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Synthesis Report of the US EPA Laboratory Enterprise Evaluation

Office of the Science Advisor
Science and Technology Policy Council
Laboratory Enterprise Work Group

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I. Message from EPA Administrator Gina McCarthy

EPA is committed to science.

Science is the foundation of EPA's work: from testing soil at Superfund sites to protecting the quality of America's waters to conducting research that supports the agency's and the President's work to take action on climate change. We must make sure our laboratory facilities are operating at their best, so our dedicated scientists and engineers have the tools and resources to provide this excellent science and research.

EPA is committed to greening the government.

EPA is a leader in making government operations more environmentally friendly. In the past, EPA was one of only two agencies in the Federal government to score green on all sustainability metrics contained in the Office of Management and Budget's environmental scorecard. This commitment extends to laboratories, and by finding ways to make EPA's laboratories more efficient, EPA can continue reducing its energy consumption, water usage, and greenhouse gas emissions.

Supporting our commitments to science and the environment

EPA is committed to providing rigorous science to protect health and the environment and to reducing our environmental impact by greening the government. This evaluation began in December 2012, when former Deputy Administrator Bob Perciasepe announced the effort to identify opportunities that would increase efficiency and effectiveness while ensuring the agency's ability to provide the best research, science and technology critical to our mission. Over the next two years, EPA collected and analyzed extensive laboratory enterprise information, which has given us a more complete and more accurate snapshot of our entire laboratory enterprise across all of our programs, regions, and research offices. EPA also asked the National Research Council (NRC) to look at ways to make our science even more effective, and it published a report in September 2014, called *Rethinking the Components, Coordination, and Management of the U.S. Environmental Protection Agency.*

The data we collected and analyzed, plus findings from the NRC's report, and information from other sources, have resulted in the *Synthesis Report of the US EPA Laboratory Enterprise Evaluation*. This report, and everything we learned throughout the evaluation, have given EPA important tools to help prioritize decisions about our facilities and make cost-effective use of laboratory resources to meet EPA's need for rigorous science and research—now and into the future. I fully support the actions described in the report and have directed our agency leaders to begin implementing them. I hope you take the time to read through the report; I've highlighted some of the actions we are implementing below.

Making the Lab Enterprise Even Stronger. EPA's Science Advisor will develop a vision for the lab enterprise that includes strengthening communication, coordination, and management processes throughout the agency as well as creating synergies with other federal organizations, and coordinating annual data collection and analysis. These actions will ensure that EPA maintains an up-to-date laboratory enterprise and continues to make informed decisions about our laboratory facilities.

Continue Planning and Management. EPA has three different types of labs: program, region, and research. These labs have very different responsibilities, and they will continue to plan their science as components of their respective program, regional, and research offices. Additionally, the Assistant Administrators and Regional Administrators of these offices will retain line management authority for their labs. These actions help ensure that our lab science contributions are aligned with the needs of EPA's programs and strategic goals.

A New Forum to Strengthen the Laboratory Enterprise. EPA's Science Advisor will charter a new, permanent lab enterprise forum within the Science and Technology Policy Council (STPC) to help implement the actions in the *Synthesis Report* and help inform future decisions regarding the lab enterprise.

Continue to Invest in our Laboratories. We found that, while our lab facilities are in good condition, there is room for improvement. We will continue to make investments in our laboratory facilities to ensure that we continue to provide the best science and attract and keep the best scientists.

Make Minor Consolidations. Sometimes people think that major consolidations save money, but this is not always the case. Our evaluation showed that there is potential to save money if we maximize the use of EPA's owned laboratory spaces Our evaluation identified several facility consolidations that we are now undertaking, several that will begin in the next two years, and two potential opportunities that require further evaluation. You can read more about the specifics of these actions later in this *Synthesis Report*. I also want to emphasize that we kept all of our lab staff and science functions in every scenario we evaluated and that any consolidation activities will follow all standard EPA procedures for notifying employees.

These actions will make EPA an even stronger science organization, and we now have a better approach than ever before to make sure we meet our science needs – now and into the future. I stand by these actions and know that they are our best path forward.

II. Introduction

In December 2012, EPA began a study of its laboratory enterprise to identify opportunities to increase the efficiency of its facilities and the effectiveness of its science while retaining the agency's ability to provide the preeminent research, science, and technical support critical to advance its mission. The purpose of this synthesis report is to present a summary of the completed analysis, provide observations and conclusions, and identify actions that EPA could undertake to improve its laboratory enterprise for the longer term.

The "Lab Study" was a multi-phased evaluation of EPA's laboratory enterprise and the laboratory science that supports our work. The first phase of the evaluation included data collection, verification, and analysis. The EPA Science Advisor established four subcommittees to collect facility, operating cost, workforce, and science contribution data from all of its laboratories.

Using these data, EPA worked with Smith Group JJR, a nationally-recognized consultant with expertise in architecture, engineering, and strategic planning for laboratory portfolios, to develop metrics, criteria, and a framework for analyzing options and improving the efficiency of the laboratory portfolio. The results of the facility analysis included the total cost of ownership for the portfolio,[*] potential benefits such as avoided costs and energy savings that could be realized through renovations, co-locations, consolidations, and investments to implement portfolio realignment and optimize the condition of the entire portfolio.

To complement Smith Group JJR's analysis, EPA also requested recommendations for strengthening the effectiveness of the EPA laboratory enterprise from an independent expert committee convened by the National Research Council (NRC) of the National Academy of Sciences. The NRC committee began its work with EPA in September 2013 and published its report a year later.

Collectively, EPA's data analysis, Smith Group JRR's assessment, and the NRC report provide EPA with more complete, timely, and consistent information about its laboratory portfolio than the agency has ever had

In a December 18, 2012 memorandum, the EPA Deputy Administrator announced an integrated evaluation of the agency's laboratories:
The agency's "evaluation aims to strengthen the management, effectiveness and efficiency of our laboratory network while enhancing its capabilities for pre-eminent research and other lab-based scientific and technical work in the years ahead." The evaluation will also address the U.S. Government Accountability Office's recent recommendations that we improve cohesion in managing and operating our laboratories. Finally, it will help the agency's laboratory enterprise respond to change and be equipped to handle emerging scientific challenges. To support this evaluation, Congress provided funds for EPA to undertake 'a long-term evaluation of the agency's laboratory network to ensure that the current organization matches the agency's strategic needs.'"

[*] In this document, "portfolio" refers to laboratory facilities and physical infrastructure. The facilities portfolio is a component of the laboratory "enterprise" that encompasses the organization, funding, workforce, equipment, scientific functions, activities, and contributions to clients (programs) and stakeholders.

before. This information will help EPA make decisions that could increase the efficiency and effectiveness of the laboratory enterprise now and during the next ten years.

Subsequent sections of this report outline the drivers for the Lab Study, a review of the data collection process, the analyses performed by the NRC and Smith Group JJR, and conclusions and actions for the path forward.

III. Drivers for Change

In 2007, the Administrator of the U.S. Environmental Protection Agency (EPA) requested a near-term review and long-term evaluation of EPA's laboratory network. The goal of the near-term review was to identify opportunities to improve efficiency and effectiveness at individual agency laboratories. The near-term review concluded in 2009 with the publication of a report, *Commonsense Actions and Best Practices that Improve Laboratory Efficiency and Effectiveness*.[1] The report documented more than 500 actions that individual EPA laboratories were planning on implementing nation-wide to reduce energy use and environmental impacts and to improve efficiencies in other areas.

In 2011 and 2012, the U.S. Government Accountability Office (GAO) published three reports about EPA laboratories, reducing the footprint of federal real property, and streamlining the physical infrastructure.[2, 3, 4] In its 2011 report *To Better Fulfill its Mission EPA Needs a More Coordinated Approach to Managing its Laboratories*, GAO made seven recommendations to the EPA Administrator to strengthen the management and cohesion of the agency's laboratory enterprise. In the 2012 report, *Streamlining Government: Questions to Consider When Evaluating Proposals to Consolidate Physical Infrastructure and Management Functions*, GAO recommended that EPA evaluate options to consolidate and co-locate its laboratory physical infrastructure. This report also provides guidance to federal agencies about how decision makers should evaluate the results of consolidation initiatives. The third GAO report, *Opportunities to Reduce Duplication, Overlap and Fragmentation, Achieve Savings and Enhance Revenue*, identified 51 areas where programs government-wide may be able to achieve greater efficiencies or become more effective in providing government services.

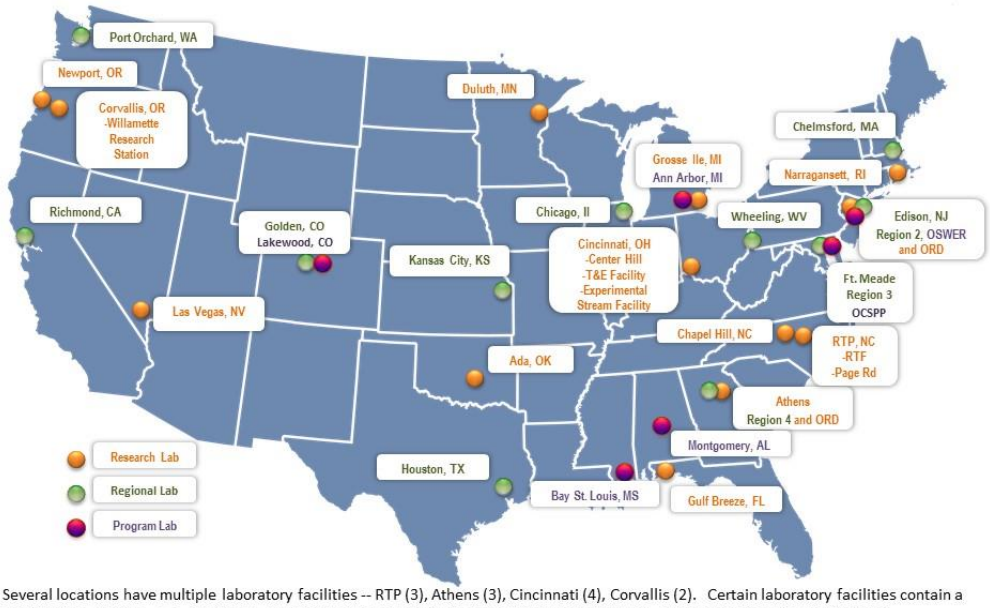
Additionally, both the President and the Office of Management and Budget (OMB) have issued executive orders and memoranda directing federal agencies to improve the sustainability of their facilities and increase the cost-effectiveness of federal property.[5,6,7] For example, the March 2013 memorandum from OMB provided direction to "freeze the federal footprint" and recommends that all federal agencies undertake studies to evaluate consolidation and co-location options for their office space and warehouse facilities.

In FY 2012, Congress appropriated funds for EPA to undertake "a long term evaluation of the agency's laboratory network to ensure that the current organization matches the agency's strategic needs . . . ."

To implement this evaluation, the EPA Deputy Administrator issued a memo announcing that the Laboratory Enterprise Work Group, under the direction of the EPA Science Advisor, was charged with responding to recommendations from GAO and leading the evaluation of the laboratory enterprise. The Deputy Administrator's memo named the Deputy Assistant Administrators from the Office of Administration and Resources Management (OARM), the Office of the Chief Financial Officer (OCFO), the Office of Research and Development (ORD), and the lead Deputy Regional Administrator for Science (Region 10, FY 2012 through FY 2013 and Region 3, FY 2014 to present) as the co-chairs of this workgroup. Appendix 1 provides a list of the EPA workgroup members and contributors.

IV. Background on the EPA Laboratory Enterprise

In 2012, EPA had a total of 34 laboratory facilities located in 29 cities nationwide. Figure 1 is a map of EPA's laboratory locations and Table 1 contains the name, location, and organization of each laboratory facility. These 34 laboratories provide critical scientific, technical, and research support that underpin agency decisions about protective health standards, policies, risk management, emergency response, compliance, and enforcement. More specifically, the EPA laboratory enterprise contains a mix of leased and owned facilities, which are identified in Table 2.



Several locations have multiple laboratory facilities -- RTP (3), Athens (3), Cincinnati (4), Corvallis (2). Certain laboratory facilities contain a combination of labs – e.g., Ft. Meade is counted as a single laboratory facility containing both a Program Lab and a Regional Lab

Figure 1. Map of US EPA Laboratory Facilities

Table 1. EPA Laboratory Locations at the Beginning of the Laboratory Study

Location	Name of Organization	Type
Ada, OK	Ground Water and Ecosystems Restoration Division	Research
Ann Arbor, MI	National Vehicle and Fuel Emissions Laboratory*	Program
Athens, GA	Field Research Annex	Research
Athens, GA	Science and Ecosystem Support Division	Region 4
Athens, GA	Ecosystems Research Division	Research
Bay St. Louis, MS	Environmental Chemistry Laboratory	Program
Chapel Hill, NC	Human Studies Facility*	Research
Chelmsford, MA	New England Regional Laboratory	Region 1
Chicago, IL	Chicago Regional Laboratory	Region 5
Cincinnati, OH	Center Hill Research Facility	Research
Cincinnati, OH	Andrew W. Breidenbach Environmental Research Center	Research, Program
Cincinnati, OH	Test & Evaluation Facility (T&E)	Research
Corvallis, OR	Willamette Research Station	Research
Corvallis, OR	Western Ecology Division (aka Environmental Research Lab)	Research
Duluth, MN	Mid-Continent Ecology Division*	Research
Durham, NC	Fluid Modeling Facility (aka Grand Slam Building)	Research
Durham, NC	Reproductive Toxicology Facility	Research
Edison, NJ	Region 2 Lab and Urban Watershed Management Branch	Region 2, Research, Program
Fort Meade, MD	Mid-Atlantic Environmental Science Center	Region 3, Program
Golden, CO	Central Regional Laboratory	Region 8
Grosse Ile, MI	Large Lakes and Rivers Forecasting Research Branch	Research
Gulf Breeze, FL	Gulf Ecology Division*	Research
Houston, TX	Environmental Services Branch Laboratory	Region 6
Kansas City, KS	Science and Technology Center	Region 7
Lakewood, CO	National Enforcement Investigations Center	Program
Las Vegas, NV	Environmental Sciences Division	Research
Milford, OH	Experimental Stream Facility	Research
Montgomery, AL	National Air and Radiation Environmental Laboratory*	Program
Narragansett, RI	Atlantic Ecology Division*	Research
Newport, OR	Pacific Coastal Ecology Branch*	Research
Port Orchard, WA	Manchester Environmental Laboratory	Region 10
Research Triangle Park, NC	Main Building	Research
Richmond, CA	Pacific Southwest Laboratory	Region 9
Wheeling, WV	Freshwater Biology Team	Region 3

*Indicates highly specialized laboratory functions or locations

Table 2. Breakdown of EPA's laboratory inventory by ownership and lease type

Laboratory Facilities by Ownership Type (Fiscal Year 2012)	
EPA Owned	19
GSA Leased	8
EPA Leased	4
GSA Owned	2
Special Use Agreement	1
Total	34

For the purposes of the Lab Study the term "laboratory facility" means a single laboratory structure or multiple laboratory structures housed at a single location. Also, a laboratory facility can contain multiple organizational units with laboratory functions. Laboratory facilities can also contain organizational units co-located with the laboratory not performing or supporting laboratory functions (e.g., Research Triangle Park is a research facility that also houses employees from the Office of Air and Radiation and the Office of the Chief Financial Officer).

EPA laboratories have three distinct and complementary missions

- **Regional Laboratories** have primary responsibility for providing scientific data in support of decisions by the EPA Regional Office's environmental programs, for addressing the comprehensive needs of the Regions, and for informing immediate and near-term decisions on environmental conditions, emergency response, compliance, and enforcement.
- **National Program Laboratories** have primary responsibility for implementing legislative mandates to develop and provide specific programs that support decisions for regulations, compliance, and enforcement at a national level.

- **Research and Development Laboratories** have primary responsibility for developing knowledge, assessments, and scientific tools that underpin decisions about EPA's protective standards, risk assessments, and risk management decisions.

Because of their complementary and distinct missions the design of laboratory space and facilities are different across the three types of laboratories. For this reason, an "apples-to-apples" comparison between laboratory types is not appropriate from the perspectives of lab science functions and facility design.

V. Data Collection

To develop the foundation from which to analyze EPA's current laboratory enterprise, EPA needed current basic data and information. While EPA laboratories individually track a variety of data, through this evaluation uniform timeframes and definitions were used across all types of laboratories. EPA, under the guidance of the Science and Technology Policy Council, formed four subcommittees to gather and analyze data. Each subcommittee was led by a team of senior agency managers, had representatives from across the agency, and had a Workgroup co-chair as a champion/advisor. The four subcommittees and their functions were:

1. Facilities Subcommittee: collected data on facility space, type, condition, and energy use.
2. Cost Subcommittee: collected data on facility costs, including rent, labor, utilities, equipment, operation and maintenance, IT, security, safety, and health.
3. Workforce Subcommittee: collected data on the current on-board workforce by discipline and number of federal staff and contract staff working on-site.
4. Science Subcommittee: collected data on representative laboratory science outputs, use by agency programs, and alignment with agency strategic goals. This Subcommittee also organized information and expert panels for NRC public meetings.

The data collection efforts included data review and verification by Deputy Regional Administrators and appropriate Deputy Assistant Administrators. Each Subcommittee compiled and reviewed the data and conducted quality assurance and follow up as needed. Below is a summary of each data call.

Facilities Subcommittee

The Facilities Subcommittee developed a template comprising characteristics such as facility area, age, condition, and annual utility consumption and cost. The Subcommittee created a customized version of the template for each of EPA's 34 laboratories and pre-populated these facility-specific spreadsheets with elements including gross square footage, annual utility consumption and cost, and fleet composition for FY 2012. Facility contacts were asked to verify the pre-populated data and to provide

additional data including operational characteristics (e.g., maintenance costs), site mission, and function. Some facilities also provided supplementary materials (e.g., organizational charts) to accompany their completed templates.

Cost Subcommittee

The Laboratory Operating Cost Subcommittee collected FY 2012 EPA laboratory facility costs (obligations and expenditures of both laboratory and non-laboratory costs) for each laboratory. Laboratory costs included both direct and indirect laboratory support costs while non-laboratory costs captured costs for personnel co-located at a facility but not working in the laboratory (e.g., at the laboratory bench). Costs were submitted within ten lab cost categories:

1. Environmental Health and Safety
2. Expendable Supplies
3. Facility
4. IT Support
5. Labor
6. Laboratory Equipment
7. Licenses & Fees
8. Moving Service
9. Security
10. Transportation

Each laboratory cost category was further broken down by specifically defined cost elements. For example, the Environmental Health and Safety cost category was further broken down into three cost elements: Hazardous and Solid Waste Transport and Disposal; Health Unit—Medical Monitoring; and Safety, Health and Environmental Management (SHEM) Support. Each laboratory categorized costs using a data export of expenditures from EPA's official accounting system.

Workforce Subcommittee

The Workforce Subcommittee requested FY 2012 data from all laboratories. Requested data included organization, location, grade levels for EPA personnel, and expertise categories (e.g., analytical chemistry, biology, earth science, engineering) and covered both federal personnel (on-board agency personnel supporting laboratory functions) and non-federal personnel (on-site contractors, research students, and other outside collaborators supporting laboratory functions).

Workforce data arrays developed from the data call include: (a) EPA personnel aligned with laboratory facilities, (b) workforce data by expertise, and (c) workforce data organized by category (science, technical, legal, and administrative).

The Subcommittee concluded that People Plus (the EPA time, attendance, and payroll system) data, while not designed to isolate laboratory personnel, reliably verified the EPA personnel reported in the data call.

Science Subcommittee

The Science Subcommittee gathered data on laboratory science functions and their contributions to EPA programs, outcomes, and strategic goals. Because of the complexity and number of tasks and projects undertaken by EPA laboratories in any given year, the Subcommittee asked each laboratory to provide data for about 5-10 laboratory science projects completed during FY 2012 that were broadly representative of the laboratory's project level contributions to agency clients (programs). Laboratory science projects were defined as projects led by laboratory science staff such as (a) chemical or biological analyses, (b) engineering analysis, simulation, or synthesis, (c) computational model development, testing, or application, and (d) non-bench scientific technical support—such as audits, field monitoring, technical assessments, quality assurance, or data validation.

The Science Subcommittee's analysis of the resulting data validated that laboratory science activities and outputs (a) are aligned with needs of agency strategic goals and objectives, (b) help agency program clients and stakeholders accomplish mission-relevant outcomes, and (c) are captured effectively by current agency planning and accountability systems that implement requirements of the Government Performance and Results (GPRA) Modernization Act (GPRAMA) of 2010 and OMB Circular A-11. The Science Subcommittee also observed that many EPA laboratories contribute to program outcomes for multiple strategic goals.

VI. Analysis of National Research Council Recommendations

In another component of EPA's multi-phase laboratory study, the agency requested independent expert advice from the National Research Council (NRC). In response, the NRC convened an *ad hoc* "Committee on Strengthening the US Environmental Protection Agency Laboratory Enterprise," which focused on priority needs, guiding principles, and goals. The Committee was asked to focus on science, and not to assess the organization, the portfolio-level assessment, or the consolidation initiatives recommended by GAO for the laboratory enterprise because these analyses were undertaken in a separate effort. The NRC committee requested extensive information and presentations for its information-gathering sessions; presentations by EPA representatives are identified in Appendix C of the committee's report. The Committee published its report, *Rethinking the Components, Coordination, and Management of the US EPA Laboratories*,[8] in September 2014. The report includes 23 recommendations derived from nine principles developed by the Committee for effective and efficient management of the laboratory

The charge requested that the NRC Committee's report (a) assess EPA's highest-priority needs for mission-relevant laboratory science and technical support, (b) develop principles for the efficient and effective management of EPA's laboratory enterprise to meet the agency's mission needs and strategic goals, and (c) develop guidance for enhancing efficiency and effectiveness now and during the next 10 years.

enterprise to meet the agency's mission needs and strategic goals. Appendix 2 presents the NRC Committee's 9 principals, which are the basis for its 23 recommendations.

In summary, the NRC Committee found that EPA laboratories could become more effective and efficient by considering the agency's system of laboratories from an enterprise perspective. The NRC Committee recommended that the actions EPA should take to improve the effectiveness and efficiency of its laboratory enterprise should be organized around the concept of a system that maintains the strength of the individual laboratory types while providing systematic collaboration and communication throughout the agency.

In its report, the NRC Committee also developed an analytic framework for each type of laboratory and the entire enterprise to help EPA align its laboratory facilities, functions, and capabilities with the highest-priority scientific needs related to the agency's strategic goals, such as addressing climate change, improving air quality, and protecting America's waters.

VII. Facility Data Analysis and Scenarios

This section presents a summary of Smith Group JJR's assessment, including an analysis of the facility information, development of metrics, and the application of a cost model.[9] The analysis used EPA-collected data to consider the efficiency of the agency's nationwide laboratory portfolio and to provide EPA with the tools and framework for future planning and decision making.

The portfolio analysis was guided by a Workgroup consisting of representatives from across the agency. Incremental presentations of the project status were provided to EPA management at workshops for review and feedback.

The portfolio analysis process is graphically depicted in Figure 2 and consisted of three distinct segments:

- EPA data collection
- Analysis
- Evaluation of scenarios

The foundation of the data analysis was the verified data from the facility, workforce, and cost data calls (discussed in Section IV). In some cases, EPA-collected data were further validated through site visits (Ft. Meade, MD; Athens, GA; Chicago, IL; and Ann Arbor, MI). This ensured that at least one Regional, Program, and Research laboratory was verified by site visits.

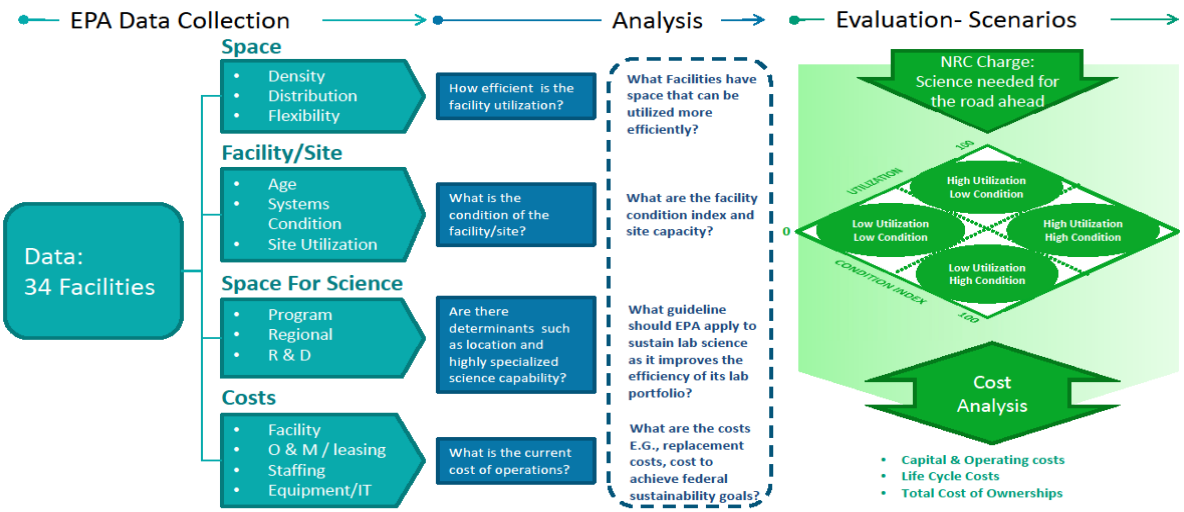


Figure 2. Laboratory Assessment and Evaluation Process

Metrics

One important component of the data analysis was the development of four categories of metrics, which were established by the Workgroup early in the portfolio analysis.

1. Space Density and Utilization

   Space density was used as a measure of space utilization, represented as usable square foot (USF) per laboratory occupant. Occupant data included all federal employees, contract workers, and grantees using space for laboratory functions. The usable square foot in each facility was consistently defined and calculated using classifications of laboratory, laboratory office, laboratory support, and special laboratory space. Non-laboratory related space was not included in the density calculation. The inventory data added up to more than 3.75 million gross square feet (GSF) of laboratory facilities and 2.75 million of usable square feet (USF), as defined by the Building Operations and Maintenance Organization (BOMA) standards.[10]

2. Facility Condition Index (FCI)

   The FCI is an industry standard asset management tool that measures the "constructed asset's" condition at a specific point in time. The facility condition for the study was assessed based on GSA Guidance for Real Property Inventory reporting and the National Aeronautics and Space Administration (NASA) Deferred Maintenance Model, modified to include a scalar rating for architectural, mechanical, electrical, and plumbing systems, and a parametric estimating method to calculate renovation cost relative to replacement cost.[11] The FCI, based on a scale of

1-100, assesses facility infrastructure and provides a consistent rating system for agency-wide value comparison among facilities. The area-weighted FCI of EPA's laboratory portfolio was determined to be 64.4.

3. Sustainability

   Sustainability metrics include space, energy, greenhouse gas emissions, and water use. Space was included under Space Density and Utilization. Overall the EPA is exceeding the requirements of the President's initiative for space reduction, by reducing our office space and warehouse footprint versus simply freezing it (OMB memorandum M-12-12 Section 3, Freeze the Footprint). Energy and water factors were included in the development of the FCI. EPA projects exceeding all of the Presidential greening requirements (Energy Policy Act of 2005, Energy Independence and Security Act of 2007, and Executive Order 13423 and 13514). The agency projects energy, water, GHG, and water reductions to continue to meet or exceed the current and future projected federal requirements.

4. Costs

   Cost data were collected and organized into cost categories (e.g., information technology and telecommunications infrastructure, facility operations and maintenance, lease costs, costs of safety and health, security, and transportation). Total operational costs for all laboratory-based functions in the FY 2012 baseline year were approximately $450 million. Facility renovation and improvement costs were approximately $18 million in FY 2012. Additionally, EPA's capital building and facilities average annual budget is about $30 million/year, of which approximately $25 million/year has been spent on laboratory facilities over the past ten years.

Comparative Analysis of the Laboratory Portfolio

One component of the portfolio analysis developed a quantitative basis for measuring efficiency across the laboratory portfolio using the metrics for facility space utilization and facility condition. To evaluate individual facilities as a part of the portfolio of laboratory facilities, an evaluation matrix was used to combine the space utilization of each facility (as measured by the USF/occupant) with the Facility Condition Index (a numerical assignment on a 1-100 scale with a value of 100 defined to be a brand new state-of-the-art facility). Figures 3, 4, and 5 depict the evaluation matrices for research, regional, and program laboratories, respectively.

The combination of these two metrics (space utilization and Facility Condition Index) provided an easy-to-understand visual approach that indicates which sites exhibited high utilization with a high Facility Condition Index, and conversely, which sites exhibited low utilization at facilities with a low Facility Condition Index. The latter were likely candidates for improved utilization and/or high priority for upgrades and renovations.

In creating the matrices in Figures 3 and 4, research and regional laboratories were considered separately to appropriately compare these different types of facilities with the external benchmarks that were used for utilization. In Figure 5, program laboratories were not benchmarked externally due to the unique and variable nature of their work.

- Research laboratories were benchmarked against government research laboratories, corporate research laboratories, and university research laboratories.
- Regional laboratories were benchmarked against state analytical labs and corporate laboratories.

Additionally, the bubble size of each facility in Figures 3, 4, and 5 is scaled according to the number of occupants at that facility. Intuitively, it is desirable to move the indicator bubbles toward the lower right of the matrix – indicating both a high utilization rate (by minimizing the USF/occupant number) and a high condition index. Figures 3, 4, and 5 indicate that the majority of the agency's laboratory facilities currently are in conditions that do not require immediate upgrades or renovations due to space utilization and FCI rating.

The Lab Study provided a unique opportunity to look across the entire EPA laboratory portfolio, combining individual facility information. Figure 6 graphically represents the space utilization of the entire EPA laboratory portfolio. The totals for usable square feet (as calculated using Building Owners and Managers Association standard) and mechanical, structural, and public circulation space are presented as fractions of EPA's gross square feet of laboratory space. Using external benchmarking, approximately 15% to 20% of EPA's laboratory space was identified as underutilized (as represented in red). This square footage is distributed across the laboratory portfolio and generally cannot be reallocated for use by laboratory functions or organizations in other locations. Furthermore, a number of laboratories contain special types of spaces for specialized science functions such as vivarium, high bays, test chambers, and specialized analytical equipment. These specialized functions are not easily comparable to external laboratory benchmarks.

In Figure 7, EPA's laboratory facilities were divided into three FCI categories: <25, 25-50, and >50. A Facility Condition Index range below 25 identifies facilities that should be considered for replacement, as the cost of renovation could exceed facility replacement cost. A range of 25-50 identifies facilities that should be evaluated for renovation or replacement. A range above 50 identifies facilities that should be considered for renovation. The area weighted average FCI for EPA's laboratory portfolio is 64.4. We used an FCI of 82 for owned sites and an FCI of 60 for leased sites as an input for the cost model so we could have an order of magnitude estimate of costs, but going forward we will further evaluate each upgrade and consolidation project based on its costs, projected savings, and importance from a mission and operational perspective.

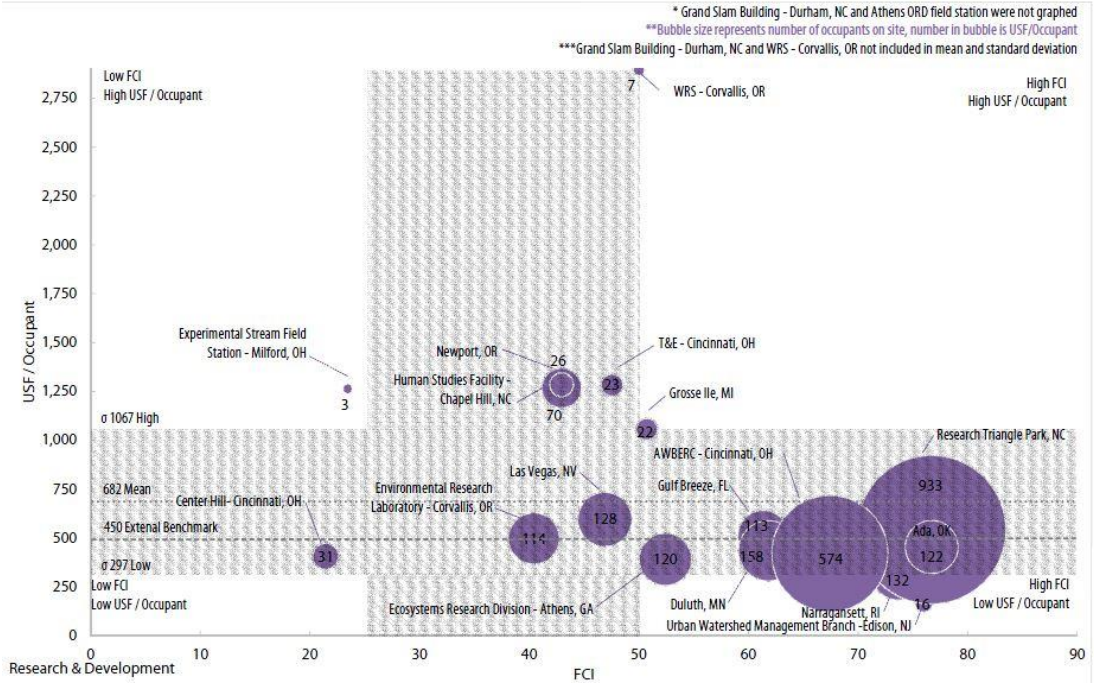


Figure 3. Evaluation Matrix for Research Laboratories

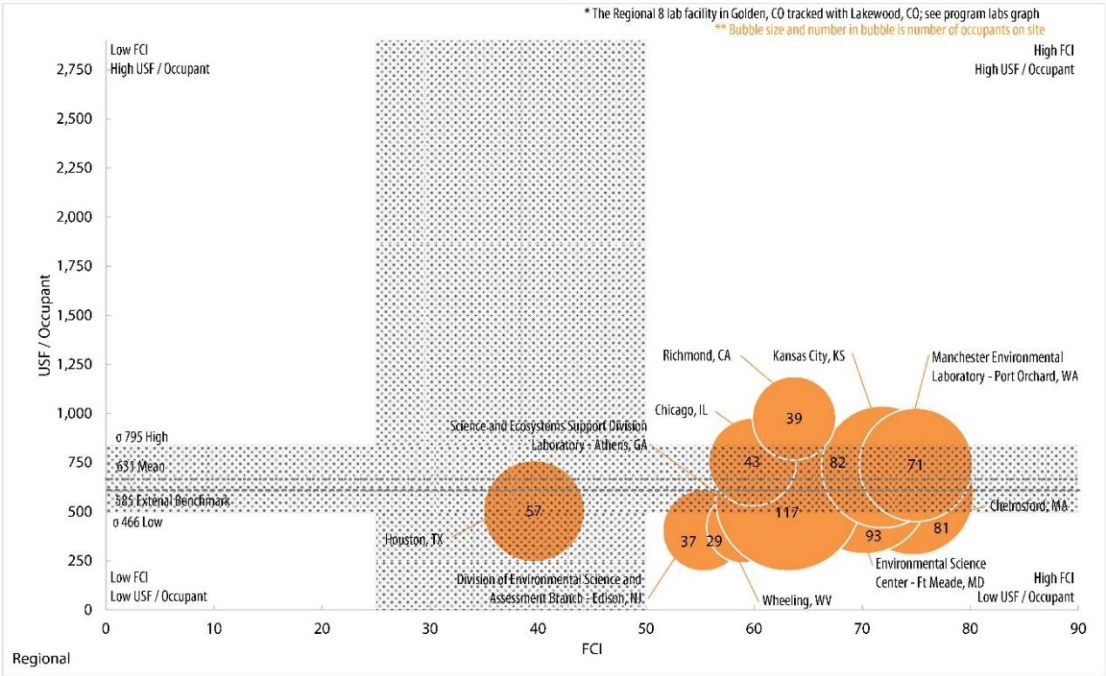


Figure 4. Evaluation Matrix for Regional Laboratories

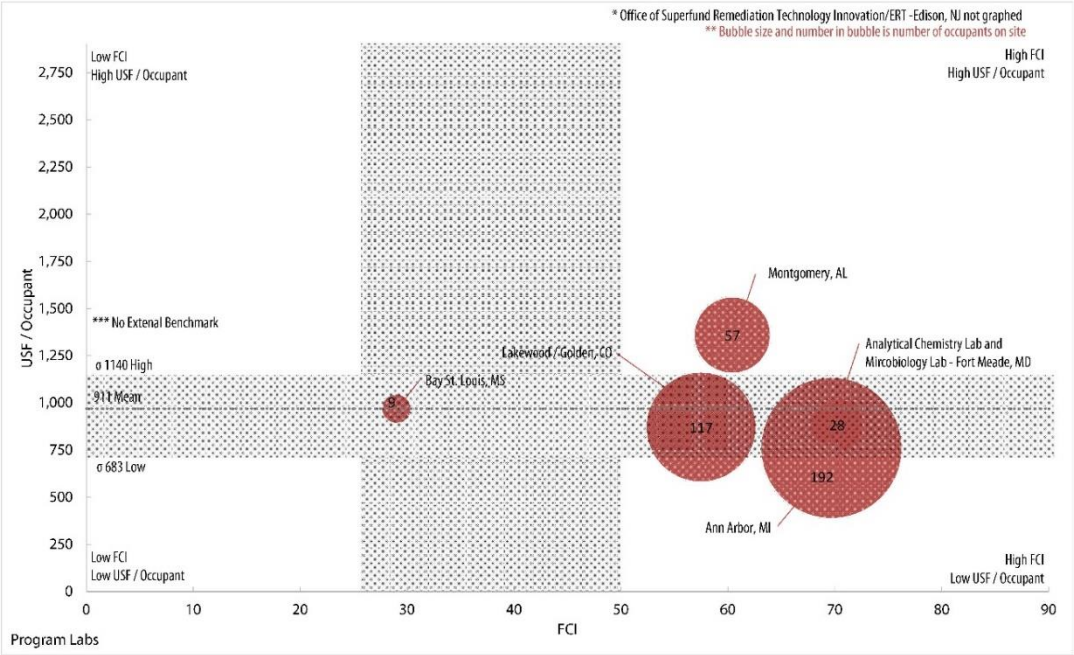


Figure 5. Evaluation Matrix for Program Laboratories

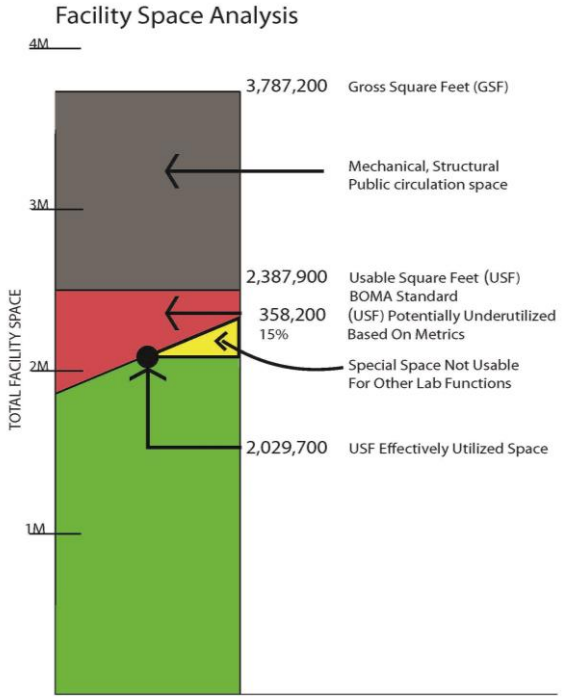


Figure 6. Portfolio Level Facility Space Analysis

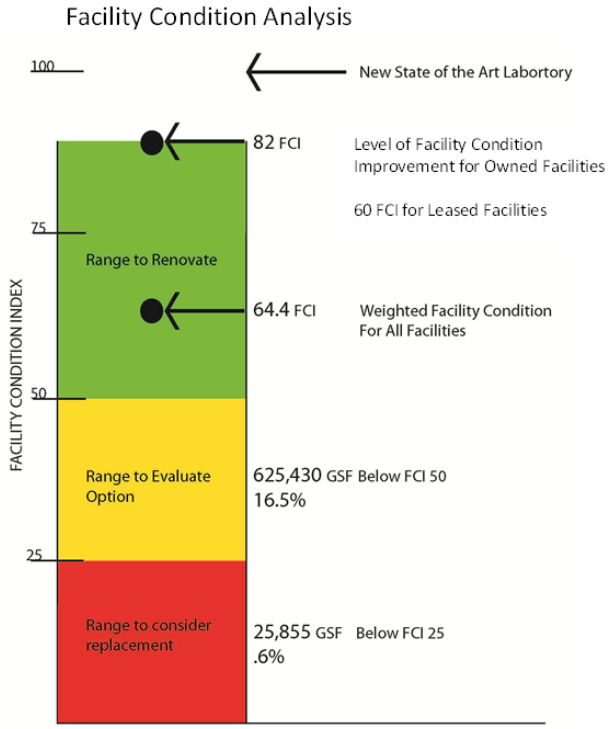


Figure 7. Portfolio Level Facility Condition Analysis

Cost Modeling and Development of Hypothetical Scenarios

Smith Group JJR utilized cost modeling guidance from OMB Circular A-94 to conduct life cycle benefit-cost analyses. Cost data collected and validated by the Cost Subcommittee created an annual operational cost baseline using FY 2012 data. These cost data along with facility and workforce data were analyzed thoroughly to create a series of 5 hypothetical scenarios (A, B, C, D, and E) that modeled a range of options, from 34 laboratory locations to a down-sized portfolio of 19 laboratory locations. Improved facility condition, performance, space utilization, and co-location shaped the 5 scenarios. In the 5 hypothetical scenarios, the costs to implement facility condition improvements were based on renovating to the FCI of 82 (leased facilities are renovated to FCI of 60) which would help to meet federal and EPA sustainability guidelines. The FCI targets in this report are used for comparative purposes only and do not lead directly to facility decisions or investments.

It is important to note that three science determinants were identified by the EPA Workgroup and "function as practical constraints on which laboratory capabilities and facilities may be considered for relocation in the scenarios and model evaluations" according to the Smith report.

- Current laboratory science capability and contributions were retained, including personnel.
- Current laboratory science capability and contributions that required access to aquatic ecosystems (Atlantic, Pacific, Great Lakes and the Gulf of Mexico) were not feasible to relocate because the investment required would likely be substantial (see Table 1).
- Current highly specialized laboratory functions and contributions were not feasible to relocate because the investment required would likely be substantial. These include equipment needed to conduct vehicle emission and fuel economy testing at the National Vehicle and Fuel Emissions Laboratory in Ann Arbor, MI and the environmental exposure chambers used to conduct human health research in Chapel Hill, NC (See Table 1).

Scenario A includes the 34 laboratory facilities present at the beginning of the study with infrastructure and sustainability improvements.
Scenario B consolidates or co-locates 4 facilities to achieve a reduced footprint of 30 laboratory facilities.
Scenario C consolidates or co-locates an additional 4 facilities to achieve a reduced footprint of 26 laboratory facilities.
Scenario D consolidates or co-locates an additional 4 facilities to achieve a reduced footprint of 22 laboratory facilities.
Scenario E consolidates or co-locates an additional 3 facilities to achieve a reduced footprint of 19 laboratory facilities.

For each hypothetical scenario, 30 year life cycle costs were calculated, including renovation costs, operation and maintenance costs, relocation and laboratory decommissioning, and the capital cost of increasing the FCI of each facility to the targeted values. The 30 year life cycle cost of each site was calculated based on net present value. The net present value (or present worth) calculations convert the monies spent at various times over the 30 year life cycle to an equivalent cost as of present day, to create a basis for comparison. The total value of each scenario (A through E) was calculated as the summation of all costs for each location including inflation and projected economic growth. It is important to keep in mind that these scenarios are hypothetical and were modeled to determine what scenario minimizes the operational costs of the EPA laboratory portfolio over a 30-year life cycle. Additionally, a cash flow analysis was conducted on each scenario to estimate the payback period – the length of time theoretically required to recover the modeled investments necessary for facility renovations and replacement from resulting cumulative savings and avoided costs.

EPA determined that out of the 5 scenarios – A through E – scenario B provided the greatest potential for savings and avoided costs. In order to further optimize scenario B, cost-effective opportunities within scenarios C through E were incorporated into 2 hybrid scenarios, based on scenario B.

Scenario B1 consolidates and/or co-locates 2 laboratory facilities to achieve a reduced footprint of 28 laboratory facilities.
Scenario B2 consolidates and/or co-locates 5 additional laboratory facilities to achieve a reduced footprint of 23 laboratory facilities.

Table 3 presents aggregated facility information for each of the 7 modeled scenarios, including the changes in gross and useable facility space (GSF and USF, respectively).[†] Table 3 also presents the cost modeling results for each of the 7 modeled scenarios, including life cycle cost information (presented as the 30 year net present value), the projected O&M costs, and the projected O&M savings.

[†] Gross Square Feet (GSF) is defined as the total area encompassed within a building's footprint. Usable Square Feet (USF) includes space for laboratories, offices, laboratory support, and specialized space used for laboratory functions. (See reference 10 and page B-5 of reference 9)

Table 3. Modeled Scenarios- Aggregated Costs and Facility Information

		Scenarios						
		Current State	Future State					
	Existing	A O & M + R & I Improvements	B Improve Footprint & Sustainability	B1 Improve Footprint & Sustainability	B2 Improve Footprint & Sustainability	C Minor Consolidation / Change	D Moderate Consolidation / Change	E Major Consolidation / Change
Number of Sites	34	34	30	28	23	26	22	19
GSF (Addition)		--	52,864	124,413	379,095	243,657	583,800	638,479
GSF (Closed Down)		--	384,799	427,095	759,816	527,164	800,847	921,821
Total GSF	3,787,196	3,787,196	3,450,784	3,430,201	3,355,028	3,349,756	3,493,154	3,350,771
Change in GSF (From A to other scenarios)	-	--	(336,412)	(356,995)	(432,168)	(437,440)	(294,042)	(436,425)
Total USF (Remaining)		2,374,083	2,090,290	2,112,497	2,051,207	2,087,917	2,110,835	2,056,053
USF (Interior renovation / build out)		--	103,741			164,912	164,912	141,512

	Existing	Scenario A	Scenario B	Scenario B1	Scenario B2	Scenario C	Scenario D	Scenario E
Capital Cost (for Comparison)		$166,958,101	$205,056,265	$231,169,552	$409,510,590	$283,794,653	$380,376,081	$407,301,780
Capital Cost (for Budgeting)		*$233,741,342*	*$287,078,771*	*$323,637,372*	*$573,314,825*	*$397,312,514*	*$532,526,513*	*$570,222,491*
Life Cycle Cost (PW)	$10,322,005,184	$10,006,741,648	$9,738,858,628	$9,682,195,699	$9,400,028,097	$10,029,623,658	$9,985,746,086	$9,902,713,415
LCC/ GSF	$2,725.50	$2,642.26	$2,822.22	$2,822.63	$2,801.77	$2,994.14	$2,858.66	$2,955.35
O&M Cost (Annual)	$405,826,583	$386,867,247	$374,837,095	$371,582,612	$353,476,959	$383,173,270	$377,650,894	$373,327,700
O&M Savings Compared to Existing (Annual)		$18,959,335	$30,989,488	$34,243,971	$52,349,624	$22,653,313	$28,175,689	$32,498,883
e Payback (Years) If 100% Funded Immediately		8.81	6.62	6.75	7.82	12.53	13.50	12.53

The purpose of scenario cost modeling was to identify the optimal scenario for the portfolio of lab facilities. EPA identified the optimal scenario by comparing model results in Figure 8 with those in Figure 9. By minimizing both values—the lowest life cycle cost (30 year net present worth) and the lowest capital cost for budgeting—EPA determined that the optimal scenario lies between scenarios B1 and B2.

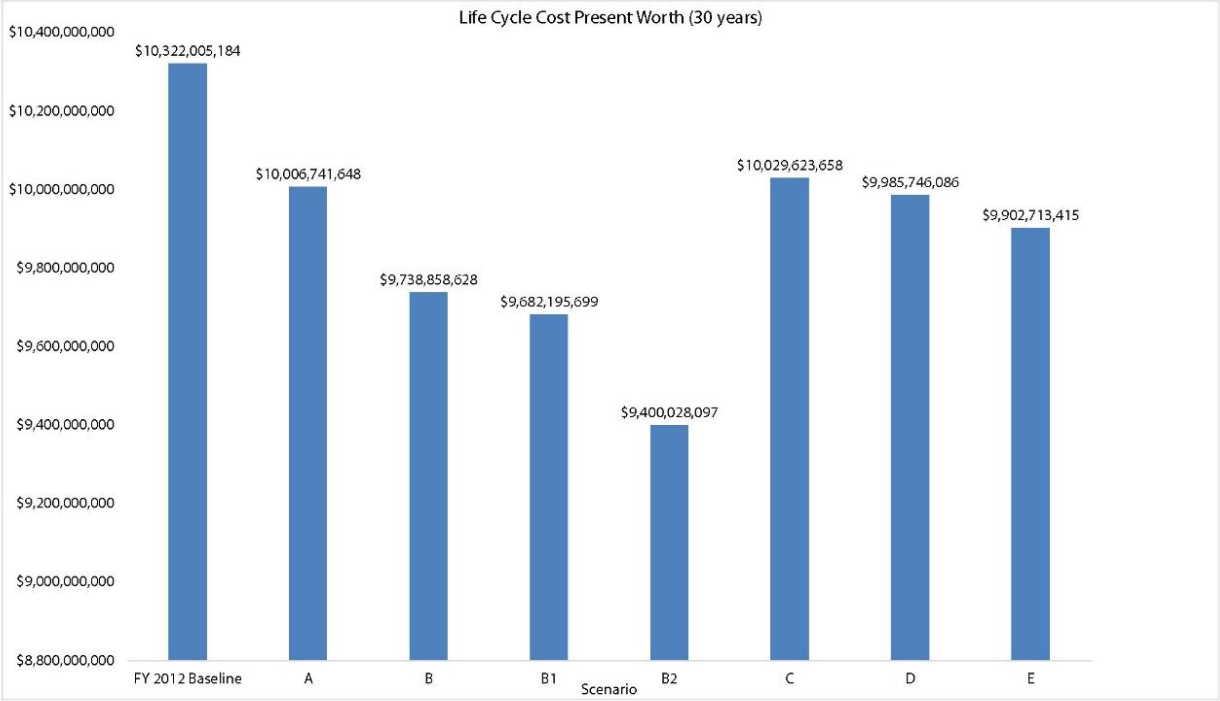


Figure 8. Life Cycle Cost (30 year Present Worth) for each Scenario

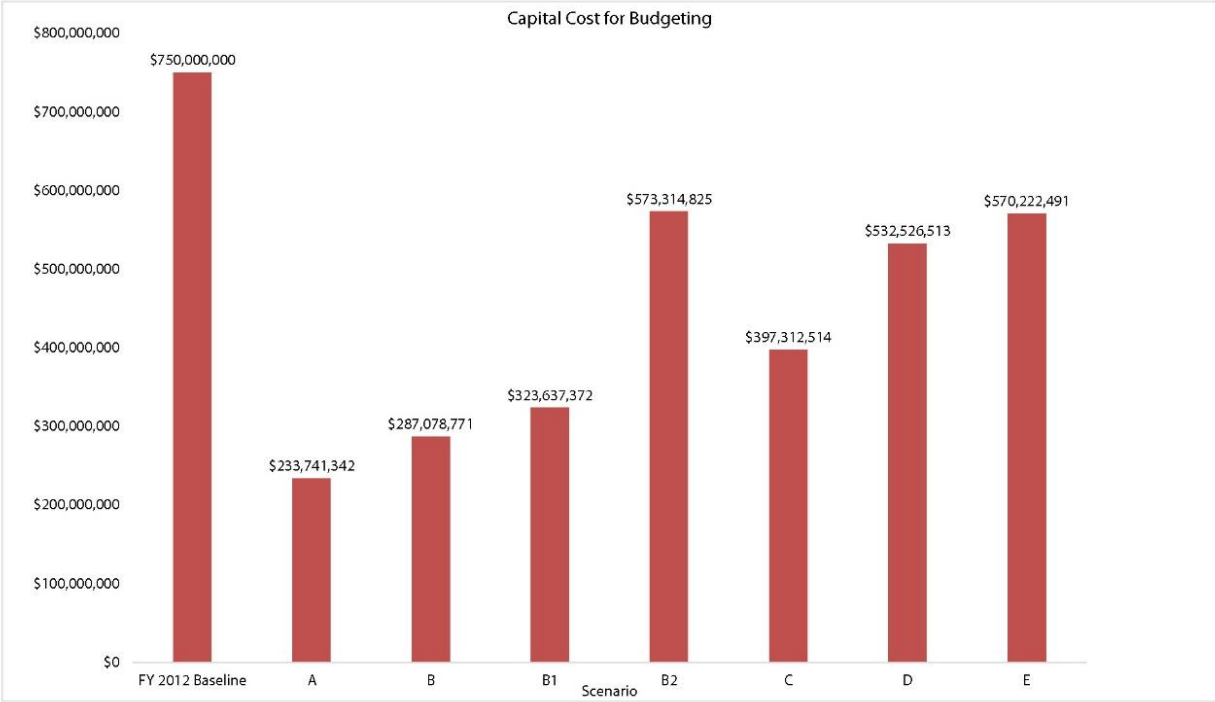


Figure 9. Life Cycle Capital Cost for Budgeting (30 Year Present Worth)

EPA analyzed the cost modeling and underlying data between scenarios B1 and B2. As a result of this analysis, EPA determined that the additional capital cost required to implement scenario B2 substantially exceeds the marginal benefits. After reaching this conclusion, EPA identified a scenario between B1 and B2. This scenario includes changes described in scenario B1 and potentially cost-effective space reductions from other modeled scenarios. EPA labeled this scenario B1+, a combination of actions currently underway along with some potential options identified on the next page. Scenario B1+ consists of 26 laboratory facilities and results in a reduction of approximately 380,000 GSF from the existing laboratory portfolio.

Actions currently underway include:

- Reproductive Toxicology Facility (RTF) – Consolidate activities at the RTF to the nearby Research Triangle Park, NC main building. The construction of the A wing at the Research Triangle Park campus and modification of the existing laboratory facilities enabled employees in the RTF facility to be moved onto the main RTP campus, saving approximately $1.7 million annually in lease costs and $1 million annually in utilities, security, and operating costs beginning to accrue in fiscal year 2015, reaching the full annual savings in 2016.
- Grosse Ile, MI – Discontinue laboratory activities in Grosse Ile, designating it as a field station. Laboratory research is no longer being conducted at the Grosse Ile facility, and

any needed bench research will be accommodated at the Duluth, MN research laboratory. A change in facility designation from laboratory to field station will be completed in 2015.

- Bay St. Louis, MS – Discontinue laboratory activities at Bay St. Louis facility consolidating the laboratory activities to Ft. Meade, MD. The Office of Chemical Safety and Pollution Prevention (OCSPP) will be combining its two program laboratories in Ft. Meade, MD. This will save approximately $61,000 annually in lease costs (from Bay St. Louis, MS) and $135,000 annually in operational resources by combining two facilities in the first quarter of fiscal year 2015.
- Wheeling, WV – Discontinue regional laboratory activities at the Wheeling laboratory and conduct laboratory activities at Ft. Meade, MD. EPA Region 3 is no longer conducting laboratory work is at the Wheeling, WV location and EPA will designate the facility as a field station. Region 3 will continue to operate a Regional laboratory in Ft. Meade, MD. The change in facility designation from laboratory to field station will be completed in 2015.

Actions to be completed in the future:

- Golden, CO – Discontinue the lease for the Region 8 laboratory in Golden, CO, co-locating the regional lab with the nearby NEIC facility in Lakewood, CO.
- Willamette Research Station – Consolidate the Willamette Research Station to the nearby lab facility in Corvallis, OR.

Actions to be evaluated in the future:

- Athens, GA – Assess all options, including co-location and/or consolidation, upgrades, and retaining the “as-is” footprint.
- Chelmsford, MA – Assess all options, including co-location and/or consolidation of this leased laboratory facility, upgrades, and retaining the “as-is” footprint.

Actions for individual lab facilities require detailed site-specific master planning to further inform decision-making.

VIII. Conclusions and Path Forward

This section of the EPA Synthesis Report presents conclusions and potential actions based on the agency's evaluation and analysis of reports from GAO, the NRC, and Smith Group JJR.

General Conclusions

A number of overarching general conclusions can be drawn from the information presented in Sections V through VII:

- **EPA analysis of data about its FY 2012 laboratory science contributions indicates that they are well-aligned with the agency's strategic goals and programs** and help program clients and stakeholders accomplish mission-relevant outcomes. One reason for this alignment is that EPA laboratories are not managed as independent entities; rather, their plans and outcome-oriented contributions are integrated into their respective national, regional, and research programs and EPA's planning, budgeting, and accountability processes that implement requirements of the GPRAMA of 2010 and OMB Circular A11.

- **Analysis of FY 2012 operating costs indicates that the laboratory enterprise is approximately 10% of the agency's total FY 2012 enacted budget, excluding State and Tribal Assistance Grants (STAG).** An important part of EPA's mission, the laboratory enterprise was about 10% of the FY 2012 enacted budget of $4.8 billion, excluding STAG. A breakdown of annual laboratory operating cost data for FY 2012 indicates that the total annual lab operating costs for FY 2012 (including lease costs) were under $500 million.

- **Savings may be realized by shifting from leased facilities to currently owned facilities, where additional capacity already exists.** The annual costs of laboratory leases continues to increase such that the enterprise-wide focus has to be on maximizing the usage of EPA's owned laboratory capacity.

- The portfolio analysis evaluated a series of scenarios, and **the potential savings from consolidating owned facilities where there is insufficient additional capacity is minimal**.

- **External benchmarking of our laboratory occupant density identified opportunities to use space at some facilities more efficiently.** The analysis has given us standard benchmarks that the agency can apply to its portfolio to optimize efficiency and maximize utilization.

- **EPA now has information to analyze and quantify the investments to help make decisions to improve the condition of the agency's portfolio**.

Actions to Improve Effectiveness and Efficiency

With the detailed quantitative data and analysis resulting from the Lab Study, EPA is in the position to inform decisions and ensure that EPA's laboratory enterprise continues to provide the preeminent science needed to meet the agency's mission in an effective and efficient manner. The following actions improve the effectiveness and efficiency of EPA's laboratory portfolio.

Actions to Improve Effectiveness

- **The Deputy Administrator should direct the Science Advisor to take the following actions, which will strengthen the effectiveness, efficiency, and cohesion of lab enterprise:**
    - **Develop a vision** for the agency's laboratory enterprise. The vision statement should communicate why the laboratory enterprise is important to the agency now and in the future and how its efforts can best contribute to the agency's mission and goals. It will help tie the components of the laboratory enterprise together and maintain the strengths of the individual types of laboratories.
    - **Charter a new permanent lab enterprise forum within the STPC.** This forum will engage participants with diverse backgrounds and extensive experience with the components of the enterprise, its partners, and its impacts. Among its responsibilities, the forum will develop guidance related to the lab enterprise for consideration by the Science Advisor and will contribute to the systematic communication, coordination, and collaboration described below.
    - **Strengthen communication, coordination, and collaboration** among the EPA laboratory enterprise — using the principles, criteria, and frameworks for efficiency and effectiveness described in the NRC report. Enhanced communication, coordination, and collaboration among the laboratories will lead to improved transparency and cross-agency awareness of scientific and engineering capabilities, contributions, and staff expertise.
    - Develop and prioritize actions for the Science Advisor to help **strengthen management processes** for planning, budgeting, funding allocations, internal and external assessments, and laboratory capital science equipment. Effective management with appropriate flexibility enables an effective laboratory enterprise.
    - **Strengthen synergies with other federal organizations and explore partnerships with state and other agencies**. This will enhance the laboratory enterprise and prepare it for the future.

The laboratory enterprise should continue to function as an organized system comprised of three components — regional office labs, program office labs, and ORD labs. The three types of labs will continue to plan their science activities and contributions as integral components of their respective

regional, national, and research programs—consistent with EPA and OMB guidance that implements requirements of the GPRAMA. Assistant Administrators and Regional Administrators will retain line management authority for their labs and will be engaged with the laboratory enterprise through their Science and Technology Policy Council (STPC) representatives. This organizational approach preserves the strengths of the three lab components and the diversity of the capabilities they engage to support EPA and its stakeholders.

- Recognizing that the alignment of the laboratory science contributions with agency Strategic Goals is appropriate, **EPA should build upon the current management, planning, and budgeting process for the laboratory enterprise**, including input from regional office laboratories, research laboratories, and program office laboratories—consistent with the requirements of the GPRAMA, and the normal budget process. The Science Advisor should not be responsible for managing the agency's laboratories because each laboratory is appropriately integrated into its respective national, research, or regional program planning and accountability processes.

- **EPA should not create the separate "overarching issue-based planning process" recommended by GAO**. This GAO recommendation refers to a separate planning process used by some EPA laboratories in the early 1990's before the GPRA was enacted. Both GPRA and GPRAMA include government-wide requirements for planning, budgeting, and accountability; these federal requirements supersede the procedures in the overarching issue-based planning process mentioned by GAO.

<u>Actions to Improve Efficiency</u>

- **The Office of Administration and Resources Management (OARM) should prepare portfolio-level and site-specific master plans** to manage EPA's laboratory facilities as an integrated portfolio and strategically assess specific needs, estimate costs, savings and environmental benefits, and implement practical actions to improve the efficiency of our portfolio.

- **EPA should continue investing in physical infrastructure to improve the overall condition of the agency's portfolio of laboratory facilities.** The portfolio analysis demonstrates that EPA should continue to invest in the physical infrastructure to ensure the condition of the lab facility portfolio does not degrade to an unacceptable level over time. Future investments will be justified based on a variety of factors including relationship to agency mission and the lab enterprise vision; safety of facilities; and costs and benefits.

- **The new STPC lab enterprise forum should annually collect and analyze data about the facilities, workforce, and operating costs for the lab enterprise.** Using these data and appropriate metrics, the new forum should coordinate periodically with OARM to identify trends and opportunities to improve effectiveness and efficiency for consideration by the Science Advisor.

- EPA should implement the scenario B1+ (described in Section VII), subject to available resources, the results of facility-specific studies, and other relevant information. **Individual actions within the recommended scenario will require site-specific analysis to optimize the facility footprint, estimate potential savings or avoided costs, and ensure that the building environment meets the needs for laboratory science functions.**

In conclusion, as a result of the Lab Study, EPA now has more detailed and consistent information about its laboratories than ever before. These analyses create a snapshot of EPA's network of laboratories and helps to inform a path forward. The results of the Lab Study and the analytical framework developed give EPA the information to prioritize facility decisions, make cost effective use of agency laboratory resources, manage our laboratories as a single enterprise, and ensure the sustainability of our laboratories and the agency's capability to meet its laboratory-based science needs.

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X. Appendices

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The Nationwide Laboratory Assessment* January 2015

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U.S. Government Accountability Office (GAO)

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David C. Trimble, Ed Kratzer, Diane LoFaro, Ellen W. Chu; John H. Edwards; Angela Miles; Daniel Semick; John C. Smith; Kwame Som-Pimpong; Tim Persons; Cheryl Peterson; Vasiliki Theodoropoulos; and Greg Wilmoth.

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Appendix 2: Principles and Recommendations for the EPA Laboratory Enterprise

Rethinking the Components, Coordination, and Management of the U.S. Environmental Protection Agency Laboratories, pages 60-63, (NRC, 2014).

A VISION FOR THE EPA LABORATORY ENTERPRISE

Summary Principle 1: Every science institution is more effective if it has a vision of how its scientists, technicians, and other professionals can best contribute to the organization's mission and goals.

> **Principle 4-1**: An important part of management is knowing what the entity is and what it is intended to do, and this is true of every scientific institution as well.
>
> EPA should approach management of its laboratory enterprise not so much as separate types of laboratories but as a system of the various laboratory efforts in EPA in which science and technical support activities are undertaken to support and advance the agency's mission–in other words, as an organized composition of diverse components. (Recommendation 4-1)
>
> EPA should develop a vision for its laboratory enterprise that maintains the strengths of the individual components but provides synergy through systematic collaboration and communication throughout the agency. (Recommendation 4-2)

ENSURING LABORATORY FUNCTIONS MEET THE HIGHEST-PRIORITY MISSION NEEDS

Summary Principle 2: Essential laboratory capabilities are the ones that are relevant to the current mission and the ones that anticipate future mission needs. Priorities for laboratory capabilities should focus on work that is central to the agency's mission rather than on small peripheral efforts.

Summary Principle 3: Laboratories should avoid internal redundancy or duplication of capabilities that are readily available externally.

> EPA should use the frameworks presented in Figures 4-1 through 4-4 for the individual components of the laboratory enterprise and for the laboratory enterprise as a whole. (Recommendation 4-10)

WORKFORCE

Summary Principle 4: Recruiting, developing, and retaining an outstanding, committed scientific and technical workforce is crucial for maintaining outstanding laboratory capabilities.

> EPA should continue and strengthen its characterization and evaluation of its laboratory workforce, establishing a defined timeline and being transparent in its processes for internal and external audiences. (Recommendation 3-1)
>
> EPA should initiate or complete the development of a strategy for periodically addressing the composition of the workforce, in the ORD laboratories, the regional office laboratories, and the program office laboratories, particularly after completion of the Voluntary Separation Incentive Payments/Voluntary Early Retirement Authority actions in 2014. The analysis should include an

inventory of skills and training and demographic analysis (for example, projected retirements over the next 5 years) for strategic planning for the future. This information is essential for making sensible decisions in hiring, future reassignments, and offers of voluntary retirements. (Recommendation 3-2)

EPA should continue its planned hiring of postdoctoral researchers by ORD and expand it to other types of laboratories as appropriate. (Recommendation 3-6)

EPA should be granted permanent Title 42 authority and the expanded authority to define the number of Title 42 positions on the basis of its programmatic needs and available budget. In addition, EPA should use an independent body to review the Title 42 program every 5 years to ensure that it is being used for its intended purposes. (Recommendation 3-7)

EPA should continue, enhance, and expand its student training grant programs, such as GRO. The STAR fellowship program should be reinstated in EPA to support the research programs specific to EPA's mission and goals. (Recommendation 3-5)

CAPITAL EQUIPMENT

Summary Principle 5: State-of-the-art facilities and equipment are essential if a laboratory enterprise is to be able to meet current and future mission needs.

EPA should link inventory of equipment over $500,000 in all laboratories, without regard to mission, to an agencywide accessible process. Before investment in large capital equipment, laboratory equipment in other parts of EPA, other agencies, and universities that could be available for shared use should be explored. (Recommendation 3-9)

EPA should continue taking steps to improve the transparency and agencywide awareness of all its laboratory science capabilities. (Recommendation 3-10)

MANAGEMENT

Summary Principle 6: Effective management with appropriate flexibility enables an efficient and effective laboratory enterprise.

The means of implementing the vision for the laboratory enterprise should be determined by the EPA Administrator with a view to meeting the functional criteria set forth in this report for enhancing the efficiency and effectiveness of the enterprise. (Recommendation 4-11)

EPA should continue to look for innovative ways to address emerging problems and opportunities that create synergies among agency personnel who might encounter similar problems or opportunities within different EPA laboratories within ORD, program offices, and regional offices. (Recommendation 4-5)

Principle 4-2: Systematic involvement of all the agency’s laboratories in the planning process is far preferable to ad hoc connections and would probably yield a stronger and more efficient laboratory enterprise.

EPA should ensure that its laboratory planning process includes cross–regional office and cross–program office laboratory input and that it is more transparent within the agency and to outsiders. (Recommendation 4-3)

Principle 4-3: The overall aim should be for EPA to have the ability to produce fairly accurate estimates of costs for implementing various types of laboratory activities before undertaking a project and be able to provide final costs at the completion of the project.

EPA should conduct an annual internal accounting of the cost of the entire laboratory enterprise as a basis for assessing efficiency and assisting in planning. (Recommendation 4-4)

EPA should compile adequate data regarding the costs of individual activities in the various laboratories so that it can manage the laboratory enterprise appropriately. (Recommendation 4-6)

COMMUNICATION AND PARTNERSHIPS

Summary Principle 7: Communication and coordination among the laboratories within an organization are essential for efficiency and effectiveness.

EPA should continue to cultivate an interdisciplinary scientific workforce at all levels of expertise throughout the laboratory enterprise that can engage in high-quality, collaborative, science activities aimed at transdisciplinary challenges. (Recommendation 3-3)

EPA is encouraged to continue taking steps to improve the transparency and cross-agency awareness of capabilities through enhanced communication regarding scientific and engineering staff expertise and laboratory equipment. (Recommendation 3-8)

EPA should determine precisely what lines of communication are needed, which ones already exist, and which ones should be established. It should then clearly articulate the need for these avenues and the mechanisms by which they will be sustained. (Recommendation 4-9)

ENSURING QUALITY

Summary Principle 8: Outstanding research and other science-related activities are the foundation for meeting current and future mission needs and for sustaining leadership in environmental science and applied research.

Principle 5-1: Success is largely a matter of commitment to a sound scientific and technical workforce and research and technical infrastructure.

Principle 4-4: Most successful organizations use both internal and external mechanisms for assessment.

EPA's program office laboratories and regional office laboratories should undergo regular internal reviews of their efficiency and effectiveness. (Recommendation 4-7)

EPA should expand the use of external reviews to cover all components of its laboratory enterprise. (Recommendation 4-8)

SYNERGIES WITH OTHER ORGANIZATIONS

Summary Principle 9: A strong linkage to universities, industry, research institutions, and other federal and state government organizations enhances the laboratory enterprise and prepares it for the future.

Principle 4-5: An effective EPA laboratory enterprise should be fully cognizant of the array of research conducted outside EPA laboratories, should have mechanisms and programs to capitalize on that scientific work, and should have plans and staffs in its own laboratories not only to accomplish work necessary for its mission but to complement efforts of other agencies and to provide a means of collecting, sorting, and analyzing the results of those efforts to serve EPA's mission.

EPA should develop more explicit plans for partnering with other agencies (federal and state), academia, industry, and other organizations to clarify how it uses other federal and nonfederal knowledge resources, how it maintains scientific capabilities that are uniquely and critically needed in the agency, and how it avoids unnecessary duplication of the efforts or capabilities of the other agencies. (Recommendation 4-12)

EPA should develop relationships with community colleges and universities to enable students to work in EPA laboratories as interns or student employees in an effort to develop future technicians and scientists who will conduct research and other laboratory functions related to EPA needs. (Recommendation 3-4)

EPA should consider using a variety of structured approaches for identifying emerging issues and possible solutions, including formal analyses of future societal scenarios and their ramifications and third-party advisory groups. (Recommendation 5-1)

EPA should consider creating an Environmental Advanced Research Projects Alliance (E-ARPA) and also consider how and under what circumstances E-ARPA efforts could be managed to address the agency's future scientific and technical needs. (Recommendation 5-2)

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