

- Currently no animal pathology work occurring in a productive manner outside of that which is completed in slaughter facilities.
- Current work activities are in need of Lab support include necropsy and pathological inspection of carcasses/parts of animals:
    - Specimens from slaughterhouses for food safety
    - Animals experiencing high mortality on a farm
    - Ongoing Staff training in pathology
- Animal health, meat inspection and possibly dairy hindered by current physical space that exists to perform these duties:
    - Providing services to external stakeholders, as well as providing wet lab training for internal staff.

- Previously, they did training on collecting brain and lymph nodes from deer heads- did not have space or adequate training space.
- Continue to have the need to do necropsies in certain circumstances, but without adequate space this is hindered
- Would like to have adequate space to conduct animal pathology in lab for external stakeholders, as well as training.
- Most inspection (whole animal) is done on-site.
- Pathology samples are sent to NH veterinary diagnostic facility.
    * Currently, capacity does not exist in VT for gross pathology or histopathology of specimens
    * Was using USDA lab services
    * Using NH for about a year, send about 4 samples/ year
    * NH Lab supports pathological inspections of carcasses in slaughter houses for food supply safety- done in plant/ on-site.
    * Capacity in VT moving forward: potential for necropsy capacity for analysis for producers and private veterinarians. If these services would be offered, they need physical space and human resources, such as a veterinary pathologist.
- Whole animals being brought in would be poultry to sheep/goat- not for cows, horses, etc.
- Unlikely that they would knowingly be dealing with dangerous/foreign animal diseases.

Major required equipment:

- Impermeable floor surface for easy decon/cleaning
- Stainless steel work-top (table with wheels or stationary)
- Necropsy table
- Drains, hoses
- Freezer
- Storage for PPE
- LIMS- need a workstation for necropsy and other data can be entered.

Desired equipment and other resources:

- Dissecting scope, A/V capabilities included

Space and/or laboratory requirements:

- Storage space for PPE
- Showering, gowning and de-gowning areas
- Storage for surgical equipment, tranquilizers- locked stainless cabinet?
- Never had anything in Waterbury for this purpose, but would like to have:
    * Separate entrance for delivery of animals/ specimens. Sectioning of loading dock, shipping receiving?
    * Necropsy room with storage capabilities
    * Smaller "clean" room for diagnostics
    * Could be separate rooms, but having a central facility/lab with flexibility.
- Independent of loading dock, 1,200-1,500 ft2 would likely be sufficient.
- Space would need to be big and open enough for training, 10-12 people at a time in the room.

Safety and regulatory requirements:

- Waste management of animal remains would need to be figured out. Would probably use a service rather than build infrastructure for animal disposal.

Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space):

- Possible sharing of space and/or resources with F&W (ANR), need for necropsy space is desirable.
- Location is important- don't want to have to drive to Burlington to get equipment, then drive to another part of the state. Location in central VT would be ideal.

Outsourcing vs. In-House:

Other info: N/A

***<u>Lab Title: Fish & Wildlife (ANR)</u>***

Contact: Barbara Johnston

Description of work activities:

- Provides disease diagnostic AND inspection services to the 5 State of Vermont Fish Culture Facilities AS WELL AS all the private aquaculture facilities/business located in Vermont. Legal requirement in Vermont to have an annual fish health inspection per the Breeder's Permit necessary to operate in Vermont however, we are also contacted whenever the private facilities have a problem.

- Primary work also includes live bacteriology, parasitology work.
- Investigate fish kills.
- Analysis for viruses, parasites and bacteria- chartered to look into those common to Northeast area.
- Primary lab work includes cell culture, ELISA, PCR.
- Sample on site- fish do not come back to lab. However, it would be preferred to have this capability.
- Current samples may be internal organs, live culture agar, whole heads, gill scrapings.

Major required equipment:

- 2x BSC Class II
- 5x Incubators
- Bench top space for microscopes, centrifuges, etc.

- Sterilizer
- 4x fridge/freezer combos- have to be in a separate room for COC, or they have to be locked. These are assigned to the four rooms below.

Desired equipment and other resources:

- Preference would be to have dedicated PCR room separate from Molecular Lab. This is both a contamination issue (minimal risk if room is dedicated for Molecular/PCR work) and Chain Of Custody (COC) issue.

Space and/or laboratory requirements:

- Waterbury lab was sufficient for the 4 rooms below, but they did not have a PCR lab.
- Bench space at Waterbury was sufficient.
- Four rooms at Waterbury were:
    - * Processing
    - * Bacteriology
    - * Virology
    - * Darkroom- for Direct Fluorescent Antibody Technique assays which we use currently for bacteriology. MUST be dark – prefer separate room because it is difficult to work in a completely dark room on other fish health/assay work at the same time. The room also provided storage area for supplies.

Safety and regulatory requirements: N/A

Segregation (i.e. cross-contamination) vs. compatibility (i.e. shared equipment and space):

- PCR room could be shared with molecular lab, but there are legal issues surrounding cross-contamination - separate PCR room? COC applies as well.
- 4x fridge/freezer combos- have to be in a separate room for COC, or they have to be locked.

Internal vs. outsourced: N/A

Data collection/entry/accessioning:

- Closed network. Paper data in manually entered into computer system.
- Reports into U.S. Fish and Wildlife Survey.

Other info: N/A

Summary:

- Bench space at Waterbury was sufficient.
- Dark room preferred to be separate room.
- Previously occupied approx. 600 ft2 (Waterbury plan, Rm. 140).
- Waterbury facility provided sufficient lab space at approx. 300 ft2
- Should plan for specimen storage in the event that whole fish samples return to the lab capabilities.
- Providing that storage areas are locked (i.e. refrigerators & freezers), could have core facility for refrigerators and freezers.
- Access to PCR for Fish and Wildlife could be accomplished by having dedicated PCR machines in the Molecular Lab. Alternative: create 5th room for Fish and Wildlife for clean, PCR conditions.

The **S** / **L** / **A** / **M** Collaborative

# Meeting Minutes No. 01

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|---|---|---|---|
| **Project:** | State of Vermont Agency of Agriculture and Department of Environmental Conservation Laboratory | **Issue Date:** | October 23, 2013 |
| | | **Meeting Date:** | October 21, 2013 |
| **Project No.:** | 13184.00 | **Meeting Time:** | 9:00AM |

| | | |
|---|---|---|
| **Present:** | Chuck Ross | VT Secretary of Agriculture Food & Markets |
| | Jolinda LaClair | VT Deputy Sec'y. of Agriculture Food & Markets |
| | Justin Johnson | VT Deputy Secretary of Natural Resources |
| | Jim Leland | Vermont Agency of Agriculture |
| | Daniel Needham | Vermont Dept. of Environmental Conservation |
| | Cary Giguere | Vermont Agency of Agriculture |
| | Trey Martin | Vermont Dept. of Environmental Conservation |
| | John Schmeltzer | Vermont Dept. of Environmental Conservation |
| | Dan Scruton | Vermont Agency of Agriculture |
| | Tim Schmalz | Vermont Agency of Agriculture |
| | Ryan Burnette | Alliance Biosciences |
| | Robert Blakey | Strategic Equity Associates |
| | Richard Polvino | The SLAM Collaborative |
| | Lois Rosenblum | The SLAM Collaborative |
| | Paul Rammelsberg | The SLAM Collaborative |

| | | |
|---|---|---|
| **Distribution:** | Marc Paquette | Vermont Agency of Agriculture |

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To All Present:

The Following is believed to be an accurate representation of discussions and decisions made at this meeting on October 21, 2013. If any of the items are incorrect or fail to record discussions at the meeting, please notify the writer of these minutes, in writing, within 5 days of the issue date. Failing such notification, these minutes will be considered a matter of record.

1-1 **Study Schedule**: The study has a short time frame due to the need to be prepared for the legislative session starting in January. The deadline is December 16 but could be extended if necessary, possibly as late as January 10. Any decision on an extension must be made this week.

1-2 **Study Significance**: The study is seen as the key to the future of the lab. The lab has political support but also skeptics. Some see the expenditure required vs. the number of staff affected as being disproportionate. There is competition for funding for projects to recover from Tropical Strom Irene.

1-3 **Study Work Product**: To be effective, the study has to clearly tell the story of the value of the lab, be clear about the proposed solution, and must be outcomes oriented.

If the study does not present their case successfully, they will not be able to fulfill their mission.

1-4 **Crisis Response**: One of the key disadvantages of an outsourcing option is inability to respond to crises and emergencies. A state operated lab has the ability to divert all of its resources to urgent issues that may arise, thereby preventing problems from developing into something much larger. It was noted that the cost-benefit analysis for processing routine samples is a straightforward math exercise, but the ability to respond is a key rationale to operate the lab. Staff were encouraged to write case studies illustrative of this concept that can be included in the report.

1-5 **Lab Closure History**: It was noted that the state had considered closing the Department of Environmental Conservation Lab several years ago, but the proposal was rejected by the legislature. The state will furnish copies of documentation surrounding those events.

1-6 **Operating Model**: The agencies see the lab as historically having been very siloed. They see the current operation, where everyone has been relocated into too little space on an ad hoc basis, as creating a blank slate opportunity to try new ideas.

1-7 **Pre Irene Merger**: Before Tropical Storm Irene, an initial discussion had begun on administratively merging the Agriculture Lab and the DEC Lab into a single entity under the Agency of Agriculture. The state will furnish copies of documentation surrounding this effort.

1-8 **Waterbury Lab Facility**: The Waterbury lab facility is scheduled for demolition.

1-9 **Temporary Space**: The temporary space in Berlin and at University of Vermont is leased. The space at the University is leased through August 2015. An additional year may be an option. They spent $1 million to adapt the University space to their needs.

1-10 **DEC Interaction**: The DEC lab primarily interacts with other New England states only, because those are the states that fall within the same federal EPA region.

1-11 **New York Lab**: The new state lab in Albany is a $40 million facility and is reported to be operating nowhere near capacity.

1-12 **New England Collaboration**: Agricultural labs in the New England states collaborate well. The team should be able to expect cooperation from lab directors in other states when approached.

1-13 **Data History**: Various programs in the labs have generated uninterrupted streams of data over many years that identify long term trends and inform environmental policy decisions. The Vermont air monitoring program, along with California's, is considered a national leader. The water program in Lake Champlain is on the leading edge as well.

1-14 **Law Enforcement**: Samples in the lab can become evidence in enforcement actions, so issues such as chain of custody are critical. It is often not known at the outset that any particular sample will become involved in an enforcement action, so rigor throughout the process is required.

1-15 **Lessons Learned**: It was requested that the labs report on which changes and compromises since Tropical Storm Irene have been successful, and which have not.

1-16 **Equipment Expense**: The study should identify expensive laboratory equipment that can be shared among labs, so as to avoid unnecessary duplication. If there is expensive equipment that is not frequently used and those tests can be outsourced, this should be given strong consideration.

1-17 **Health Department Lab**: The new Health Department lab in Colchester is scheduled

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for completion in Autumn 2014. Historically they have been focused for many years on pursuing this new facility, and so have been less open to discussing shared governance. It is reported that their site has expansion capacity, but also that there had been local concerns about the lab siting. A conversation with the Health Department should be initiated.

1-18 **Public Safety Lab**: It was generally though that the Department of Public Safety would want to maintain a separate lab in order to maintain direct control over evidence, etc.

1-19 **Agriculture and DEC Shared Governance**: The Agency of Agriculture and the DEC are very open to a shared governance model. The working assumption is that the combined operation, if only involving those two groups, would report through the Agency of Agriculture.

1-20 **Staff Cross Training**: It was noted that a shared governance structure could facilitate more cross training among staff and thus better responsiveness.

1-21 **Lab Protocols**: The study team needs copies of any standard operating procedures and protocols that are available. Some of this was lost in the storm.

1-22 **Competition**: By statue the Agency of Agriculture cannot offer services that already available in the private sector. DEC complies with the same standard, but as a matter of policy rather than law.

1-23 **Weights and Measures**: It was noted that weights and measures is better housed in Berlin than they were in Waterbury. They are satisfied with their current location, which has recently attained NIST certification.

1-24 **Tiered Plan**: The plan for a proposed new lab should be tiered, with certain operations identified as critical and others as optional. Three tiers are envisioned.

1-25 **Waterbury Operations**: The study team needs a list of services provided in Waterbury before the storm, plans of the facility, and space assignments.

1-26 **Revenue Streams**: The study team needs an outline of fees and revenues for services provided, as well as any funding sources outside of general state appropriations.

1-27 **Siting**: The working assumption for the site for a potential new lab has been a ten mile radius from Montpelier or along the Interstate 89 corridor between Colchester and Randolph.

1-28 **Surge Capacity**: One model for a lab co-located with a college or university could include a lab space that doubles as a teaching facility and a surge space for use in a crisis situation.

1-29 **Capacity in Other States**: At this point, not all of the specific capabilities and capacities of other states are known. It was thought unlikely that the sharing options could be worked out with enough specificity to include in the business model, given the available time.

1-30 **User Meetings**: The next meeting cycle in two weeks should include meetings with individual users. It was agreed that final word on needs would belong to Jim Leland for Agriculture and Trey Martin for DEC.

1-31 **Organizational Structure**: The study team needs to understand the current organizational structure, and how programs, processes, and personnel interrelate. A series of matrices was seen as the best tool to communicate this.

1-32 **Information Technology**: The DEC lab has had a web based lab information management system for several years. The Agriculture lab does not have a similar system but expects to within the next year.

1-33 **Other Agency of Natural Resources Labs**: The labs within Fish and Wildlife and Forests, Parks, and Recreation are dry labs and mainly consist of tables to count specimens. It was generally thought that they would be low priority candidates to include in a new combined lab.

Respectfully submitted,

*The* ***S / L / A / M*** *Collaborative*

Paul D. Rammelsberg AIA, LEED AP
Senior Associate

The S / L / A / M Collaborative

# Meeting Minutes No. 02

| | | | |
|---|---|---|---|
| **Project:** | State of Vermont Agency of Agriculture and Department of Environmental Conservation Laboratory | **Issue Date:** | November 11, 2013, *Revised* November 25, 2013 |
| | | **Meeting Date:** | November 5, 2013 |
| **Project No.:** | 13184.00 | **Meeting Time:** | 10:00AM |

| | | |
|---|---|---|
| **Present:** | Jolinda LaClair | VT Deputy Sec'y. of Agriculture Food & Markets |
| | Jim Leland | Vermont Agency of Agriculture |
| | Daniel Needham | Vermont Dept. of Environmental Conservation |
| | Cary Giguere | Vermont Agency of Agriculture |
| | Kristin Haas | Vermont Agency of Agriculture |
| | John Jaworski | Vermont Agency of Agriculture |
| | Trey Martin | Vermont Dept. of Environmental Conservation |
| | John Schmeltzer | Vermont Dept. of Environmental Conservation |
| | Dan Nielsen | Vermont Dept. of Environmental Conservation |
| | Robert Blakey | Strategic Equity Associates |
| | Richard Polvino | The SLAM Collaborative |
| | Paul Rammelsberg | The SLAM Collaborative |

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|---|---|---|
| **Distribution:** | Chuck Ross | VT Secretary of Agriculture Food & Markets |
| | Justin Johnson | VT Deputy Secretary of Natural Resources |
| | Marc Paquette | Vermont Agency of Agriculture |
| | Dan Scruton | Vermont Agency of Agriculture |
| | Tim Schmalz | Vermont Agency of Agriculture |
| | Katherine McNamara | Vermont Agency of Agriculture |
| | Ryan Burnette | Alliance Biosciences |
| | Jenna Hess | Alliance Biosciences |
| | Lois Rosenblum | The SLAM Collaborative |

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To All Present:

The Following is believed to be an accurate representation of discussions and decisions made at this meeting on November 5, 2013. If any of the items are incorrect or fail to record discussions at the meeting, please notify the writer of these minutes, in writing, within 5 days of the issue date. Failing such notification, these minutes will be considered a matter of record.

2-1. **Meeting Intent**: One of the key intents for the meeting was to reach a consensus on how to structure the options and secondary options to be investigated. The SLAM Team proposed a model with three primary options:

- A co-located pair of laboratories for Agriculture and DEC, similar to the destroyed facility in Waterbury, but with some basic sharing of services such as shipping/receiving, glassware washing, etc.

- A collaborative laboratory in which all reasonable opportunities for combining services are implemented, and the lab is structured as one entity serving both groups.
- An outsourced model, in which all lab services are provided by laboratories in the private sector, or by other public sector laboratories.

The approach of studying these three options was seen as an appropriate way to encompass the range of available possibilities, and to ensure that the study is perceived to be thorough.

2-2. **Secondary Options**: A layer of secondary options will be investigated as well, as they apply to each of the primary options. These are:

- Scope of lab services to be provided in a new facility: The Tier 1 or "must have" services would generally be wet lab services. The Tier 2, or "should have" services would generally be dry lab services. The Tier 3, or "would like to have" services would generally be ancillary services such as weights and measures. Alternative locations would be required for any Tier 2 or Tier 3 services not located in a new facility, in either their current locations or at new locations.
- Location: The location of the new facility may affect acquisition cost and operating cost. Greater distance from Montpelier may present administrative challenges. If the lab needs BSL-3 capabilities, a location near University of Vermont or the Department of Health lab in Colchester may facilitate shared usage.
- Growth: Anticipated growth in the demand for current services, and how to accommodate that, needs to be considered.

2-3. **2006 Association of Public Health Laboratories Report**: It was noted that implementation of the recommendations in the 2006 APHL report was hindered by the configuration of the Waterbury facility.

2-4. **2009 Outsourcing**: The plan to outsource the DEC lab services in 2009 was not implemented, but there were still staff reductions in the labs at that time due to state budget difficulties.

2-5. **Tertiary Options**: The third layer of variables includes planning for new areas of testing, and exploration of opportunities to collaborate with neighboring states, with each possibly concentrating on particular areas of expertise. This could include bringing back testing that is currently outsourced.

2-6. **Terminology**: Where needed, the report needs to take care to explain terminology for the audience that will be reading it.

2-7. **Outsourcing Cost Model**: For the outsourcing model, additional information is needed on the staffing that would be required to manage the process, and to perform tasks that cannot be outsourced. Possibly as few as three positions would be eliminated in Agriculture. It was unclear how thoroughly the internal costs were analyzed in 2009, when the DEC lab was previously proposed to be outsourced. This information will be assembled in the next week.

2-8. **Historic Operating Budgets**: Budgets for each year since 2008 will be provided, so that trends can be reviewed. The 2009 budget is the first to reflect cutbacks due to the economy, and the 2012 budget is the first to account for changes caused by Tropical Storm Irene.

2-9. **FEMA Funding**: The information that a replacement lab will be 90 percent FEMA

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funded is outdated. The working assumption is that some funding will be available but the amount is unclear. The team can develop cost models illustrating the impact of varying levels of FEMA reimbursement. The upper limit is likely 50 percent.

2-10. **Dedicated Funding**: There is currently no dedicated funding available for this project from any source. Agency of Agriculture will contact Buildings and General Services to review funding, including potential for FEMA reimbursement.

2-11. **Acquisition And Operating Cost**: It was noted that the acquisition cost for a co-located lab and for a collaborative lab would likely by very similar. The lower operating cost for the collaborative model will be the differentiator.

2-12. **Site Acquisition**: If a new lab facility is located on the site of an educational institution, it should be assumed that a site lease would be negotiated. If a new lab is built as an independent entity, it should be assumed that a site would be purchased. If a new lab can be built adjacent to the Department of Health lab in Colchester, there would be no site acquisition cost. It may also be possible to utilize and renovate an existing building at the IBM site in Essex.

2-13. **Regional Model**: Due to the limited time for the study, it will not be possible to adequately plan for collaboration with neighboring states in the stage of the process. Regional collaboration should be incorporated in the plan as a future opportunity. The goal is for each state to develop different areas of expertise. Connecticut is a leader in poultry and New York in dairy. Current sharing with other states is on a fee for service basis only.

2-14. **Commitment to Collaboration**: The Agency of Agriculture and the Agency of Natural Resources both indicated that they are firmly committed to a collaborative model.

2-15. **Governance of a Collaborative Lab**: Of several options discussed for governance, the most viable seemed to be a lab that would be located in one agency, with an oversight board that includes representation from each client group. This board might meet quarterly to assure that all needs are being met. The organization might have a lab supervisor with an organics lab, an inorganics lab, and a microbiology lab directly reporting to the supervisor.

2-16. **Independent Lab**: It was thought that setting up an independent entity to operate the lab would only make sense if the Department of Health lab was included. It was assumed that the forensics lab would not be a willing participant due to the care required with their chain of custody.

2-17. **Health Department Collaboration**: It was though that a new lab built on the Colchester site might initially operate as a lab co-located with the Health Department lab, but that a collaborative model could emerge in the future.

2-18. **Lab Financing and Staffing**: It was though that an internal fee for service model would be the most prudent way to account for funding of a collaborative lab. Employees may need to be reclassified to reflect the new model. It needs to be confirmed whether the executive branch would have the authority to implement the collaborative model on its own.

2-19. **Operation**: Based on information provided to date, the DEC clientele appears to be more complex. Additional information is needed from Agency of Agriculture to complete the picture. Full understanding of this will facilitate a decision on which agency would be better equipped to house the collaborative lab.

2-20. **LIMS and Quality Assurance**: It was thought that three roles would need to be filled- a quality assurance person, an IT person, and a database manager. None of these are likely full time roles. The best means of combining these responsibilities into staff positions needs to be determined. It was thought that the state would allocate two new staff positions to the lab at the most.

2-21. **Mission Statement**: It was thought that a joint mission statement with shared themes would foster an identity for the lab, and help outsiders understand its purpose. The themes would include water quality and food safety.

2-22. **2012 Merger Plan**: The documentation from the initial meeting in early 2012 to explore a shared lab has still not been located.

2-23. **Interviews**: The next meeting cycle will include individual user meetings. The list of users needs to be confirmed.

2-24. **Tier 2 Functions**: It was though that Plant Pathology and Entomology should be Tier 2 functions rather than Tier 1. If they are not accommodated in a new facility, they could potentially be housed at UVM. Tier 2 should also include biomonitoring and future necrology/pathology.

2-25. **Tier 1 Functions**: Tier 1 should include a molecular lab.

2-26. **Lab Type and Function Matrix**: The Lab Type and Function Matrix was revised based on input received in the meeting and is attached.

2-27. **Omitted Functions**: If any Tier 2 or Tier 3 functions are not included in a final recommended new facility, the report need not include alternative plans for where to locate them.

Respectfully submitted,

*The **S / L / A / M** Collaborative*

Paul D. Rammelsberg AIA, LEED AP
Senior Associate

The **S** / **L** / **A** / **M** Collaborative

# Meeting Minutes No. 03

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|---|---|---|---|
| **Project:** | State of Vermont Agency of Agriculture and Department of Environmental Conservation Laboratory | **Issue Date:** | November 25, 2013 |
| | | **Meeting Date:** | November 19, 2013 |
| **Project No.:** | 13184.00 | **Meeting Time:** | 10:00AM |

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|---|---|---|
| **Present:** | Justin Johnson | VT Deputy Secretary of Natural Resources |
| | Jim Leland | Vermont Agency of Agriculture |
| | Kristin Haas | Vermont Agency of Agriculture |
| | Marc Paquette | Vermont Agency of Agriculture |
| | Marcy Hodgdon | Vermont Agency of Agriculture |
| | Trey Martin | Vermont Dept. of Environmental Conservation |
| | John Schmeltzer | Vermont Dept. of Environmental Conservation |
| | Robert Blakey | Strategic Equity Associates |
| | Paul Rammelsberg | The SLAM Collaborative |

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| **Distribution:** | Chuck Ross | VT Secretary of Agriculture Food & Markets |
| | Jolinda LaClair | VT Deputy Sec'y. of Agriculture Food & Markets |
| | Daniel Needham | Vermont Dept. of Environmental Conservation |
| | Dan Nielsen | Vermont Dept. of Environmental Conservation |
| | Cary Giguere | Vermont Agency of Agriculture |
| | Dan Scruton | Vermont Agency of Agriculture |
| | Tim Schmalz | Vermont Agency of Agriculture |
| | Katherine McNamara | Vermont Agency of Agriculture |
| | John Jaworski | Vermont Agency of Agriculture |
| | Ryan Burnette | Alliance Biosciences |
| | Jenna Hess | Alliance Biosciences |
| | Richard Polvino | The SLAM Collaborative |
| | Lois Rosenblum | The SLAM Collaborative |

Atlanta, GA

Glastonbury, CT

To All Present:

The Following is believed to be an accurate representation of discussions and decisions made at this meeting on November 19, 2013. If any of the items are incorrect or fail to record discussions at the meeting, please notify the writer of these minutes, in writing, within 5 days of the issue date. Failing such notification, these minutes will be considered a matter of record.

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3-1. **Financial Data Received**: It was noted that the financial data furnished by DEC was in a different format than the data furnished by Agriculture, making it difficult to compare. DEC will furnish their information in the format that Agriculture used, which is consistent with the format used to present budget information to the Legislature.

Tracy LaFrance at DEC is the best point of contact to obtain additional information and clarification.

3-2. **Agency of Agriculture Data**: It was noted that the Agriculture budget information furnished was not exclusively regarding the lab. Agriculture will clarify which personnel are assigned to the lab full time and their job classifications, as well as any that are in the lab part of the time.

3-3. **Agriculture Prior Year Budgets**: Agriculture financial data has been submitted for 2008, 2009, and 2013. Agriculture will follow up with 2010, 2011, and 2012, although each year was affected by unique circumstances.

3-4. **Unmet Need**: The financial model attempts to capture the value of the unmet need for services that have not been available since the storm.

3-5. **Temporary Space**: It was noted that the current agency budgets, since the storm, have not included the cost of rent paid for space at University of Vermont and in Berlin, since this rent has been paid from the Department of Buildings and General Services budget.

3-6. **Fee For Space**: It was reported that the fee for space charged by Buildings and General Services was $11.09 for fiscal year 2011 and $11.66 for fiscal year 2012, for the Montpelier area. Rates for more recent years are still needed. The fee for space is intended to cover costs incurred by BGS for both construction and operation. For upcoming years, rates are not published until shortly before the start of the year. For past years, budgets for both agencies do not isolate space costs for the lab from other agency space costs.

3-7. **DEC Budget**: It was reported that DEC restructured their budget in 2008 to allocate more overhead costs to their cost per test, so comparisons to the earlier years become complicated.

3-8. **Equipment Replacement**: The current budgeting approach makes it challenging to fund replacement of major equipment, whether planned or unplanned. The agencies own all of their equipment and typically have service agreements in place. It was thought that a model where major equipment is leased would be preferable, but this approach is contrary to normal state policy. A waiver may be obtainable.

3-9. **Outsourcing Costs**: In the cost model for outsourcing all lab functions, it is assumed that the actual cost per test would be similar to the average cost available on the market. Using the lowest cost available on the market was not seen as realistic, as the low price could only be obtained by constantly rebidding, and could require compromising responsiveness and accuracy.

3-10. **DEC Outsourcing Bids**: The cost model for outsourcing is extrapolated from the pricing in the bids obtained by DEC in 2009. This approach was seen as being the most favorable to the outsourcing model. The prices were obtained near the low point in the economic cycle and would likely have been as aggressive as bidders would ever be.

3-11. **Current Outsourcing**: Agency of Agriculture does currently outsource some diagnostic testing. Costs will be furnished. It will be helpful to demonstrate that the agencies do consider outsourcing seriously and utilize it in cases where it is advantageous. In some areas, the cost of maintaining in house capabilities is not justifiable. With a new facility, it may make sense to perform some tests in house that have historically been outsourced.

3-12. **Outsourcing Quality Control**: It was thought that the outsourcing model would not lead to increased costs for quality control.

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3-13. **Cost Justification**: The primary task is to convince the Legislature that the new lab facility makes sense operationally. The capital cost of the new facility does not have a major impact on the agency budgets because of the fee for space model used by BGS. It will be important, however, to provide a sense of what the capital cost will likely be to procure the new facility.

3-14. **Co-located Vs. Collaborative Model**: It may be useful to structure the report to present the cost to replicate the Waterbury facility and operations (co-located model), and then the cost savings associated with changing to the collaborative model.

3-15. **Waterbury Capital Improvements**: It was noted that the Waterbury facility would have required significant investment within a few years due to age, if the flood had not happened.

Discussion regarding lab safety and lab waste management on November 20, 2013 following user interview meetings, attendees Jim Leland (AAFM), Dan Needham (DEC), John Schmeltzer (DEC), Ryan Burnette (Alliance Bioscience), and Paul Rammelsberg (SLAM):

3a-1. **Hills Building**: The lab in the Hills Building is currently operating under the safety plan and waste management plan of the University of Vermont. If the mix of testing performed in the lab were to change, they could be required to develop their own plan.

3a-2. **Select Agent License**: It needs to be determined whether a select agent license is needed due to handling of avian influenza and brucella.

3a-3. **BSL Status**: It currently appears that the lab will not require BSL-3 capabilities, but this is yet to be confirmed. It may be advantageous to construct the new facility to a BSL-2 enhanced standard to improve its capability to respond to certain public health emergencies.

3a-4. **Safety Officer**: The new facility will require a designated safety officer, although it does not appear to be a full time job. Depending on the final governance plan and the siting, this could be a full time person who is assigned to other duties part of the time, or it could be a position shared with a host institution such as a college or university. The Department of Health is likely required to have a full time dedicated safety officer that may not be available to share.

3a-5. **Consent Decree**: It was noted that the DEC lab is operating under a consent decree through 2015 due to violations several years ago.

3a-6. **Lab Infections**: No one present was aware of any past cases of lab acquired infections among staff in either lab.

Respectfully submitted,

The S/L/A/M Collaborative

Paul D. Rammelsberg AIA, LEED AP
Senior Associate

The S / L / A / M Collaborative

**Meeting Minutes No. 04**

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|---|---|---|---|
| **Project:** | State of Vermont Agency of Agriculture and Department of Environmental Conservation Laboratory | **Issue Date:** | December 6, 2013 |
| | | **Meeting Date:** | December 3, 2013 |
| **Project No.:** | 13184.00 | **Meeting Time:** | 10:00AM |

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|---|---|---|
| **Present:** | Jolinda LaClair | VT Deputy Sec'y. of Agriculture Food & Markets |
| | Justin Johnson | VT Deputy Secretary of Natural Resources |
| | Jim Leland | Vermont Agency of Agriculture |
| | Kristin Haas | Vermont Agency of Agriculture |
| | Marc Paquette | Vermont Agency of Agriculture |
| | John Jaworski | Vermont Agency of Agriculture |
| | Cary Giguere | Vermont Agency of Agriculture |
| | Tim Schmalz | Vermont Agency of Agriculture |
| | Trey Martin | Vermont Dept. of Environmental Conservation |
| | Daniel Needham | Vermont Dept. of Environmental Conservation |
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| **Distribution:** | Chuck Ross | VT Secretary of Agriculture Food & Markets |
| | Dan Nielsen | Vermont Dept. of Environmental Conservation |
| | Dan Scruton | Vermont Agency of Agriculture |
| | Katherine McNamara | Vermont Agency of Agriculture |
| | Ryan Burnette | Alliance Biosciences |
| | Jenna Hess | Alliance Biosciences |
| | Lois Rosenblum | The SLAM Collaborative |

To All Present:

The Following is believed to be an accurate representation of discussions and decisions made at this meeting on December 3, 2013. If any of the items are incorrect or fail to record discussions at the meeting, please notify the writer of these minutes, in writing, within 5 days of the issue date. Failing such notification, these minutes will be considered a matter of record.

4-1 **Data for Cost Model**: The financial data that has been provided for the cost model is generally sufficient to support the development of the model. Clarification is still needed regarding staff positions that were lost due to budgetary issues in 2008 and following, and due to Tropical Storm Irene. It was also noted that some staff that work in the lab facility are not paid out the lab budget. In order to resolve the lack of clarity,

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a staffing level spreadsheet will be drafted and circulated for input.

4-2 **Outsourcing Cost**: The cost model shows that full outsourcing of lab services is not viable, economically or otherwise. The outsourcing model cannot readily deliver the level of responsiveness desired. An internal lab has proven to be able to detect problems with samples or results more rapidly than an outsourcing model. The outsourcing model was also seen as ineffective when the task is to identify the unknown source of a problem.

4-3 **Co-Located Model**: The co-located model was seen as a reasonable and responsible approach, replicating the model employed prior to Tropical Storm Irene. Costs would be higher than costs for a collaborative model.

4-4 **Collaborative Model**: The collaborative model would offer considerable operational savings as well as reduced cost for construction of a new facility. The savings in staff cost is projected in the current draft to be $500,000 per year for the same level of output, due to improved work flow. The anticipated annual savings in fee for space is projected at approximately $30,000 per year. The cost of the new facility could be reduced by approximately $1.7 million, based on a cost of $450 per square foot.

4-5 **APHL Recommendations**: The recommendations in the 2006 APHL report on the lab would generally all be implemented in the collaborative model.

4-6 **DEC Test Pricing**: From analysis done to produce the cost model, the DEC's cost per test appears to be slightly understated. The operational savings from moving to the collaborative model would likely bring the actual cost per test into closer alignment with the pricing structure.

4-7 **Unmet Need**: The value assigned to unmet need in the cost model is based on the difference between actual expenditures since Tropical Storm Irene and the expenditures projected from the budgeting and spending trajectory prior to the storm. This is assumed to be the value of services that could not be provided due to limited capabilities. The unmet need does not include growth or new service areas. DEC believes that their actual unmet need may be greater, because recovery from 2009 cutbacks is not accounted for.

4-8 **Staffing Realignment**: The basic concept in staffing the collaborative model is to base staffing on the type of testing provided rather than on the identity of the customer.

4-9 **Coordination Between Lab and Program**: It was noted that the close interaction between lab staff and program staff adds value and efficiency to the services provided by the lab, in a way that would not be possible with an outsourced model.

4-10 **Future Growth**: To cost effectively provide for future growth, the new facility could be designed to accommodate all Tier 1, Tier 2, and Tier 3 functions according to current needs. If Tier 1 wet lab functions grow in the future, the Tier 2 or Tier 3 functions could then be moved elsewhere to create space. This would require a relatively modest initial additional expenditure to upgrade systems to provide this flexibility.

4-11 **Examples of Flexibility**: It would be beneficial to show examples of facilities designed to be upgraded in the future and later being successfully adapted.

4-12 **BSL-3 Capability**: It does not appear that the lab currently requires BSL-3 capability, and it does not appear economically realistic to construct for future BSL-3 capability. The lab should, however, make a conscious decision about what it would do in the future if BSL-3 capability were to become necessary. One option would be to locate the lab adjacent to another facility with BSL-3 space that could share. Another option would be to make a conscious decision that having BSL-3 capability at a remote location would be acceptable.

4-13 **Future Regulations**: The lab should consider whether future regulations may lead toward a closer interface with the Department of Health lab. If this seems to be a likelihood, the Colchester site becomes more attractive. Development of the Colchester site as a technology park could be beneficial to the state in the long term.

4-14 **Cost Accounting**: The 1989 DEC Laboratory Cost Accounting System is a good model for allocating test costs in a collaborative lab, but it needs to be thoroughly updated to reflect current circumstances.

4-15 **FEMA Funding**: The report should not imply that the replacement facility is relying on FEMA funding. FEMA can be mentioned, but it should be in the context of the overall budget for replacement of the Waterbury complex.

4-16 **New Facility Site**: The report should not recommend a site or location for a new facility. Siting narrative should be limited to identifying options, and presenting the considerations that will affect the siting decision.

4-17 **Business Model Comments**: Comments on the draft business model should be provided by the end of the week.

4-18 **Governance Model**: AAFM and DEC are scheduling a separate meeting to develop their ideas on the shared governance model.

4-19 **Report Clarity**: It was noted that clarity will be critical to the success of the report. Some specific areas noted include:

- Clearly identifying which staff are paid out of the lab budget and which are not.
- Clearly outlining what the lab does now and why, what it can do in the future, and how it positively affects the state in the areas of human health, environmental health, and commerce.
- Terminology should be defined for laypeople where necessary.

4-20 **Future Growth**: As time does not permit development of detailed plans for growth and additional fee for service options, the report should simply identify and list the anticipated possibilities. Several are outlined in the RFP for the feasibility study. AAFM and DEC will develop others.

4-21 **Outsourcing Costs**: In the cost model for outsourcing all lab functions, it is assumed that the actual cost per test would be similar to the average cost available on the market. Using the lowest cost available on the market was not seen as realistic, as the low price could only be obtained by constantly rebidding, and could require compromising responsiveness and accuracy.

4-22 **Tier 2 and Tier 3 Functions**: It was noted that the distinction between Tier 2 and Tier 3 functions is that Weights and Measures (the only Tier 3 function) has current space that meets their needs.

4-23 **Advantages of Consolidation**: If all functions can be included in the new facility, it offers the opportunity for the leanest, most efficient operation, and promotes a stronger image to external customers, whose issues can all be addressed at a single location.

4-24 **Space Programming**: A meeting will be scheduled for next week to review the development of the space program for the new facility. The program is being based on user interviews that took place two weeks ago. Users have been furnished with meeting notes for review and most have responded with comments.

4-25 **Board of Advisors**: In addition to the governance board, it was thought useful to consider developing a Board of Advisors that would draw on constituents for the lab, such as farmers and environmentalists. DEC is already doing this but more informally.

4-26 **Upcoming Meetings**: AAFM and DEC will be meeting with the Deputy Secretary of Administration on December 31 regarding the proposed new lab. There will be a meeting to review the draft report on December 19 at 10:00. A meeting to review the final draft was tentatively set for January 7.

4-27 **Work Product**: The final work product for the study is expected to be a bound report and a series of slide for incorporation in a Powerpoint presentation.

Respectfully submitted,

The S/L/A/M Collaborative

Paul D. Rammelsberg AIA, LEED AP
Senior Associate

The S / L / A / M Collaborative

# Meeting Minutes No. 05

| | | | |
|---|---|---|---|
| **Project:** | State of Vermont<br>Agency of Agriculture and<br>Department of Environmental<br>Conservation Laboratory | **Issue Date:** | December 26, 2013 |
| | | **Meeting Date:** | December 13, 2013 |
| **Project No.:** | 13184.00 | **Meeting Time:** | 9:30AM |

| | | |
|---|---|---|
| **Present:** | Jim Leland | Vermont Agency of Agriculture |
| | John Jaworski | Vermont Agency of Agriculture |
| | Daniel Needham | Vermont Dept. of Environmental Conservation |
| | John Schmeltzer | Vermont Dept. of Environmental Conservation |
| | Ryan Burnette | Alliance Biosciences |
| | Paul Rammelsberg | The SLAM Collaborative |

Architecture
Planning
Interior Architecture
Structural Engineering
Landscape Architecture
Construction Services

| | | |
|---|---|---|
| **Distribution:** | Chuck Ross | VT Secretary of Agriculture Food & Markets |
| | Jolinda LaClair | VT Deputy Sec'y. of Agriculture Food & Markets |
| | Justin Johnson | VT Deputy Secretary of Natural Resources |
| | Trey Martin | Vermont Dept. of Environmental Conservation |
| | Dan Nielsen | Vermont Dept. of Environmental Conservation |
| | Kristin Haas | Vermont Agency of Agriculture |
| | Marc Paquette | Vermont Agency of Agriculture |
| | Dan Scruton | Vermont Agency of Agriculture |
| | Katherine McNamara | Vermont Agency of Agriculture |
| | Cary Giguere | Vermont Agency of Agriculture |
| | Tim Schmalz | Vermont Agency of Agriculture |
| | Robert Blakey | Strategic Equity Associates |
| | Jenna Hess | Alliance Biosciences |
| | Richard Polvino | The SLAM Collaborative |
| | Lois Rosenblum | The SLAM Collaborative |

Atlanta, GA

Glastonbury, CT

To All Present:

The Following is believed to be an accurate representation of discussions and decisions made at this meeting on December 13, 2013. If any of the items are incorrect or fail to record discussions at the meeting, please notify the writer of these minutes, in writing, within 5 days of the issue date. Failing such notification, these minutes will be considered a matter of record.

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4th Floor
Boston
Massachusetts 02210-1135
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5-1 **Lab Organization**: From analysis of the science that is being done, it appears that the proposed collaborative lab facility can be best organized under the two primary groupings of biology and chemistry. All of the labs except weights and measures can be logically grouped into one of those two.

Meeting Minutes 05
Page 2

5-2 **Reporting Structure**: In general, it was though that the Tier 2 and Tier 3 labs should not be part of the collaborative lab governance. One of the reasons for them to remain separate is their direct relationships with the programs that they support, and another is the separate budget lines and/or funding sources that support them. Their location in the facility should still be determined based on whether their work is biology or chemistry.

5-3 **Organizational Diagram**: The Tier 2 and Tier 3 labs should be shown at the side with a dashed line to indicate their indirect relationship to the collaborative governance model.

5-4 **Plant Lab**: It was though that the Forests Parks and Recreation Lab would need to remain administratively separate from the Plant Industry Lab.

5-5 **Safety and Waste Management**: It was noted that any occupant of the new facility, regardless of the reporting structure, should be accountable to the safety and waste management authority, as a condition of being allowed to use space. This policy will need to be reinforced at the agency level.

5-6 **Quality, Safety, and Waste Management**: It will be assumed that the roles of quality assurance, safety, and waste management require the equivalent of one full time position. The report needs to be clear that it is necessary to dedicate resources in these areas, and that it will ultimately save money. The recent DEC consent decree is evidence of the cost of not doing so.

5-7 **Safety Consultant**: It will be recommended that a qualified consultant be hired during the design phase of the new facility to assist in development of the safety and waste management plan, as the safety and waste management plan plan will influence the design.

5-8 **LIMS**: It is not known at this time whether the current DEC LIMS can be expanded to serve all of the needs of a collaborative lab. It also may be advantageous to outsource LIMS support, or to purchase LIMS as a service rather than a product. Several user groups have security and chain of custody issues that need to be considered in planning a comprehensive LIMS. For present purposes, it will be assumed that no staff position will be dedicated to LIMS. It will also be recommended that a qualified consultant be engaged to develop a LIMS plan. The Department of Information and Innovation will need to be involved.

5-9 **Classroom**: The Waterbury facility included a classroom that was reportedly underutilized. It was thought that a similar space in a new facility would be more useful if it could be slightly larger and have some bench space, sinks, etc. for training use. If the new facility were located in a campus setting, this room could be potentially be omitted in favor of using space in another building when needed.

5-10 **Microbiology**: It was confirmed that the primary users of the microbiology lab would be the dairy program and the animal health program.

5-11 **Chemistry Labs**: The grouping of the chemistry labs will be redefined to be (a) metals, (b) nutrients, (c) non automated analysis and inorganics, and (d) organics.

5-12 **Space Allocation**: It was generally thought that the Waterbury facility had an excessive quantity of partitions and that a new facility could benefit from a more open, flexible plan.

5-13 **Chemical Fume Hoods**: It was noted that, going forward, it will be important to carefully define how many fume hoods are needed, and to design the ventilation accordingly. It was not possible to use all of the fume hoods in the Waterbury facility simultaneously, as cost cutting had reduced the capacity of the building exhaust system.

5-14 **Lab and Lab Support**: The space program should better explain the distinction between the types of space intended by "lab" and "lab support". "Lab" space will typically have a higher ventilation rate and more intensity of lab services. "Lab support" includes rooms with specialized equipment, prep rooms, etc.

5-15 **Waste Storage**: For present purposes the temporary waste storage is assumed to be included in the nonassignable area.

5-16 **Metals Analysis**: It is foreseeable that the metals lab may need another position in the future. For clarity of comparison, that will not be accounted for in the present business model.

Respectfully submitted,

*The* ***S / L / A / M*** *Collaborative*

Paul D. Rammelsberg AIA, LEED AP
Senior Associate

# Appendix E: Other State Regulatory Lab Models



Water Quality Monitoring Program- Laboratory Services in Other New England States

| State | Relevant experience | How adaptable is this system if you suspect a new environmental threat? | Data transfer smooth? | How are lab services funded? | Asked to describe ideal lab services |
|---|---|---|---|---|---|
| CT | Changed from state DOH state lab 5 yrs ago to UCONN & CBL (Maryland state lab) | Not very | Get electronically as Excel and put into Access. DOH had old hospital billing sys that took a lot of work to set up system with, but worked until lab personnel laid off | State and Federal money, mostly Federal (EPA) | Vermont is the model |
| ME | Consolidated Envir & Health Labs in 1992 | Adaptable, after 5 yr hiccup due to changing labs | Have not gotten to electronic data transfer yet. | State general fund for lake assessment | Described Vermont's set up, what they used to have until 1992 |
| RI | Changed from University of RI contract to state DOH lab & contract out since DOH can't meet their detection limits | Adaptable, but constrained on biological side the DOH microbiological lab geared around disease and not zooplankton | Working toward it, behind VT. | Federal money (EPA) | Described Vermont's set up, 'always been envious of Vermont' |
| MA | State Environmental Lab | Adaptable | Yes, Get electronically | State and Federal money (EPA) | Described the Vermont set up. Having their state lab on site with more capacity. |
| NH | State Environmental Lab on site | Very, if the state chem lab can't do it, they can adapt their limnology lab to do method. | Yes, get electronically. LIMS system similar to Vermont's | State and Federal money, mostly Federal (EPA). Lake Assoc pay for Lay Monitoring Samples | What Vermont and NH have now |
| NY* | Lost access to DOH lab services in 1990s, use private contract labs now | Not very, any parameter w/ short holding time needs to be planned out far in advance. | Not asked | A contract line in the budget. Full-time Laboratory Coordinator in charge of bidding and payments | "I do know that we are envious of your (Vermont's) facility." |

*Contacts for each state's water quality monitoring programs were: CT DEP: Ernie Pizzuto 860-424-3715; ME DEP: Linda Bacon 207-287-7749; RI DEM: Sue Kiernan 401-222-4700 x7600; MA DEP: Bob Nuzzo 508-767-2809 and Rich Chase 508-767-2859; NH DES 603-271-3414. NY DEC: Fred Dunlap and Scott Quinn (*NY was not asked exact questions as other states so table uses most relevant response that addresses column question).*

*Privatization of state lab services: Connecticut's Experience*

Connecticut used to have their chemistry samples analyzed by their state Department of Health (DOH) laboratory. Five years ago the lab staff were cut and DEP had to put together an RFP for private labs. It was a 'nightmare', reviewing all the proposals, a lot of labs couldn't meet their low detection limits, or method needs. They have been contracting with UCONN ever since although couldn't do all the methods they needed. Since then have renewed contract with UCONN for 3 yr periods and have begun using Maryland's state lab, Chesapeake Biological Laboratory for samples UCONN couldn't do. Found out that can use pas with state and federal labs and do not have to go out to bid. USGS good quality analyses, but expensive. Five years after transition, things finally going smoothly, but took a lot of resources to iron out the kinks and problems (i.e. chain of custody protocols, data transfer, detection limits, methods, etc.). Really have to stay on top of QA though, which takes a lot of resources.

*Consolidation: Maine's Experience*

Maine went through consolidation of environmental lab with health lab. They had to throw out 1 yr .of Chi a data as a result of the transition. It took them 5 yrs to work out all the kinks in the sample analyses for their long term monitoring programs. Consolidation caused environmental lab services to be moved offsite. No longer could they meet with lab personnel with 2 minutes notice to: sort out a problem. They would like to have environmental lab back on site. In 1996, 4 yrs after state lab consolidation, went to using University· of Maine at Orono for some analyses. Consistent and good collaborative relationship built with them, always easy to work out problems.

*Conversion from private to state lab services: Rhode Island*

Rhode Island's water monitoring lab services are provided by the state DOH lab. DEM transitioned to that when the private contract with the University of Rhode Island wasn't working out. They still have to contract out services, because the DOH lab doesn't have low enough detection limits or support the methods they need. They have a Master Price agreement that goes out to bid every 3 yrs for multiple state agency lab services. Need to make sure that labs that provide the methods and detection limits DEM needs are solicited, if not paying attention during negotiations then may end up out of luck for a contractor on approved list to get analyses done with. Worrisome for their long term monitoring programs, since changing labs every three years is a real possibility. Benefit of state lab's analyses is the dedicated QA

*State Environmental Lab: Massachusetts*

Like Vermont, Massachusetts has both an Environmental Lab and DOH lab in separate parts of state.. Unlike Vermont, Massachusetts's lab is not located on site and DEP generates more samples than their lab can process so DEP has to contract out some samples for that reason. In past used to put out RFRs for specific tests, but this year doing Master Services Agreement RFR. Sent out to 120 labs in and out of state, and received proposals from 12. Plan to add to existing list for total of 18 labs with one as far away as British Columbia. Getting funding for contract lab work is a battle every year. They have had trouble with contract labs. They send them QC samples and while their state DEP lab does fine, the contract labs haven't always done as well. Have to be very careful with contract labs since there is a lot that Isn't in the SOP that could be compromising the samples or data. Must make surprise audits of labs and must look through documentation very carefully. They spend time working with the lab if it fails it's QC test. Like RI and CT they noted this is very time consuming and necessary for quality assurance.

*State Environmental Lab on site: New Hampshire*

New Hampshire is the most similar set up to ours. Their DEM Limnology lab is in the same building as their DEM chemistry laboratory (Similar to our bio-monitoring and chem lab situation). They've been using this lab for 30 yrs. There really isn't anything that doesn't work. If they have a problem, they just pop into lab manager and chemist's office and work it out. Plenty of QC and consistency in long term monitoring data.

*Privatization of state lab services: New York's Experience*

New York State DEC lost access to lab services at the State DOH Lab in the 1990s and has used private contract labs for water quality analytical services since then. When they had access to DOH lab services, they enjoyed a much more robust ambient monitoring program than they do now. They had an aggressive wastewater monitoring program and an extensive stream surveillance network. Now they don't have either. Short holding time parameters are very difficult to do now. Any bacteria work they want to do has to be planned out well in advance as they generally have to have a sub-contract it with a local lab facility. It's difficult to respond to emergencies that may pop up from time to time. After some data quality problems early on with the change to private labs the low-concentration lake samples seem OK now. However, it is harder now to assess data quality because we don't do lab comparisons with split samples, etc. The large private labs don't run many of the typical lake parameters (e.g., phosphorus, chlorophyll-a) and tend to sub-contract these out to small research labs. Now there is additional planning, justification, and paperwork required to secure laboratory services and there is a full-time Laboratory Coordinator in charge of bidding and payments. There have been no savings in costs-per-sample compared with costs at the DOH lab. Because lab services are a contract line in the budget, these funds are vulnerable to cutting. All lab services funds were withdrawn in Nov 2008 due to the state budget crisis, and NY DEC has had to suspend all water sampling for an indefinite period. In summary, "We are used to it (contracting for laboratory services) but we don't like it."

05/16/90 10:12 202 472 0114 EPA FOD 002/008

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF ADMINISTRATION AND RESOURCES MANAGEMENT

April 30, 1990

Mr. Wallace McLean, Chief
Environmental Sciences Section
Department of Environmental Conservation
Agency of Natural Resources
103 South Main Street
Waterbury, VT 05676

Dear Mr. McLean:

It is my pleasure to approve your method of deriving a Work Time Unit (WTU) cost to use in establishing billing rates for laboratory services. We have worked together for a long time to reach this point. Your agreement to allocate administrative services to the analytical cost centers using a basis of salaries and wages resolves the final open issue.

Enclosed is my calculation of the WTU rate for the five analytical cost centers using the agreed upon salaries and wages distribution base for the administrative cost center.

I appreciate your determination to develop a direct billing procedure for laboratory services and thank you and Dr. Gerald DiVincenzo for all of your efforts. Call me at 202-382-3243 if you have any questions.

Sincerely,

John J. Zabretsky, Chief
Cost Policy & Rate Negotiation Section
Cost Review & Policy Branch (PM-214F)

Enclosures

cc: Mike McGagh
Region I

Vermont ANR Lab Rate

| | Total | Admin | Organics | Atomic Absorb | Auto wet Chem | Wet Bact | Biotics |
|---|---|---|---|---|---|---|---|
| Salaries/Benefits | 316,524 | 95,260 | 55,576 | 46,014 | 30,853 | 47,859 | 40,962 |
| Non-Contractual | 1,922 | 752 | 1,170 | | | | |
| Total Personnel | 318,446 | 96,012 | 56,746 | 46,014 | 30,853 | 47,859 | 40,962 |
| Total Operating | 90,688 | 53,614 | 22,865 | 8,377 | 2,359 | 2,639 | 834 |
| Total Personnel & Operating | 409,134 | 149,626 | 79,611 | 54,391 | 33,212 | 50,498 | 41,796 |
| Administrative reapportionment | 100% 149,626 | 0 | 26% 38,172 | 21% 30,953 | 14% 20,754 | 22% 32,194 | 18% 27,554 |
| Total Revenue Center | 409,134 | | 117,783 | 85,344 | 53,966 | 82,692 | 69,350 |
| WTU | 252,652 | | 56,139 | 42,443 | 79,216 | 74,854 | 0 |
| Cost/WTU | 1.62 | | 2.10 | 2.01 | 0.68 | 1.10 | ERR |

# LABORATORY COST ACCOUNTING SYSTEM

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION

October 1989

Revised April 1990

## INTRODUCTION

During 1987, the Vermont Department of Environmental Conservation (DEC) Laboratory considered initiating procedures to quantitate its work and calculate its costs for services it provides to the line divisions within the Department and to other Departments in State government. The Laboratory management was also interested in having a "system", which would facilitate (a) planning future laboratory activities, (b) management of activities within the laboratory; and (c) reimbursement from grants requiring that in-house laboratory services be treated as contractor services. The laboratory intends to integrate this information into our existing laboratory data management system.

After reviewing several methods for developing cost accounting systems, the Work Time Unit (WTU) concept, developed at the Center for Disease Control (CDC) for use in public health laboratories, emerged as the preferred approach. It is an established system, which is in use by Vermont's Department of Health to support its fee for service systems. The WTU concept has widespread use in other public health laboratories as well. Discussions between John Zabretsky, Chief of Planning and Cost Advisory Branch, US EPA, Washington, Dan Regan of EPA's Region I accounting office, and Wallace McLean, Hale Ritchie and Gerald DiVincenzo of the DEC in the spring of 1987 led to a decision to undertake a cost accounting study based on the WTU concept.

The Department hired Mr. David Pegg, an industrial engineer previously employed by CDC as a cost accounting specialist, to consult with Laboratory staff, Department management and EPA officials from 12/14/87 to 12/16/87 regarding the development of a cost accounting system specifically utilizing the WTU concept.

The objectives of the consultation were to:

1. Teach the laboratory staff the principles of laboratory cost accounting and the mechanics of information gathering to determine times and ultimately the cost of laboratory tests.
2. Initiate a work load measurement structure which permits the generation of cost-per-test information and productivity indicators.
3. Instruct laboratory personnel in the documentation and timing of test procedures, and in the managerial uses of productivity data.

The balance of this report is devoted to the development of a cost accounting system utilizing the WTU concept and its application to the Laboratory's management objectives.

**BUILDING THE COST ACCOUNTING SYSTEM**

A. Organization

During the first step cost centers are identified. A cost center is a definable activity that produces a product or provides a service and in doing so incurs costs for salaries and operation. To determine appropriate cost centers the following criteria were considered. A cost center should:

1. have at least one service or product as an output of the activity,

2. be similar or related by service or product to the parent organization, and be definable by personnel assigned to a unique organizational unit,

3. provide for ease in the collection of cost data, or permit this collection with reasonable effort, and

4. have a continuing program of providing services or products, with a person responsible and accountable for the activity.

There are two types of cost centers:

1. Revenue Centers - are those activities that provide services (or products) to users outside of their parent organization and for which revenue could be gained if charges were made. Whether or not charges for services are actually made is immaterial. For example, the DEC Organics Cost Center is a revenue center even though a direct fee for a laboratory analysis is not charged.

2. Non-revenue Centers - are those activities that support other cost centers within the organization and for which revenue could not be gained. In the Vermont DEC Laboratory, the administrative cost center includes the supervisor's office, clerical support, glassware, and facilities management. It is a definable cost center that provides a service only to other cost centers in the laboratory. The administrative cost center is therefore a "non-revenue" producing cost center.

Figure 1 indicates how the cost centers are organized for the purposes of developing a cost accounting methodology. It indicates which of the cost centers are non-revenue, and which are revenue producing centers. It also provides a coding procedure which can be used to accumulate costs in each center.

(3)

B. Cost accounting analysis is performed in five basic steps:

1. Accumulation - Costs (expenses) are linked with the laboratory's technical, administrative, and support sections (called "cost centers") where the costs are incurred. Costs are usually determined based on expenses incurred and work performed during a specific period. This laboratory implemented a cost accounting system starting with a year of data collection. (Cost data for this study were collected July 1, 1988 through June 30, 1989.)

2. Allocation - Those costs which cannot be connected with any particular section are allocated to each section on a fair-share basis. At the end of this step, the total cost of producing tests or services in each section will have been identified.

3. Reapportionment - The cost of operating the sections providing internal support, such as administration, glassware, and facilities management, are reapportioned to those sections performing tests and other services based on the percentage of support that they each receive. Support services were combined and apportioned to "revenue producing" cost centers based on expenditures incurred.

4. Cost-Per-Test - The total cost of each laboratory section (revenue producing cost center) is calculated for each test performed.

5. Productivity - Productivity indicators are identified using WTU's performed by those laboratory sections processing samples.

Accumulation

Once the cost centers were designated, costs were accumulated. Accumulation means that costs are directly identified by cost center and recorded in an account for each cost center. The primary targets for accumulation are cost for labor (salaries and benefits) and operations because these expenses usually constitute the total operating cost of a laboratory. Employees coded their time to a specific cost center in proportion to the average time spent in that center. Operating costs were assigned to the cost center in which they occurred.

The expenditure summary (Table I) provides a sample format for accumulating cost. It provides a column for each cost center, and a line for each type of expense. All non-revenue producing cost centers are included in the Administrative cost center. In this example nine categories of expenses have been entered as accumulated expenses. Table II lists object codes within each of these categories, and Table III lists titles for these object codes.

Allocation

After the accumulation of costs has been completed, costs that cannot be identified as having been incurred by a particular cost center must be allocated on some fair-share basis. Vacation, sick leave, etc. are coded to 36-371, the administrative center. Operating costs not associated with a particular center were coded to the administrative cost center. Appendix I, "Agency of Natural Resources, Expenditures by AID, DIV, SDIV, Object," summaries the allocation procedure for FY 1989.

Reapportionment

The costs of the non-revenue cost center were spread or reapportioned to specific revenue centers. Once this is done, an estimate of the total cost of each revenue producing cost center can be determined. This third step in building a cost accounting system is called reapportionment.

The basis used for reapportionment rests in the "services" provided by a non-revenue center to all other cost centers, including both non-revenue as well as revenue centers. In this Laboratory all expenditures in non-revenue cost centers were combined into the administrative cost center and reapportioned to revenue cost centers according to the percentage of the total laboratory personnel budget spent in that cost center. Administrative allocation and reapportionment is summarized in Tables IV and V; the administrative reapportionment to each revenue cost center is shown in Tables VI, VII, VIII, IX and X.

Cost Per Test

The standard time, in minutes, or number of Work Time Units (WTU), for each test or procedure is shown by revenue cost center in Tables XI, XII, XIII and XIV. Efficiency of production is generally proportional to the number of tests performed. The WTU's per test generally decrease as the number of tests increases (see Table XIII).

The WTU's shown in the document are intended to measure only the analytical time necessary to accomplish the analytical tests and procedures. They do not include the non-analytical time required for (1) collection of samples, (2) logging in and labeling samples, (3) instrument operating or performing a step in a procedure being automatically processed (incubating time, etc.), while the analyst is performing other duties, (4) method development, and (5) clerical work involved in reporting results after they are first recorded.

This does not mean that the non-analytical times are ignored. Indeed, they represent a significant amount of the laboratory's work. Non-analytical times are accounted for when tests costs are calculated. Analytical times do include quality control, sample preparation and both writing and checking results; non-analytical times include consultation with program personnel, correcting sample labeling errors, method refinement and adaption, etc..

WTU's have been developed for all of our laboratory tests. Most WTU assignments are the direct result of timing studies. Untimed or partially timed tests have been denoted with an asterisk. Estimated times for tests that are performed occasionally were assigned by consultation with the appropriate analyst. For all other tests, each analyst was required to list the steps taken to perform each analytical test. These steps were timed as scheduling opportunities allowed. When all steps for a test were timed, a number of WTU's for that test was assigned. Some steps/tests have had multiple timings. All conclusions on WTU/test will be based on a multiple timings as the system is refined. The Laboratory's use of the WTU concept will include:

1. Estimating test cost using standard cost accounting techniques.

2. Calculating work load efficiency (productivity).

3. Forecasting workload.

Cost per test data were developed using the expense data assigned to each revenue producing center (available in fiscal year production reports) and the number of WTU's each center produces (from timing studies and summary Laboratory Management Reports). From these elements the cost per WTU for each revenue center is calculated by dividing the cost for that center by the number of WTU's generated. An example of the use of this data follows: In cost center 374 (Table XIII) the cost of a WTU is $0.68 and the time to perform a chloride test is 10 minutes (10 WTU). Therefore, the cost for a chloride analysis in FY 1989 was $6.80. This laboratory has quantitated analytical times only for tests performed. Consultations, time in court, and training services, etc. using laboratory personnel are currently considered non-analytical time.

<u>Productivity</u>

Work hours can be measured in at least three ways: gross time, available time, and net available or actual time. Gross time is total paid hours, typically, 2,080 hours per year, for a 40 hour week. Available time is gross time less time for vacations, holidays, sick leave, and coffee breaks. This authorized time away from the work bench reduces the gross time by about 20%. Net available time is available time less time for training, literature and regulation review, fire drills, restroom breaks, voting, jury duty, work flow delays, etc., (the numerous things that take the analyst away from the bench). Net available time is approximately 10% less than available time and 30% less than gross time. A fourth measure of work hours, which can be developed when a sufficient data base is available, is <u>non-analytical time</u>. Assuming that the analytical time required in a test is described by WTU's, then the difference between total test time and analytical time is the non-analytical time. Ten percent is estimated for cost centers producing results requiring minimum interpretation. Non-analytical time can reach 50% of total time in cost centers where consultation and sample handling decisions are frequent.

When this laboratory uses WTU's to describe workload index (productivity), it uses available time. The methodology for these calculations is the same, however, whether gross, available, or net available time is used.

The automated wet chemistry cost center (374) produced 79,216 WTU's in FY 1989 using 2,984 man hours. To calculate the W.L.I.

$$\text{WLI} = \frac{\text{Total WTU's}}{\text{Man Hours}} = 79{,}216/2{,}984 = 26.5 \text{ WTU/hour}$$

The measurement of WLI, or productivity, is generally useful for intra-laboratory comparisons among analytical centers and provide its director with a management tool to deal with manpower and resource problems. It is inappropriate for inter-laboratory comparison. Attempts to compare this type of data between laboratories will lead to oversimplified and incorrect conclusions.

Low WLI's in relation to the laboratory average WLI can indicate: (1) procedures with improper WTU's; (2) the use of outdated procedures; (3) a high percentage of research or consultation effort in that particular area; (4) slow workers or disorganized and inefficient work habits; (5) equipment with excessive down time; (6) overstaffing; or (7) specialists with excessive free time when their specialties are not needed. On the other hand, unusually high WLI's in relation to the laboratory average WLI can indicate: (1) a large volume of repetitive or automated type tests not given proper WTU's; (2) padded workload data; or (3) overworked personnel.

**FORECASTING**

Laboratories are frequently required to project future needs in many areas; personnel, budget, supplies, equipment, space, etc.. A common factor that can be related to these areas is the amount of work produced in the laboratory. With sufficient historical data, the number of Work Time Units can be projected with a reasonable degree of accuracy, assuming that the determinants are consistent. Table XV provide an example of the WTU concepts being used in this Laboratory to assess manpower requirements for a planned lake assessment. For this assessment 60% (36 WTU/hour) of gross time was considered an ideal WLI goal because these individuals will not be involved heavily in interpretation or consultation. Tables XVI and XVII illustrate use of the WTU concept as an auditing procedure for ongoing programs. These programs (021 and 041) are required to treat the DEC Laboratory as a contractor and pay on an as use basis.

(7)

## CONCLUDING REMARKS

The above described cost accounting system is aimed at:

1. identifying costs for specific laboratory functional areas, and administrative/support areas, and

2. estimating costs per test and productivity using these costs and WTU data.

It describes the steps used to build the system and supplies worksheets with the raw data.

For the 1989 fiscal year, the use of depreciation for major pieces of equipment was not considered necessary. Future major equipment purchases will be allocated to appropriate revenue centers using the principles outlined here and depreciated by methods approved by the Internal Revenue Service.

Supporting documents for the WTU development resides with the laboratory director. Expenditure documentation is with the department business manager.

# Appendix G: Feasibility Study Team



## *The S/L/A/M Collaborative (SLAM)*

SLAM is a 150-member full-service architectural firm with offices in Boston, Syracuse, Glastonbury, and Atlanta. A fully-integrated, multi-disciplinary firm, SLAM offers architecture, planning, interior design, landscape architecture and site planning, structural engineering and pre-construction services, and takes responsibility for projects from planning and design through construction. We specialize in the programming, planning and design of laboratories. Our scope is national, working for prominent institutions across the United States. SLAM specializes in helping our clients align their physical resources with their strategic vision. SLAM has planned and designed research projects that range from facilities that are focused on basic research to scale –up and production facilities. Our experience includes a full range of wet labs, analytical labs, high hazard labs, animal vivaria, visualization and computational labs, clean rooms, containment labs, barrier labs, BSL 2 and 3 labs, and more. SLAM has provided feasibility studies and master planning services to such institutions as Purdue University, Iowa State University, The Jackson Laboratory, Pfizer Corporation, The Center for Medical Science in Albany, Rutgers University and Cornell University. These feasibility and pre-design services are instrumental in defining the challenges that each institution faces, in developing alternate options and scenarios for meeting these challenges, and then providing a plan for aligning the physical resources required to sustain and advance each clients' mission, goals, and objectives.

**Richard Polvino, AIA, LEED AP**

Rick is the managing Principal of SLAM's Boston office with over 20-years in the architectural profession. His expertise is in the overall leadership and vision of a project for all-phases of Science Technology, Higher Education and Healthcare design and building programs. Rick's leadership process involves all stakeholders from administrators, facilities personnel, and end-users, along with community committees and the extended Architectural / Engineering team. Rick's professional and 'personal' end-goal for a successful project is the data-driven successes of the outcomes whether it being a higher-performing work environment, increased revenue, staff recruitment or most importantly, and simply 'a happy client'.

**Paul Rammelsberg, AIA, LEED AP**

Paul is a Senior Project Manager in SLAM's Boston office, with over 25 years of experience in design and construction of technologically sophisticated facilities for higher education, corporate, and public sector clients. He is skilled in assembling data and requirements from a wide range of sources, including end users, administrators, and regulatory authorities, and translating that information into solutions that meet or exceed expectations.

**Lois Rosenblum, AIA**

Ms. Rosenblum, a Principal with the Firm since 2006, has 25 years of experience in the design and construction of new and renovated facilities for research laboratories, colleges and universities, and corporations. She is skilled architect in ensuring that projects respond to academic and/or research missions; that they incorporate requirements for funding and fundraising; that budget, schedule, and quality are appropriately aligned; that capital and operating costs are controlled; and that project designs are flexible enough to accommodate future needs. Lois serves on the Scientific and Technical Review Board of the National Institutes of Health and has been widely published in journals such as Animal Lab News and Laboratory Design.

## *Strategic Equity Associates, LLC - Life Cycle Value Analysis Consultant*

Mr. Robert Blakey is the facilitator for the development and cost-benefit analysis of the laboratory administration and business model opportunities. Mr. Blakey has a Master's Degree in Engineering Management. He has worked as a consultant and a business manager in the areas of research and healthcare/ development for the past 12 years. His overall management experience is well over 20 years. He is a Board Member of the Building Smart Alliance at the National Institute of Building Sciences, the President of the Research & Development Council of the International Facilities Management Association, President of the Washington State Society for Healthcare Engineering, a past Board Member of the International Institute for Sustainable Laboratories, and an accredited instructor in Facilities Management. In addition to his consulting work, Mr. Blakey is currently the Senior Manager for Operations for a Healthcare organization in Washington State with close to 60 facilities and 3,000,000 sf of clinical and lab space. Mr. Blakey has provided similar consulting work, as a member of SLAM's team, with MIT, Cornell, and Upstate Medical University. He has also performed relevant work at the Oregon Health Sciences University, City of Portland (Oregon), City of Seattle, and the State of Washington. Other credentials of Robert include -

US Merchant Marine - Chief Engineer of Steam, Motor, or Gas Turbine Vessels of Any Horsepower

US Green Building Council - LEED Accredited Professional (LEED-AP) O&M

American Hospital Association / American Society for Healthcare Engineering - Certified Healthcare Facility Manager (CHFM)

Association of  Energy Engineers

Certified Energy Manager (CEM)

Certified Sustainable  Development Professional (CSDP)

International Facility Management Association

Certified Facility Manager (CFM)

Facility Management Professional (FMP)

Sustainable Facility Professional (SFP)

SAVE International - Associate Value Specialist (AVS)

## ***Alliance Biosciences***

Alliance Biosciences, a division of Alliance Engineering, Inc., is the leading laboratory design and biorisk management consulting firm on the east coast. Alliance Biosciences has the privilege of collaborating with academic, government (Federal, State, and International), and private institutions in the U.S. and around the world. As a full-service consulting engineering and biorisk firm, Alliance leads biocontainment (BSL-2/3/4, ABSL-2/3/4, BSL-3-Ag, BSL-3-Autopsy), clinical, diagnostic and research laboratory projects. Alliance BioScience has provided similar consulting work, as a member of SLAM's team at the Center for Medical Science in Albany, NY.  Core capabilities include:

Laboratory Planning & Design

Laboratory Commissioning & Verification

Regulatory Compliance (CDC/NIH, DSAT, OSHA, USDA, DOT, IATA, WHO)

Laboratory Safety

Risk Assessments & Gap Analysis

Custom Training

Project & Program Management

Construction Management

**Ryan Burnette, Ph. D.**

Director

Dr. Burnette is the Director of Alliance Biosciences, a division of Alliance Engineering, Inc. Alliance Biosciences was formed to address the specific needs of the bioscience research community, providing a full range of engineering projects for biotechnology and pharmaceutical companies, biological process scale-up, and assistance to companies, academic institutions and government agencies with biosafety plans, reviews and audits, recommendations and operational compliance. Dr. Burnette consults as a scientist and Project Manager on full-discipline engineering projects for medical testing and biotechnology companies in the U.S. and abroad, as well as the design and implementation of high-containment facilities, operations and audit programs. Dr. Burnette has extensive expertise with regard to biosafety compliance issues, drawing both from his own microbiological bench research experience and his extensive contact and familiarity with the CDC's Biosafety in Microbiological and Biomedical Laboratories, as well as other pertinent regulatory policies. Dr. Burnette regularly lectures on biotechnology issues to a variety of audiences. He serves as a member of the Institute for Biosciences and International Security Policy and other committees.