August 2004

Measuring Benefits from the National Technology Transfer and Advancement Act

Final Report

Prepared for

JoAnne Overman
Kevin McIntyre
Mary Saunders
Standards Services Division
National Institute of Standards and Technology
Gaithersburg, MD 20899-2100

Prepared by

William J. White
RTI International
Health, Social, and Economics Research
Research Triangle Park, NC 27709

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*RTI International is a trade name of Research Triangle Institute.

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Executive Summary

In fulfilling their missions, government agencies and organizations reference a variety of technical standards in rule making, in procurement, and in other activities. Since its enactment in 1996, the National Technology Transfer and Advancement Act (NTTAA) has required that all federal agencies and departments use standards that have been developed or adopted by Voluntary Consensus Standards (VCS) bodies, except where such use is inconsistent with existing laws or impractical. The requirements of NTTAA were implemented by the Office of Management and Budget (OMB) through revisions to their Circular A-119, entitled "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities."

NTTAA and the OMB circular assign significant implementation and coordination responsibilities to the National Institute of Standards and Technology (NIST). Each year NIST is required to report on progress made by federal agencies toward complying with NTTAA, as well as their participation in VCS organizations. NIST organized, and still leads, the Interagency Committee on Standards Policy (ICSP), through which it coordinates many of its leadership activities in this area.

In the eight years since passage of NTTAA, NIST has reported significant progress toward meeting its objectives, but results have been variable across government organizations. Although several agencies have enthusiastically supported the use of VCS and reported steady annual improvement to NIST, others have shown little or no standards-related activity or have not sent in reports. A number of agencies have exempted significant portions of their standards activity due to statutory conflicts.

NIST's Standards Services Division (SSD) has worked to improve the overall level of compliance with NTTAA and to help agencies realize the benefits of the use of VCS processes. Recently, SSD contracted with RTI International (RTI) to begin to document the economic benefits that agencies achieve by moving from agency-specific standards to third-party VCSs. This report summarizes our efforts in this respect, and offers recommendations for future initiatives by SSD that may help build interest and commitment from agencies whose support has been lacking.

RTI conducted background research to better understand NTTAA, its requirements and implications, and to speak with standards executives who have been supporting its implementation within the agencies. We have also devoted resources to understanding the complex conformity assessment process, including the accreditation of testing and calibration laboratories and the recognition of those accreditations by regulators, procurement agents, and other users of test/calibration data. These latter activities are consuming a large amount of effort from federal agencies, affected businesses, and NIST.

We then applied an RTI methodology for benefit-cost analysis, treating the use of VCS as a beneficial technological change. We developed a counterfactual model with which to compare hypotheses about potential benefits and costs. We identified impact areas in which economic outcomes would differ between actual and counterfactual cases, i.e., the with-VCS and without-VCS scenarios. A set of technical and economic metrics was developed for each of the impact areas, with a standard set of measurement tools to be applied, including benefit-cost ratio, internal rate of return, and net present value.

The scope of the work assignment included development and testing of data collection tools, but not a large-scale data collection effort. Due to the small number of compliant agencies involved and the complexity of the metrics being collected, we chose to develop a set of interview guides rather than a formal survey. An interview guide is a set of questions that supports a structured conversation between the researcher and the agency respondent. The interactive format allows for discussion of more complex topics than can typically be addressed in a survey.

According to the requirements of the project, we then conducted a pretest of the data collection instrument to assess its usefulness for broad-scale implementation across compliant agencies. In all, we constructed three interview guides to pretest: one for agencies that primarily reference standards in their regulatory activities, one for agencies that use standards in procurement, and one for agency efforts in laboratory accreditation and recognition. Although we planned to test all three instruments, we were only able to get agency support to test the one designed for use by regulatory agencies.

The results of the pretest were very informative, although not in the way we initially intended. Findings suggested that there needs to be additional groundwork before a successful economic analysis can be done across the universe of government agencies. The completed pretest, along with the informal conversations held with knowledgeable representatives at several agencies, has convinced us that the data needed to inform any comprehensive benefits analysis is not routinely collected or analyzed by the agencies themselves. It is our judgment that analysis using currently available data would be incomplete and perhaps misleading.

Fortunately, SSD has the means to begin collecting the type of data that would be useful in performing economic assessments in the future. The questions posed in the annual report could be modified or augmented to yield much of the information from which quantitative performance measures can be derived. RTI recommends that SSD may wish to work through existing NTTAA coordinating groups to make suitable modifications to the annual report.

The following specific changes may be considered. The report already poses questions on *outputs* of standards management processes, i.e., the number of new standards created and existing standards supported, both for VCS and agency- or government-specific standards. If conformity assessment continues to be an important area of agency activity, a suitable output measure would be helpful, such as the number of Memoranda of Understanding (MOUs) or other mutual recognition agreements being supported or newly negotiated.

On the *input* side, the data now being reported are less useful for quantitative economic analysis. Instead of gathering information on activity or interest, such as the number of agency employees participating in VCS meetings or conferences, it would be more helpful to request the *level of effort* devoted to creation and maintenance of VCSs and/or government-specific standards. Metrics could include the numbed of full-time-equivalent (FTE) employees devoted to negotiating and writing new standards and supporting existing ones.

If data of this type could be put in place over the next couple of years, it may be possible to perform the type of quantitative assessment envisioned by RTI within perhaps 3-5 years. It is also possible that some agencies we were unable to contact already have such metrics in place. If so, additional pretests performed by SSD might shed more light on the question of the economic impact of NTTAA on government agencies.

1 Introduction

In February 1996, Congress passed the National Technology Transfer and Advancement Act (NTTAA) and the president signed the Act into law the following month. Recognizing the importance of technological innovation in creating economic growth, NTTAA made a number of statutory changes intended to spur the development and diffusion of innovations within the United States. One important provision of NTTAA requires that all federal agencies and departments use technical standards that have been developed or adopted by Voluntary Consensus Standards (VCS) bodies, except where such use is inconsistent with existing laws or impractical. NTTAA also directed the National Institute of Standards and Technology (NIST) to coordinate the conformity assessment activities of government and private standards organizations, to eliminate complexity and duplication of effort.

NTTAA requirements were implemented by the Office of Management and Budget (OMB) through revisions to their Circular A-119, entitled "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities." The OMB circular assigned NIST the roles of collecting information on activities of departments and agencies on an annual basis, publishing the compiled data in an annual report, and leading a coordinating committee that monitors compliance with the provisions NTTAA.

NIST's Standards Services Division (SSD) currently manages the activities enumerated in NTTAA and the OMB circular, which have

remained largely unchanged since initially promulgated. In order to assess the impacts of their efforts, as well as to encourage agency involvement in VCS and conformity assessment activities, SSD has sought research on related economic benefits achieved by compliant agencies. SSD recently contracted with RTI International (RTI) to conduct background research and develop a methodology for measuring the benefits accruing to agencies from their use of VCS. This report summarizes our efforts and results in pursuing these objectives.

1.1 BACKGROUND INVESTIGATION

To develop an analytical framework for estimating economic benefits, RTI needed to assemble a great deal of background information about NTTAA and OMB's directive for compliance with its provisions, roles of key stakeholders in developing VCSs and government-specific standards, and standards in general. To support this need, we engaged in a significant amount of library and online research, conducted a detailed literature review on both academic and business literature, and contacted a number of key players at NIST, other government agencies, and at Standards Development Organizations (SDOs). In addition, we had informal discussions with in-house RTI resources, each of whom has significant experience with one or more key agencies.

This type of intensive research is an important piece of every economic analysis we perform, and the complexity of standards in general and conformity assessment in particular made this research especially critical for this study. Still, our primary skill and expertise is in economics, and our understanding of the technical details of the field we are studying pales in comparison to that of our clients and those with whom we consult. As with most of our projects, this step concluded with the preparation of a background memorandum, which we forwarded to NIST. We summarize the contents of this memorandum in Section 2 of this report.

1.2 ANALYSIS FRAMEWORK AND METRICS

The Technology Economics and Policy (TEP) program at RTI has developed a methodology for use in performing benefit-cost analysis across a wide variety of government and private innovation processes. When proposing to evaluate the benefits of

NTTAA, we treat the use of VCS processes as a form of technological change, i.e., an innovation to an existing process. In order to quantify potential benefits, we first identified areas in which the proposed change has an impact. We next developed a set of technical and economic metrics that will help us evaluate economic costs and benefits in each of the impact areas.

Finally, a data collection process was proposed to inform the metrics and allow calculation of net economic benefits. Depending on the scope of the analysis, we typically estimate measures of private benefit (the profit impact on private firms), public benefits (which accrue to government agencies or consumers in the public at large), or the total social benefit (which combines both public and private economic benefits). In the case of VCS and NTTAA, we were asked to focus specifically on the potential benefits that would accrue to compliant federal agencies, although there are costs and benefits that are felt by participating private firms as well.

1.3 DATA COLLECTION AND SURVEY INSTRUMENTS

The scope of the current project included development of tools for data collection and pretesting those tools. A case study approach was recommended, and our preliminary analysis convinced us that case studies were the best way to proceed. In order to provide some structure to the study, however, we often prepare *interview guides*, which contain a list of questions we expect will yield the quantitative and qualitative information needed to inform the economic metrics and to allow estimation of benefits.

Because our research involves a limited number of agencies, we suspected that selection of target organizations would not be a challenge, and the respondents for the annual NTTAA report made an ideal contact list for placing the interviews. As the body of the report details, we were able to establish contacts in each of the areas for which we developed an interview guide, although we had more difficulty in placing the pretests required by the project.

1.4 PRETEST RESULTS AND RECOMMENDATIONS

The pretests themselves were envisioned as face-to-face or telephone interviews with knowledgeable individuals at each of the targeted agencies. The primary audience would be standards

executives who have a broad focus on voluntary and agency- or government-specific standards. As with any data collection activity, follow-up activities were planned to clarify initial responses and to obtain additional qualitative and quantitative data.

We anticipated successful pretests in the regulatory- and procurement-focused agencies, which we had identified early on as key segments of the agency population. After receiving feedback from SSD, we designed and requested a pretest of an instrument focused on laboratory accreditation, an area of special interest to NIST and one in which there is a great deal of need for voluntary consensus approaches. With the results of the pretests in hand, recommendations on how to proceed would follow.

1.5 ORGANIZATION OF THE REPORT

The remainder of this report provides details of the sections summarized above, including the results of interactions with agency personnel during the study. We have also included an appendix containing the interview guides that were sent to the agency representatives from whom we requested assistance.

2 Background Investigation

A major objective of government departments and agencies should be to deliver valuable services to the public as efficiently as possible. The pursuit of this goal has been central to many efforts to improve the performance of government departments and agencies during the past quarter century, including those initiated by various administrations and several mandated by Congress. Academic papers published as early as the 1970s show that, in areas where private-sector businesses, educational institutions, and other nonprofit organizations have significant expertise, there is a great deal to be gained if all parties work cooperatively to optimize resource use and avoid duplication of effort (Whitaker, 1972; Miller, 1985). Congress applied this reasoning with respect to the use of VCS in its passage of NTTAA in 1996.

2.1 REQUIREMENTS OF NTTAA

Under the provisions of NTTAA, all federal agencies are required to use VCS in preference to agency- or government-specific standards for procurement and rule-making activities, except where such use is impossible or inappropriate. OMB issued a revised version of OMB Circular A-119, entitled “Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities,” to implement the provisions of NTTAA, and to define reporting and oversight responsibilities. The OMB circular assigned NIST the following

roles: collecting information on the activities of departments and agencies on an annual basis, publishing the complied data in an annual report, and leading a coordinating committee to monitor compliance with the provisions of NTTAA. In addition, NIST's strengths in information management and communication made it a natural clearinghouse for VCS-related publications and materials.

Although it was not clearly specified in either the initial act or the OMB circular that implemented it, testimony in a 2000 congressional hearing strongly suggested that quantitative benefit-cost analyses and better communication of success stories would support OMB and NIST's efforts with NTTAA (U.S. House, 2000). It seems evident that the members of Congress who worked to pass the bill were philosophically inclined to believe that the use of VCS would generate benefits; however, some evidence would also be required to convince others that the bill's objectives were being met. As early as 2000, SSD was committed to begin the process of measuring economic benefits from the use of VCS.

In addition to NTTAA, several other public laws or agency initiatives require or encourage the use of voluntary standards. Statutes governing activities of the Consumer Product Safety Commission (CPSC) have directed it to use VCS whenever possible. Since 1981, the commission has been required to make a determination that no effective voluntary standard is in place before issuing a mandatory safety standard. The Health Insurance Portability and Accountability Act (HIPAA) of 1996, the Telecommunications Act from the same year, and the FDA Modernization Act of 1997 all contain language that encouraged or required the use of VCS. The massive Department of Defense (DoD) standardization initiative, also called the Milspec Reform, had as one of its most important elements the replacement of DoD-specific procurement standards with voluntary standards that are supported by independent SDOs.

2.2 TAXONOMIES OF STANDARDS USED WITHIN GOVERNMENT ORGANIZATIONS

Several different types of standards are used by governmental organizations, and these standards function in a variety of ways to help the agencies perform their missions. The International

Organization for Standardization (IOS) has identified eight general types of standards in common use: basic, terminology, testing, product, process, service, interface, and data requirements (Breitenberg, 1987). A more useful taxonomy for this project divides government standards by function into *procurement* and *regulatory* standards. Procurement standards are used in the purchase of goods and services, and typically describe specifications, dimensions, performance characteristics, or quality attributes of the items being purchased. Regulatory standards are those specified within the regulations that businesses and other affected entities must follow.

Critical to the use and acceptance of any standard is the process of *conformity assessment*, the means by which firms can show that their products, processes, or services adhere to the standard in question. For process- or service-oriented standards, an audit or inspection of the firm's operations may be required to demonstrate conformity. For product standards, the assessment may be accomplished by physical measurement, performance testing, chemical or biological analysis, or a variety of other means and often conducted in a company-owned or independent third-party laboratory. These laboratories, in turn, must be evaluated to make sure that their results will be accepted; this important aspect of conformity assessment is called "certification or accreditation." Procurement and regulatory standards are both likely to include and depend on laboratory testing and accreditation for their effectiveness.

The use of any type of standard provides several kinds of benefits to the parties involved, some of which are easily measurable and others that are more difficult to quantify. Actions that need to be performed many times can be done consistently and repeatedly, with low transaction costs and minimal risk. Quality assurance is made simpler, less costly, and more effective by adherence to standards and established procedures. The efficiency and low cost of communicating information should support higher quality decision making, foster increased competition, and thus lower overall costs. In the next two subsections, we discuss the use and benefits of each of the standards classes described above.

2.2.1 Procurement Standards

Government organizations, like firms in the private sector, purchase a large number of goods and services in order to fulfill their objectives, including such disparate items as vehicles, office supplies, laboratory equipment, construction and maintenance services, and computer equipment. In addition, departments and agencies that produce final goods and services, such as DoD, the National Aeronautics and Space Administration (NASA), the Department of Energy's National Laboratories, and the Department of Veteran's Affairs, purchase a wide array of raw materials, capital equipment, and labor services to support their production activity. The use of suitable standards allows agencies to purchase exactly what they need, as often as they need it, without investing an inordinate amount of time in engineering, determining specifications, and negotiations. These agencies reduce the risks that the products or services will fail to function as intended (quite important for components of jet fighters or rockets) and ensure that the vendor will deliver the expected quality and performance.

Potential benefits from the use of VCS in procurement are fairly straightforward. Because private firms also buy many of the products and services purchased by governments, there is an incentive for a single standard that can be used in both arenas. It makes little economic sense to have a government- or agency-specific standard that is different from one developed for use in the private sector by an industry trade organization or SDOs. In fact, if government agencies make up a small fraction of demand for the product or service, there may be a significant cost penalty paid by any agency that insists its own standards be met. Even if the government is the only buyer for a product, as is often the case for DoD's military equipment, the inclusion of vendors in the VCS process may lead to a higher quality standard and lower product costs.

2.2.2 Regulatory Standards

Just as large procurement-intensive government departments require and benefit from standards in their purchasing activities, regulatory agencies specify many standards in the rules that they promulgate. These organizations include the Environmental Protection Agency (EPA), Food and Drug Administration (FDA),

Occupational Safety and Health Administration (OSHA), National Highway Traffic Safety Administration (NHTSA), CPSC, and several others. The rule-making efforts of these organizations typically require specific actions by affected firms to comply with the provisions of the regulation in question. In the case of environmental rules, firms may be required by EPA to install equipment that is designed in accordance with a set of materials standards, to measure effluents from their facilities using several process standards, and to check instrument calibrations using specified laboratory standards. CPSC adopts existing voluntary consensus safety and performance standards (or develops new mandatory standards if no suitable VCSs are in place) for each of the hundreds of products that the commission is responsible for regulating.

The benefits of the standards themselves include many of the cost, quality, and efficiency considerations noted previously for procurement standards. In addition, using an appropriate set of standards allows a regulatory agency to enact and enforce a rule that applies equally to all of the firms under that agency's jurisdiction, ensuring fairness and consistency across affected industries. The use of VCS should bring economic benefits to the rule-making agencies, although more indirectly than in the case of procurement. The VCS process allows the government agency to share standards development and maintenance costs with SDOs or trade associations, thereby lowering the overall costs to the regulated firms as well as to the government. By making it easier and cheaper for firms to comply with the rule, VCS should also allow agencies to better achieve their regulatory intent. Finally, the inclusion of the affected firms in the rule-making process may increase those firms' incentives to cooperate with the agency, both during and after the regulations are promulgated, thereby potentially lowering enforcement costs.

2.2.3 Conformity Assessment

A typical government agency purchase contract may specify that all required physical measurements and performance tests on the products being purchased, as well as on raw and intermediate materials, be conducted at and certified by an accredited testing firm. Environmental regulations almost always require firms that emit pollutants to air, water, or other media to use chemical

analyses performed by a laboratory that has been accredited for the specific tests involved. Often, these agencies maintain one or more agency-specific accreditation processes, which they insist that suppliers or affected firms use. For example, testing drinking water for bacteria or mercury might involve separate and incompatible accreditation processes for each of the states in the United States, as well as for the federal EPA. Laboratories that perform tests on several environmental media such as air, water, and solid waste, are currently subject to separate accreditation from three different offices within EPA.

Clearly, there are potential benefits from coordinating certification and accreditation processes between agency departments, among agencies within the federal government, across federal and state governments, and internationally as well. A number of initiatives have begun to stimulate the required sharing of information and resources. NIST leads the National Voluntary Laboratory Accreditation Program (NVLAP), which provides third-party accreditation in 25 different program areas. NIST supports the National Cooperation for Laboratory Accreditation (NACLA), whose primary mission is to evaluate and recognize laboratory accreditation bodies in the U.S. EPA heads up the National Environmental Laboratory Accreditation Program (NELAP), which is attempting to coordinate mutual recognition of laboratory accreditation across states in the U.S., beginning with drinking water and wastewater analysis.

2.3 METHODS FOR MEASURING ECONOMIC BENEFITS FROM THE USE OF VCS

The literature on program evaluation and RTI's experience in microeconomic assessment suggest several ways in which the economic benefits generated by the use of the VCS process could be measured. The relatively small number of government agencies involved suggests that case studies could be profitably employed for a few high-profile or very active organizations. Placement of a survey would provide a more systematic assessment, although at a greater cost and with a significant increase in effort. Once a measurement methodology to evaluate individual initiatives was proven, it could be included as an optional (or even mandatory) part of the agencies' reports to SSD.

Of course, success stories and other types of qualitative reporting provide useful illustrations of economic impacts, even if detailed quantitative analysis is not forthcoming. Finally, major agency initiatives, like the DoD's standardization initiative, might warrant a full-blown program evaluation, with estimation of net present value and benefit to cost ratios for the organization's investment in VCS. Each of these potential approaches is discussed further in this section of the report.

2.3.1 Case Studies: Before-and-After or Counterfactual

A case study is an ideal way to determine the impact of specific change or systems improvement for a government department or agency. The amount of time devoted to locating key resources, establishing communications, and collecting data offers the opportunity to obtain a richness of information not easily obtainable by other means. The qualitative and quantitative information obtained can help inform subsequent data collection activities in which time and complexity are more limited.

Two types of measurement methods are often used to quantify costs and benefits in case studies: before-and-after and counterfactual. In the former method, revenues (benefits) and capital and operating costs are estimated for the periods prior and subsequent to implementation of the change being studied; the difference between the net costs represents the benefit of the change. In a counterfactual analysis, a hypothetical scenario is evaluated, and the scenario's net costs are compared to those costs that are actually incurred in order to determine the impact of the systems improvement. As many of the costs in developing VCSs or agency-specific standards are one-time in nature, we expect that a counterfactual analysis might prove more productive in the present project.

2.3.2 Surveys

Although case studies can provide detailed analyses of specific events or innovations, they tend to be idiosyncratic in nature, and extrapolation of results from one case is unlikely to prove an accurate basis for estimating impacts across disparate organizations or systems improvements. A more systematic tool is needed both to provide this cross-cutting analysis and to aggregate individual results up to the level of an entire agency or

department. If NIST is interested in evaluating the economic impact of NTTAA on the entire population of federal agencies, a structured survey is a more appropriate tool. Using information gained from representative case studies, a survey instrument can be designed and placed that will request numerical or categorical responses to a limited number of questions. RTI has had great success conducting small surveys with between 10 and 150 respondents for a number of NIST program evaluations and microeconomic assessments, and the methodologies used can be easily adapted to quantify the benefits from the use of VCS.

2.3.3 Qualitative Analysis: Success Stories

As the literature review in the next section details, the simplest method for determining the benefits derived from an innovation is the creation of a qualitative "success story." In this approach, costs and benefits are described verbally rather than numerically, and directions of changes are indicated: quality was improved, labor input was reduced, prices fell, etc. Success stories frequently compare results of two or more initiatives and attempt to place these initiatives in rank order by some subjective criteria. Although these simple analyses are valuable to building understanding and creating energy to support change, these analyses cannot provide much in the way of estimating benefits or helping guide resource allocation decisions.

2.3.4 Program Evaluation: NPV or B/C of Standardization Process

If one improvement initiative is complex enough or of significant size, it may be worthwhile to conduct a stand-alone assessment of that effort using program evaluation techniques. This is, in effect, an extended case study, with the outcome being a determination as to whether the resources invested in the effort were properly allocated. In this quantitative analysis, detailed costs and revenues are collected for the entire duration of the project, and measures of economic return, such as net present value (NPV) and/or benefit-to-cost ratio (B/C), are calculated. Of the efforts we have reviewed as a part of this VCS evaluation task, only the DoD standardization initiative (Milspec Reform) would seem worthy of a separate program evaluation; however, such an effort would be well beyond the scope of this project.

2.4 LITERATURE REVIEW: ECONOMIC BENEFITS OF USING VCS

Even though we expended a great deal of effort in searching for journal articles, papers, press releases, and Web pages discussing economic benefits from the use of VCS, we found very few documented savings estimates and a relatively small number of success stories. Even the SDOs and industry trade associations, who spend a high percentage of their effort (and their member firms' financial contributions) developing voluntary standards, seem to have almost no examples of quantified benefits. Our experience matches a comment made about 2 years ago by a member of the National Society of Professional Engineers: "Despite the achievements noted earlier, success stories have still been the exception rather than the rule" (Ruggieri, 2001).

Nonetheless, we were able to find a fair number of papers that claimed economic benefits, and a few that provided numerical estimates of savings from the use of VCS or from the substitution of an agency- or government-specific standard with a voluntary one. The results of this literature search are organized by department or agency, beginning with DoD, the most active in standards reform.

2.4.1 Department of Defense and Its Service Branches

DoD has been called the most diversified and largest developer and user of standards in the United States, and possibly the world. DoD primarily uses standards for procurement purposes, requiring equipment and parts suppliers to provide products that conform to detailed product specifications.

Beginning after World War II and responding to inadequate or nonexistent private-sector standards, DoD developed its own set of agency-specific standards, known as Milspecs. For products that were common to military and civilian uses, Milspecs in most cases did not conform to the industry standards and thereby forced suppliers to develop separate methods and machinery to accommodate both markets. A study of military contractors by the management consulting company Cooper & Lybrand determined that the use of a group of 120 Milspecs increased the price DoD

pays for industry goods and services by about 18 percent (Coopers & Lybrand/TASC, 1994).

DoD has been working to reduce these excess costs by supporting the use of private-sector standards since 1962; and in fact, the original 1982 version of OMB Circular A-119 was based on DoD's established policy. These ongoing efforts were accelerated as a result of the Milspec Reform Initiative, which was ordered by Secretary of Defense William Perry in 1994. This reform's immediate purpose was to review the current military-unique specifications and determine if any of those specifications could be replaced by reasonable private-sector standards. For the future, Milspec emphasized a greater use of and reliance on performance and commercial specifications and standards by the DoD (American National Standards Institute [ANSI], 2003a). Since the beginning of Milspec Reform, DoD has reviewed over 29,000 agency-specific standards and has cancelled or replaced 9,600 of them. These profound efforts continue today under the direction of the Defense Standardization Program Office.

One DoD reform success story is the C-17 Program. The C-17 Program develops cargo aircraft. These aircraft are used to perform tactical airlift and airdrop missions. In the 1990s, program costs were out of control, and aircraft were being delivered late and with poor quality. The program decided to eliminate the traditional Milspecs and replace them with commercial systems. In addition, the military developed a quality control program based on Boeing's successful D1-9000 system. The C-17 Program reports that initially the production line slowed down even more, causing even greater delays. Slowly, the delivery schedule started improving, and by 1997 the program was awarded the California Golden State Quality Award for being the best of the state's large manufacturing enterprises. The program now reports that it is delivering about 6 months early on contracts with one of the lowest "costs of quality" of any aircraft currently being manufactured. "Production span time as well as fly-away cost of the aircraft has been cut in half" (Department of Defense [DoD], 2002a).

As part of the DoD Reform efforts, the Navy led an effort to replace 33 MIL & FED Specs for insulation with ASTM International standards. ASTM International, formerly the

American Society for Testing and Materials, is a not-for-profit SDO that specializes in the development and publication of voluntary consensus standards for materials, products, systems, and services. According to a DoD publication, the use of ASTM standards has resulted in $89 million total life-cycle savings (ANSI, 2002).

One specific example of the Navy's successful work with ASTM standards is its application of mechanically attached pipe-fitting (MAF) testing. MAF was a new pipe-fitting technology that promised substantial improvements over existing pipe-joining technologies, such as welding and brazing. Most MAFs offered easy fabrication, high reliability, and lower installation costs. To the Navy, these assets would mean cost of maintenance savings while maintaining fleet material readiness. The problem was that the Navy could not implement the MAFs without proof that the MAFs would indeed provide better integrity than brazing or welding. No testing methods were in place, and the Navy had to use various testing procedures provided by each of the individual manufacturers. It was difficult to compare the results and to ensure that the Navy would get the best MAF at the best price (ASTM International, 2001).

Instead of developing its own Milspec for MAF, the Navy asked ASTM to work with them and the manufacturers to develop a common standard. During the development of this standard, manufacturers funded and conducted about $1 million worth of MAF testing to prove concepts and validate tests. At minimum, the Navy saved this $1 million, because it would have had to conduct similar MAF testing if they had developed an in-house standard. The Navy further estimates that by involving ASTM, the MAF standard was develop 3 years ahead of the Navy's timetable for standard development. This progress in turn meant that the Navy could take advantage of MAF savings (which are about $136 per installed MAF) 3 years ahead of schedule. Because the Navy installs about 42,500 MAFs each year, this improvement resulted in a total 10-year savings of about $58 million (DoD, 2002b).

Another example of an area of concern was sealant and elastomers. The Milspecs written for these products were outdated and were causing high prices, waste of material, and delays in getting the products. DoD worked with the Society of

Automotive Engineers (SAE) to develop the portion of the National Defense Contractor Accreditation Program (NADCAP) responsible for sealants and elastomers. NADCAP is a system used to evaluate quality systems for suppliers and distributors. By using NADCAP to evaluate sealants and elastomers, the number of product returns decreased by 90 percent. The quality of materials supplied to the field was improved, and waste associated with shelf life has been eliminated. The General Service Administration (GSA) was able to discontinue lab testing for a savings of $200,000 to $300,000, while the industry saved $2.2 million. Future government savings are expected to be around $760,000 yearly (DoD, 2002c).

2.4.2 Consumer Product Safety Commission

CPSC is charged with protecting the public from unreasonable risks of death and injury associated with consumer products. In order to fulfill that objective, CPSC researches, develops, and enforces product safety standards. The Consumer Product Safety Act of 1996 requires CPSC to rely on voluntary standards when such standards are likely to result in the adequate reduction of the risk of injury and when it is likely that there will be substantial compliance. If there are no suitable standards for the product in question, or if an existing standard is not being followed by industry, CPSC is expected to develop an agency-specific standard. As a result, the commission spends about 70 percent of its regulatory effort participating in voluntary standards-setting efforts and about 30 percent developing government-specific standards.

As it considers the development of a new standard, CPSC estimates the benefits that will be generated, both in terms of avoided medical costs and the value of lives that will be saved. Our research did not uncover any instances in which the commission estimated savings from using a VCS process rather than developing its own mandatory standard. Recent cooperative regulatory efforts for which it might be possible to quantify benefits include:

- work with ASTM on safety standards to protect children in cribs and on playgrounds;

- work with the Water Heater Joint Research and Development Consortium and the Gas Appliance Manufacturers Association to reduce the risk of injuries and deaths from gas-fired water heaters; and
- joint efforts with the National Fire Protection Association (NFPA) and Congressional Fire Services Institute to evaluate the effectiveness of smoke detectors during fire incidents and to develop related product safety standards (Consumer Product Safety Commission [CPSC], 1997).

2.4.3 Department of the Interior

The Department of the Interior (DOI) is the nation's principal conservation agency. This agency has been tasked with the responsibility of fostering sound use of land and water resources and conserving and protecting fish and wildlife. In DOI's regulatory capacity, the agency sometimes looks to industry associations and standards for guidance. For instance, the U.S. Mineral Management Service (MMS), a bureau of DOI, worked with the American Petroleum Institute (API), the primary trade association of the oil and gas industry, to develop Safety and Environmental Management Programs (SEMP) for offshore operations. According to API, the SEMP standards saved the petroleum industry $200 million in compliance costs (American Petroleum Institute [API], 2002).

2.4.4 Occupational Safety and Health Administration

OSHA, an agency within the Department of Labor (DOL), was created to ensure safe working conditions for employees in the United States. OSHA works closely with accredited SDOs, including the American National Standards Institute (ANSI). ANSI is a private, nonprofit organization that administers and coordinates the U.S. voluntary standardization and conformity assessment system. ANSI does not itself develop American National Standards (ANSs); rather ANSI facilitates development by establishing consensus among qualified groups. For instance, ANSI adopted protective electrical equipment standards developed by ASTM. OSHA, in turn, cited six of these standards in its protective electrical equipment regulation. In all, OSHA regulations reference over 200 of the existing 800 ANSs for safety and health (ANSI, 2003b). Although we found a variety of

documents describing OSHA's extensive use of and support for ANSs, none of these documents estimated quantitative savings or described qualitative benefits from the use of VCS.

2.4.5 Food and Drug Administration

FDA is responsible for ensuring the safety of processed and formulated foods, prescription and over-the-counter drugs, cosmetics, and medical devices manufactured for sale in the United States. In addition, FDA evaluates new drugs, food additives, and medical devices that firms would like to market, and FDA approval is necessary before any of these new products can be marketed. The regulations by this agency, which is a part of the Department of Health and Human Services (HHS), typically place the burden on firms to establish procedures to ensure their products' safety and wholesomeness. As a result, FDA regulations require the use of fewer standards than most rule-making agencies. In recent years, the agency has increased its use of VCSs to replace the limited number of government-specific standards it has cited. For instance, FDA is working with the Human Milk Banking Association of North America (HMBANA) to adapt the HMBANA donor human milk guidelines into federal regulation (Food and Drug Administration [FDA], 2001).

2.4.6 Department of Energy

DOE is one of the largest users of procurement standards in the federal government for its various agencies and through its contractor-managed National Laboratories, including Oak Ridge, Argonne, Sandia, Los Alamos, and others. DOE's role in regulating nuclear power operations in the United States gives the department a prominent role in regulatory standards as well. DOE uses a VCS as a basis for some of its programs but also relies extensively on government-specific standards, either its own or those developed by other governmental agencies such as DoD. For example, DOE maintains a Laboratory Accreditation Program (DOELAP) that is separate from the NVLAP operated by NIST. Within the DOELAP, however, some VCSs are used, such as the quality of radiation dosimetry measurement performance, which is based on quality system criteria set forth by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (Department of Energy [DOE], 1998).

It is not always the case that a governmental organization agency, such as DOE, will use an existing VCS or work with SDOs to develop a new one in order to meet its procurement or rule-making needs. If the agency concludes that no adequate industry standard exists, the agency may petition an SDO to declare an existing government-developed standard as a VCS and ask the private organization to support the VCS in the future. DOE has used this process extensively in its efforts and has described the process in its Technical Standards Program Guide (DOE, 1999). In this case, the economic benefits are likely to be small, as no efficiencies are generated in standard development, and the lack of industry involvement makes cost reductions in procurement unlikely. The agency will reduce its costs of maintaining and improving the standard if the SDO agrees to take over these responsibilities.

2.4.7 Environmental Protection Agency

EPA was founded in the 1960s to protect human health and to safeguard the natural environment—air, water, and land—on which life depends. EPA's primary activities involving standards are in rule-making. In order to achieve its mission, EPA is one of the most active regulation-producing agencies in the U.S. government. As required by the underlying legislation authorizing its activities, along with its longstanding practice, the rules promulgated by EPA are very prescriptive in describing the actions that firms must take and how they must comply with the regulations. As such, there are a large number of standards referenced in EPA regulations, including specifications of materials and equipment to be used, laboratory tests that must be run, maintenance and calibration activities that need to be performed, information that must be recorded and subsequently reported to EPA.

This wealth of details means that EPA has a greater opportunity to benefit from the use of VCS than most or all other regulatory agencies. In addition, the large number of conformity assessment requirements written into EPA rules has created a significant potential for economic benefits in laboratory accreditation activities. Not surprisingly, EPA has supported the development of VCS. EPA not only offers grants for VCS research to SDOs, EPA also conducts training sessions to familiarize rule-makers

with the VCS information provided by the NSSN, an online national resource for global standards (U.S. General Accounting Office, 2000). NSSN is a cooperative partnership between ANSI, private domestic standards organizations, government agencies, and international standards organizations (NSSN, 2003).

To our knowledge, EPA has not estimated or publicized the economic benefits realized as a result of their VCS activities. Nonetheless, the agency is aware both of the potential benefits from regulatory flexibility in general as well as of the relation between reductions in industry compliance cost and improved environmental results.

3 Analysis Framework and Metrics

The heart of any economic benefit-cost analysis is the analytical framework that was developed to estimate benefits and costs. Key elements of this effort are defining the scope of the analysis, applying an analytical methodology, articulating key benefit and cost impact areas, developing technical and economic metrics to measure these impacts, and proposing data collection strategies for informing the metrics and creating results measures.

In this study of the economic impact of NTTAA, it was important to clearly define the analytical methodology, as a number of different approaches were feasible. In this section, we first restate the taxonomy of evaluation methods from the previous section, with special emphasis on how these methods could be applied in this case. Next, a brief review of relevant economic theory illustrates our decision to treat the use of VCS as a beneficial technological change. Finally, we describe impact areas, metrics, and measures, and then discuss appropriate data collection strategies.

3.1 TAXONOMY OF BENEFITS EVALUATION METHODS

In formulating a case study design for analyzing benefits from agencies' use of VCS, an initial choice needed to be made about the balance between descriptive and quantitative analysis. There are a number of potential approaches that could be used, each of which having advantages, resource requirements, and limitations. Although most of these methods are used in various applications at RTI, for studies in technology economics and policy, we tend to focus on the more quantitative approaches. A taxonomy of the most used methods appears below.

- ***Success stories*** are almost always descriptive rather than analytical. These stories can provide a richness of detail and narrative description that helps build an understanding of goals and accomplishments and facilitates communication across and between organizations. However, their selective nature and lack of quantitative data make success stories unsuitable for program evaluation or economic assessment.

- ***Qualitative case studies*** are an excellent tool for communicating comprehensive results of a key initiative, especially if quantification is difficult or impossible. Interviews with key decision-makers and stakeholders can allow a more intimate look than is afforded by the more detached success story. Although some metrics are commonly presented, there are seldom sufficient data to support quantitative analysis.

- ***Corporate-style project analyses*** are most often conducted prior to authorizing, funding, and executing new product ventures, capital projects, and major systems improvements. In a typical application, a discounted cash-flow analysis is performed to yield projected rates of return, which must exceed corporate hurdle rates for the project to be accepted. Although this process is rigorously quantitative, it is usually selective—not all of the revenues and costs affected by the project are included in the cash-flow analysis. In addition, ex-post assessments are rarely conducted or publicized, even if the project is successful.

- ***Before-and-after case studies*** are one of the two types of comprehensive, quantitative analyses commonly employed in assessing major systems changes or improvement initiatives. These studies can also be used successfully in program evaluation. In these studies, a baseline is established prior to the planned change, with a full slate of metrics defined and measured. Once a steady state has been reestablished after the change, these same metrics are collected and compared to the baseline. Economic benefits are determined from aggregates, such as profit or total cost. This approach works well if the system change is large enough relative to day-to-day or secular changes

in prices, costs, revenues, etc. If results are noisy, or if other significant events disturb the aggregates being measured, before-and-after analysis can produce misleading results.

- ***Counterfactual analysis*** involves the comparison of actual results with a hypothetical situation that would be expected to occur in absence of the intervention being studied. Just as rigorous as before-and-after analysis, counterfactuals also can take into account changes in secular variables that might confound other estimates. Although the creation of the counterfactual involves some judgment and subjectivity, it is almost always possible to develop reasonable hypotheses by conducting in-depth interviews with key participants and stakeholders. Although it is not often discussed, almost all historical and economic analyses involve some degree of counterfactual reasoning (Fogel, 1979).

For the VCS task, therefore, we built our case study methodology using counterfactual analysis. With this approach, the actual costs of supporting the VCS being studied are compared to those that would have existed had the agency used government-specific standards instead. Our initial concept involved evaluating an entire organization rather than a specific initiative. The organization could be an entire agency; or, more likely, a department or office within an agency.

DSPO has produced a series of seven quantitative case studies that implicitly apply a counterfactual approach. It should be pointed out that, by and large, the DSPO analyses focus on estimating benefits from standardization in general, comparing actual results to a situation in which no standards are available at all. Our task, however, is to compare the benefits of VCS with government-specific standards, a significantly different empirical proposition. Nonetheless, we have benefited from the example provided by the three DSPO case studies that document the use of consensus standards: Mechanically-Attached Pipe Fittings, Navy Self-Contained Breathing Apparatus, and Conversion of Mil-Std-100 to a Non-Government Standard. A fourth initiative, the NAVSTAR Global Positioning System, was started as a government-specific initiative, but this initiative has since been

broadened to include civil applications and is now largely under the control of a consensus process as well.

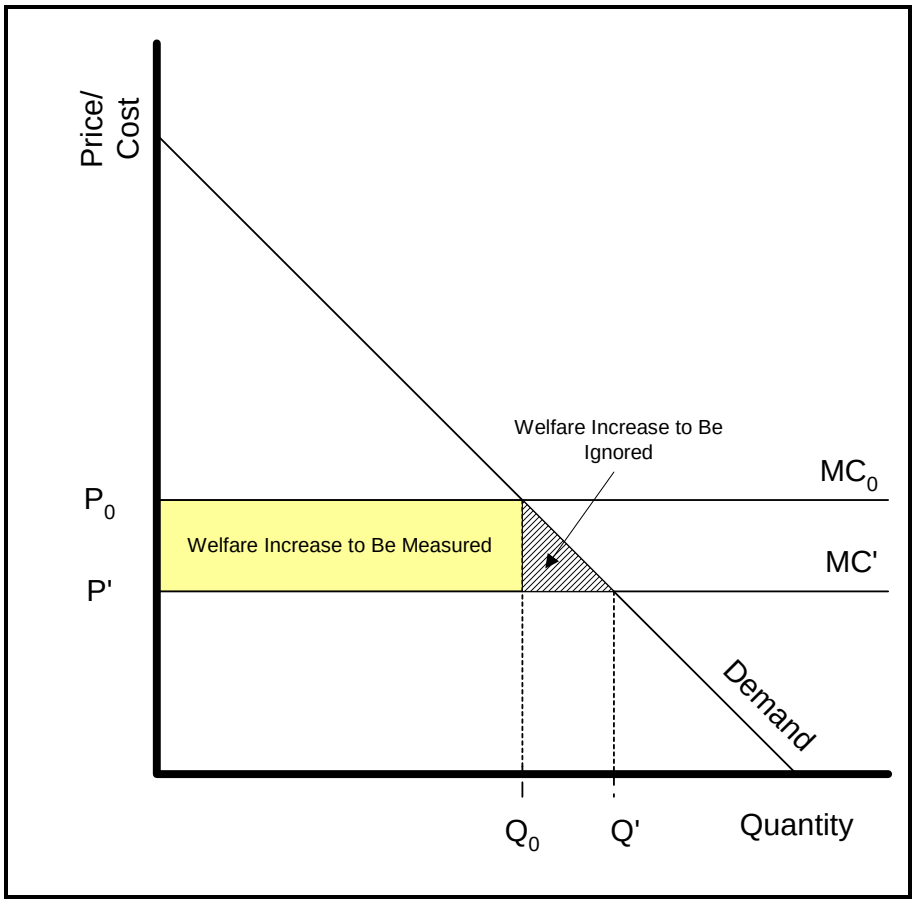
3.2 BRIEF REVIEW OF RELEVANT ECONOMIC THEORY

Standards and conformity assessment tools are indirect inputs to production processes, and the impacts of these tools can be analyzed like other economic inputs, including labor and capital. This capability remains true regardless of whether the focus of analysis is a private firm (such as a regulated manufacturing facility, government supplier, or testing laboratory) or the government agency itself. EPA, for example, produces products (regulations, analytical methods, accreditations), as does DoD (weapons systems, military facilities, national security). An improvement in the performance or decrease in the cost of using standards lowers agency costs and allows that agency to fulfill its mission more effectively. Replacement of government-specific standards with VCS can be thought of as a beneficial technological change, and economic principles from that field of study can help frame the current methodology.

In a classic set of industrial studies more than 25 years ago, Edwin Mansfield explored the measurement of the benefits of technical change (Mansfield et al., 1977). Using partial equilibrium analysis, Mansfield demonstrated the two impacts of improved processes and products: an increase in consumer and producer surplus as fewer resources are required to produce the existing level of output, and an expansion of output as supplier firms respond to the gap that opens between their marginal revenue and marginal cost. The increase in output provides an additional social benefit as purchasers are able to expand their consumption.

When cost or price reduction is the primary result of the improvement, a straightforward algebraic approach can be used. Figure 3-1 illustrates Mansfield's approach. An innovation affecting an input or production process lowers the firm's marginal cost of production from MC_0 to MC'. The firm can therefore cut its price accordingly, and with downward-sloping demand, will increase output and sales from Q_0 to Q'. The increase in social welfare includes the impact of the lower firm costs (the shaded rectangular area) and the increase in demand due to a lower price

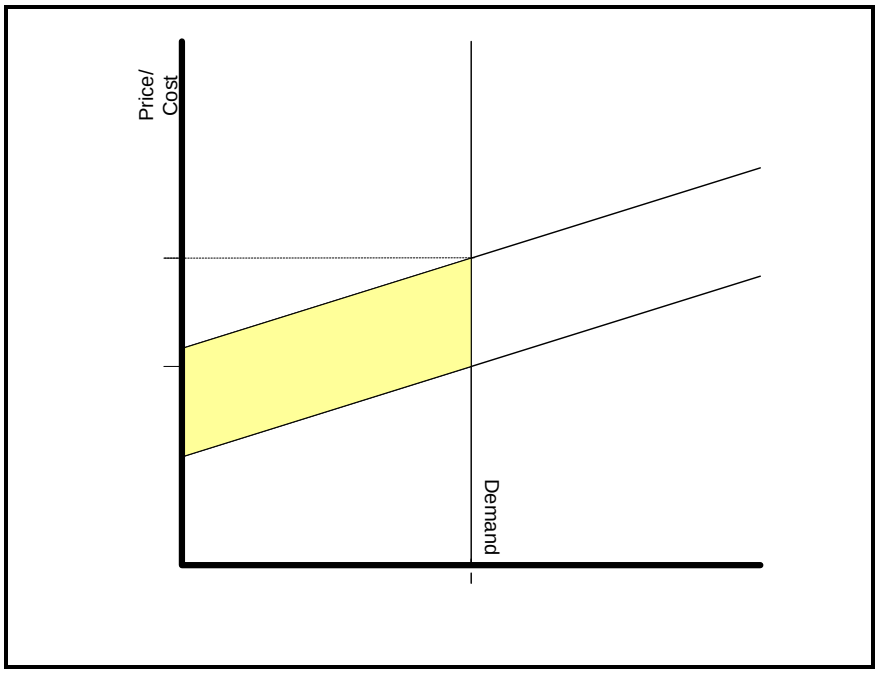
Figure 3-1. Mansfield's Approach for Evaluating Benefits of Technological Change



(the triangle). In much empirical work, economists measure the cost-reduction benefits and ignore the smaller demand impacts.

In the case of a government agency, we are not dealing with a profit-maximizing entity, so the supply behavior may be quite different. We may choose to assume that the level of output is set exogenously: by federal laws (as detailed in the Code of Federal Regulations, for instance), by a defined mission and strategy, and by congressional authorizations and appropriations. This assumption is equivalent to assuming that demand for agency "output" is totally inelastic. Figure 3-2 illustrates the resulting model, with a slightly more realistic upward-sloping supply curve (increasing marginal costs as activity is raised) replacing Mansfield's assumption of constant marginal cost. The equilibrium with the government-specific standards shows a unit cost on the supply curve at P_0 and output fixed at Q_0. Substitution of voluntary consensus standards or conformity assessment tools allows a

Figure 3-2. Simplified Equilibrium Diagram of Government Agency "Production"



reduction in costs to the supply curve S', with unit costs falling to P' in equilibrium.

The social benefit from the innovation is represented by the shaded area between the supply curves, with quantity remaining constant. This relationship can be shown algebraically to be equal to $(P_0 – P') Q_0$. To operationalize a model of this type, therefore, we need only to estimate the change in cost per unit of output (whether defined as the number of standards supported or perhaps the cost per regulation), and multiply that per-unit savings by the appropriate affected population. This dynamic is discussed in greater depth in the next section.

One the critical aspects of moving from government-specific standards and government-mandated conformity assessments to voluntary consensus processes is the maintenance or improvement of quality in the resulting systems. Standards, after all, are intended to support the core function of a government agency or private firm; standards are not to exist for their own sake. If the movement from one type of standard to another caused a decrease in the quality of products or services, any savings realized by the consensus process would be illusory. In fact, Steve Lowell, Deputy Director, Defense Standardization

Program Office suggested examples of substantial improvement in quality and/or performance following some moves to nongovernmental standards, while other initiatives resulted in quality degradation that had to be corrected by additional effort and expense. One example of this quality improvement is the move to commercial off-the-shelf semiconductors and other integrated circuits. These off-the-shelf items have a markedly shorter expected life than the military-only devices, which had become increasingly expensive as the military's share of the computer-acquisition market declined.

For the purposes of this assessment, we will make an assumption that the agency or department will act to protect the quality of its products, services, and internal processes during any transitions to voluntary consensus standards. NTTAA and the OMB circular do not force agencies to adopt VCSs at any cost, but rather allow them to maintain their agency-specific standards if required. As a result, we will assume that the quality of the regulation, procured part, laboratory analysis, or accreditation is the same in the actual and hypothetical cases.

3.3 PROCESS FOR CONDUCTING COUNTERFACTUAL ANALYSIS

RTI has established a well-defined process for conducting economic benefits analysis using the counterfactual approach, a process that consists of five major steps. In this section, we discuss each of these steps, including critical issues and actual outcomes. Application of this process to the task of estimating benefits from implementation of NTTAA is deferred to the next section, which contains descriptions of three separate case studies we constructed to inform the metrics.

3.3.1 Defining Scope of Analysis

Identifying the appropriate boundaries and the depth of penetration for the counterfactual strongly impacts the likelihood of success in the subsequent analysis. In the present case, we needed to decide whether to attempt to measure costs and benefits across an entire agency or department, to select broad activity areas within an agency, or to focus on the implementation of a single standard or set of standards. In an effort encompassing an entire department, we would measure the total

number of standards of each type (government-specific or VCS) and estimate average support costs for those standards. It is necessary to avoid penetrating too much into the details of each standard and focus on aggregates and averages to create our benefits estimates. Although this practice gives summary measures that appear to be comprehensive, the great degree of variability in resource intensity, applicability, and overall costs across standards may lead to a lack of precision in the reported figures.

Focusing on the level of an individual standard, in contrast, allows a great deal of accuracy in specifying actual and counterfactual costs, at the expense of extrapolation to the entire agency's activities or to other governmental entities. The DSPO case studies, for example, are all at the standard level—they are looking at a small set or even a single standard among the thousands of Milspecs and Non-Governmental Standards DoD supports. For the purpose of this evaluation, it seems that the standard level is too narrow a focus; however, the data needed to assess an entire agency could be quite daunting.

A couple of other possibilities exist that we believe would strike a balance between precision and coverage. As is explained in more detail in Section 4, CPSC adopts VCS and issues government-specific standards in meeting its mission, offering an unusual side-by-side comparison of the costs for supporting both systems. We could create and complete a case study to develop an estimate of the *average annual cost of developing and supporting a government-specific standard* and a second measure of the *average annual cost of assisting in development and ongoing support of a VCS*. If the experience of CPSC was thought to be similar enough to that of other agencies, NIST could use these estimates to convert the activity data that was already reported annually into a rough approximation of the newly created benefits. One disadvantage of this method, aside from the potential of poor precision, is that each agency would be unable to tie the projected savings to specific initiatives, which may make it more difficult to develop confidence in the reported results.

A second potential approach was to measure benefits across agencies for a few widely applicable types of standards. As an example, Greg Saunders, Director of DSPO, observed during our

recent meeting that some of the clearest successes in the use of VCS across all of DoD have been in military construction. A detailed case study of the benefits achieved could find wide reapplication across other agencies, as many of these agencies are involved in constructing facilities—most notably the General Services Administration (GSA), but also the DOI, Bureau of Land Management (BLM), DOE, and others.

Another common application area is in the inspection and accreditation of laboratories. This is a major issue, not only for the federal government, but also for states. Often, a laboratory that seeks to do business with multiple state and federal agencies will need to undergo scores of accreditation evaluations and inspections, as well as participate in routine round-robin or blind standard evaluations. It seems very likely that estimates of the benefits from voluntary consensus processes in this area could have reapplication possibilities across many agencies.

In order to maximize our chances of collecting useful metrics and being able to derive net benefits data during the pretests, we elected to pursue both approaches in subsequent phases of the study. The plan was to evaluate agency-wide results on the regulatory side, while focusing more narrowly on specific segments of procurement-based agencies. We also decided to pursue quantification of the interesting accreditation issues being faced by most, if not all key agencies.

3.3.2 Identifying Cost Impact Areas

Once the scope of analysis had been clearly defined, the next task was to identify those costly activities that will differ between the actual and hypothetical scenarios. In some of these areas, the VCS process should be expected to lead to smaller investments in costly resources than for government-specific standards. On the other hand, we would expect a greater level of costly activities under VCS. One simple example of such activities is labor effort and travel to support the participation in the VCS process itself. A second example is purchasing written copies of the standards themselves, a nontrivial expense for often cash-starved agency departments.

3.3.3 Technical and Economic Metrics and Discussion Guides

For each impact area identified in the previous step, a specific technical metric was developed that provided raw material for costing out the savings figures, whether positive or negative. Following this step, all of the technical metrics were associated with an appropriate economic metric, which will be an expenditure expressed in dollars. Once the impact areas and metrics were defined, case study discussion guides or survey instruments were developed to elicit responses from knowledgeable contacts.

Although full-scale deployment of the pretested instruments was beyond the scope of this study, the case study discussion guides were designed to support subsequent placement with all compliant agencies. These guides can support a structured conversation between the RTI interviewer and the agency representative, and the quantitative responses can be aggregated for statistical and mathematical analysis. During the in-depth data collection process, agency respondents will occasionally need to consult with knowledgeable persons from government or other stakeholder organizations. For this reason, the discussion guides would be sent out in advance, along with instructions for the data collection process.

3.3.4 Developing Aggregation and Benefits Quantification

For those case studies that look at agency-wide activities, the basis for aggregation is simple: a per-standard benefit is multiplied by the number of standards used by that agency to arrive at a total estimate. In the narrower selective approach, information is needed, as a part of the case study, on the number of affected projects or the fraction of the total agency the data will represent. For instance, with a finding that the use of VCS in building construction offers savings of 2 percent of the total construction costs, we would need data on the total construction expenditures to estimate the benefits. Once we eliminate the possibility of benefits totaling $1000 per accreditation, the logical multiplier is the total number of inspection visits supported by laboratories.

The data collected, suitably aggregated to represent the entire affected population, would then be used to calculate a number of measures of economic benefit, including benefit-to-cost ratio, net

present value, and internal rate of return. The following is a description of each of these benefits calculations:

Benefit-to-Cost Ratio (B/C)—Annual time series of benefits and costs, derived from the aggregated stakeholder data, are assembled. Letting B_t be the net benefits accrued in year t and C_t be the total costs incurred in that year, then the benefit-cost ratio for the program is given by

$$(B/C) = \frac{\sum_{i=0}^{n} \frac{B_{(t+i)}}{(1+r)^i}}{\sum_{i=0}^{n} \frac{C_{(t+i)}}{(1+r)^i}}, \qquad (3.1)$$

where t is the first year in which benefits or costs occur, n is the number of years the benefits and/or costs occur, and r is the social rate of discount. In most of our studies, r is set at 7 percent, the OMB-specified level. Because benefits and program costs may occur at different periods, both are expressed in present-value terms before the ratio is calculated.

Net Present Value (NPV)—The NPV of an initiative to implement VCS or conformity assessment processes can be calculated as

$$NPV = \sum_{i=0}^{n} \left[\frac{B_{(t+i)}}{(1+r)^i} - \frac{C_{t+i}}{(1+r)^i} \right], \qquad (3.2)$$

where the terms have the same meanings as identified for the B/C determination. Any project that yields a positive NPV is considered to have been economically successful. It should be noted that the 7 percent real discount rate required by OMB is a rather high hurdle for project analysis, ensuring that projects that show a positive NPV are quite socially advantageous.

Internal Rate of Return (IRR)—The IRR is the value of r that sets the NPV equal to 0 in Eq. (3.2). The IRR's value can be compared to conventional real rates of return for comparable or alternate investments. Risk-free capital investments, such as government bonds, can be expected to yield rates of return under 5 percent in real terms, while equities seldom return more than 10 percent over an extended period. It should be noted that, in cases for which costs exceed benefits, an IRR cannot be calculated.

4 Data Collection and Survey Instruments

As a result of continued background research and in-depth discussions with several government agency personnel, we have developed three detailed case study scenarios that we would like to execute in Task B of this project. Because the scenarios differ significantly in scope, target agencies, and required metrics, we have chosen to describe these scenarios more fully in this methodology document. The first study is most consistent with the work plan as initially proposed; this study attempts to measure for the CPSC benefits captured by its VCS efforts at the agency level. The second study intends to investigate standards-related activities in facility construction, an area of activity common to a number of federal agencies and one in which the DSPO believes there have been significant unrecognized benefits. Finally, we would like to assess benefits in the conformity assessment area, and the large amount of effort being expended in laboratory accreditation makes this area a natural focus for additional attention.

4.1 CONSUMER PRODUCT SAFETY COMMISSION

CPSC is directed by law to seek industry-supported voluntary standards for the products they regulate and to issue government-specific mandatory standards if no private-sector standards exist that would adequately protect the public from harm. As a result, CPSC is actively engaged in both processes of interest to our counterfactual proposition and should be in an ideal position to help us evaluate relative costs and benefits of each. Although CPSC's primary mission is to protect human health and save lives,

the reality of the budgeting process forces them to control expenditures closely. A study that describes and quantitatively estimates economic benefits from CPSC's use of voluntary industry standards may help them build support for their strategic plan and future development needs. Table 4-1 lists a number of impact areas and technical and economic metrics of CPSC.

4.2 FACILITIES CONSTRUCTION IN THE DEPARTMENT OF DEFENSE

A large number of government agencies construct facilities to support their core missions and objectives, to provide office and laboratory areas, and even to house their employees. The most important of these is DoD, which designs, constructs, and operates permanent and temporary buildings and structures on military bases and in office and research complexes. According to their 2003 appropriation, DoD, its service branches, and reserves were authorized to spend $5.6 billion in military construction during the fiscal year, along with $1.6 billion in construction of family housing.

Despite this immense level of spending and activity, military construction is a small fraction of total construction activity in the United States, which amounted to $846 billion in 2002 (U.S. Census Bureau, 2003). As a result, there are large potential benefits from DoD specifying voluntary consensus standards already in place in the private sector, rather than a set of Milspecs that they would have to initiate, maintain, and enforce. Table 4-2 lists a number of impact areas and technical and economic metrics that we would expect to be useful in quantifying benefits from use of VCS in DoD or other agency construction activities.

4.3 LABORATORY ACCREDITATION UNDER NATIONAL ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

EPA regulations require the use of a variety of standards and conformity assessment methods, many of which are agency-specific, while others are the product of voluntary consensus efforts. As a part of these activities, EPA specifies thousands of analytical tests that must be performed by private-sector firms, state and local governments, and EPA itself. Most, if not all, of

Table 4-1. Consumer Product Safety Commission Study

Activity Area	Technical Metric	Economic Metric
Areas affecting agency costs:		
Efforts of in-house experts to develop new standards	Labor hours	Labor costs
Training and development of in-house experts	Number of training courses supported	Training costs
	Supervisory effort	Labor costs
Maintenance/improvement of existing standards	Hardware and software	Info systems cost
	Conferences attended	Travel costs
	Effort hours for maintenance	Labor costs
Support for voluntary consensus standards efforts	Memberships in SDOs	Membership fees
	Meetings attended	Travel costs
	Purchase of hard-copy standards	Unit cost x number of standards
Areas affecting regulated firms:		
Contractor efforts to interpret and comply with standards	Labor hours	Labor costs
Training and development of standards experts at firms	Number of training courses supported	Training costs
	Supervisory effort	Labor costs
Change control and dissemination for existing standards	Hardware and software	Info systems cost
	Effort hours for maintenance	Labor costs
Support for voluntary consensus standards efforts	Memberships in SDOs	Membership fees
	Meetings attended	Travel costs
	Purchase of hard-copy standards	Unit costs x number of standards
Audits and inspections to ensure firm complies with standards	Inspection labor hours	Labor costs or audit fees
	Legal consultation hours	Legal fees
Conformity assessment and demonstration	Laboratory tests	Testing fees
	CofCs produced	Labor hours
	Inspection visits	Overtime pay

Table 4-2. Military Construction Study

Activity Area	Technical Metric	Economic Metric
Areas affecting agency costs:		
Efforts of in-house experts to develop new standards	Labor hours	Labor costs
Training and development of in-house experts	Number of training courses supported	Training costs
	Supervisory effort	Labor costs
Maintenance/improvement of existing standards	Hardware and software	Info systems cost
	Conferences attended	Travel costs
	Effort hours for maintenance	Labor costs
Support for voluntary consensus standards efforts	Memberships in SDOs	Membership fees
	Meetings attended	Travel costs
	Purchase of hard-copy standards	Unit costs x number of standards
Contract development and negotiation	Purchasing agent hours	Labor costs
	Legal consultation hours	Legal fees
Evaluation of contractor conformance to standards/specs	Hours reviewing documents	Labor costs
	Inspection visits	Travel costs
Areas affecting price of purchased goods:		
Contractor efforts to interpret and comply with standards	Labor hours	Labor costs
Training and development of Milspec experts at firms	Number of training courses supported	Training costs
	Supervisory effort	Labor costs
Change control and dissemination for existing standards	Hardware and software	Info systems cost
	Effort hours for maintenance	Labor costs
Support for voluntary consensus standards efforts	Memberships in SDOs	Membership fees
	Meetings attended	Travel costs
Contract development and negotiation	Sales/Marketing hours	Labor costs
	Legal consultation hours	Legal fees
Conformity assessment and demonstration	Laboratory tests	Testing fees
	CofCs produced	Labor hours
	Inspection visits	Labor hours

these tests are required by law or EPA regulations to be performed at an accredited analytical laboratory, whether operated by the regulated firm, a government organization, or a third-party service provider.

In the absence of coordinating activities, such as those facilitated by NELAP or SDO-led voluntary consensus processes, it is possible that a single laboratory intending to provide services across different media (water, air, and solid waste, for example) may require inspection and accreditation from several branches of EPA, as well as the corresponding governmental bodies in each state for which that laboratory does business. This process contains excessive costs in terms of laboratory effort and materials, agency effort and travel expense, and communications and coordination costs.

In a hypothetical world in which a single accreditation could serve to meet the requirements of several EPA agencies and the associated state bodies, a great deal of economic benefit could be derived. Agency costs could potentially be reduced, and, just as importantly, costs for the affected firms and the third-party providers would fall. This scenario would allow regulatory agencies, such as EPA, to achieve more of their core mission without adding to the burden of the regulated firms and municipalities. The differences in costs between these two scenarios are an accurate measure of the economic benefits generated by NELAP.

Table 4-3 illustrates activity areas and technical and economic metrics that may be useful in estimating benefits from NELAP and similar accreditation-recognition programs. Currently, NELAP has 11 states enrolled in their program for drinking-water and wastewater analysis, and additional state organizations are in the process of joining or have agreed to accept the accreditation from one of the enrolled states. Future plans for NELAP call for an expansion into air monitoring and other media regulated by EPA. In addition to estimating benefits to EPA and the member states for the existing program, the case study could project future benefits from this plan across EPA and even to other federal agencies.

Table 4-3. Laboratory Accreditation Study

Activity Area	Technical Metric	Economic Metric
Areas affecting U.S. EPA and state EPA costs:		
Manage accreditation and performance testing (PT) process	Manager effort hours	Labor costs
Prepare and distribute PT samples	Laboratory effort	Labor hours
	Shipping charges	Shipment costs
Conduct initial and follow-up assessments/inspections	Inspector effort	Labor and travel costs
Training and development of in-house assessors	Number of training courses supported	Training costs
	Supervisory effort	Labor costs
Support for NELAP or voluntary consensus standards efforts	Memberships in SDOs	Membership fees
	Meetings hosted	Meeting costs
	Meetings attended	Travel costs
	Purchase of hard-copy standards	Unit costs x number of standards
Areas affecting testing laboratories:		
Accreditation efforts for each state and federal agency	Proficiency tests run	Cost/test x number of PTs x states
	Accreditation fees	Cost per fee x states
	Effort to support audits	Labor hours x states
Training and development of standards experts at firms	Number of training courses supported	Training costs
	Supervisory effort	Labor costs
Support for NELAP or voluntary consensus standards efforts	Committee participation	Labor and travel costs
	Purchase of hard-copy standards	Unit cost x number of standards

One note should be added to the discussion at this point. NELAP is not, strictly speaking, a voluntary consensus organization in that voting rights have always resided in government representatives, both at the state and federal levels. Still, private testing laboratories and regulated firms have actively participated in the working groups and annual conferences of NELAP, and most of these laboratories and firms felt the process was as collaborative as an SDO-led VCS process.

5 Pretest Results and Recommendations

The benefit-cost methodology outlined in earlier sections of this report, which underlies the analytical approach and data collection instruments developed during the project, has been used successfully in a number of economic studies conducted by RTI's TEP program. In the case of estimating agency benefits from utilization of VCS, however, it is not clear at this point that our approach will produce the comprehensive, robust results desired by SSD. Based on the feedback received from our contacts in federal agencies, as well as from the completed pretest, it appears that agencies and departments may have a great deal of difficulty assembling and reporting the information required to fully inform our methodology.

In this final section of the report, we describe briefly the pretest results, discuss the implications for broad-scale implementation of the methodology, and make a few recommendations about next steps. Although we recognize that this result is not what we anticipated or hoped for at the outset of this project, we hope that NIST understands our findings and the rationale for RTI's caution. In the recommendations section, we offer several options that we now believe may have a higher chance of achieving SSD's goals of building energy and commitment to the VCS process.

5.1 RESULTS OF AGENCY PRETESTS

The interview guides discussed in the last section were shared with our contacts at the three agencies we believed would offer a thorough pretest of the questions and data needs required to inform our economic analysis. Copies of each of the interview guides we developed appear in the Appendix to this report.

To evaluate the benefits from the use of VCS referenced in regulation, we contacted Colin Church, Voluntary Standards and International Activities Coordinator at CPSC. For the use of procurement-related VCS, we requested help from Greg Saunders of DoD, who attempted to find a suitable respondent in the military construction purchasing area. To help illuminate costs and benefits from voluntary laboratory accreditation, we sent the appropriate interview guide to Lara Autry of EPA, who functions as the director of NELAP.

The discussion with Mr. Church at CPSC provided a great deal of *qualitative* support for the overall benefits of the use of VCS by that agency. As mentioned previously, CPSC is unique among federal organizations in that the use of VCS is required by its authorizing legislation, unless the commission makes a judgment that no nongovernmental organization could produce a suitable safety standard for the product under review. In addition, CPSC's status as a small, independent agency, with about 500 employees and a $50 million annual budget, encourages CPSC to rely on third-party standards-developing organizations whenever possible.

As a result, CPSC has reported that in recent years it has promulgated about seven times as many voluntary standards as mandatory ones. Only about 5 percent (or around 25) of its employees are involved in supporting voluntary efforts, which are led by industry groups and third-party SDOs. One possible conclusion from these two pieces of data is that CPSC's efforts in support of voluntary safety standards are highly efficient, although no information was available on the actual effort expended in voluntary and mandatory rule support.

The lack of quantitative information on distribution of effort and costs is very troublesome, as it relates to CPSC's ability to respond to the questions contained in the interview guide. Mr.

Church believes that the detailed data on labor effort, training costs, travel expenses, and other items required to inform our metrics is not currently available within CPSC, and that collecting this information would represent a significant burden on a small organization that is focused on saving lives and reducing injuries.

5.2 IMPLICATIONS FOR BROAD-SCALE IMPLEMENTATION OF RTI'S METHODOLOGY

Taken in a broader context, the pretest results suggest that other government agencies might also have a great deal of difficulty responding to the detailed questions contained in the interview guide. An organization like CPSC, solidly focused on using voluntary consensus processes, might reasonably be expected to track data on expenditures in each of the two regimes that the organization must operate. An organization such as EPA, whose controlling regulations obligate it to use its own laboratory methods and many other standards, is even less likely to have access to the data we require for the quantitative analysis. At a minimum, this dynamic suggests that the pretest should be repeated prior to broad-scale adoption; in the extreme, this dynamic casts doubt on the feasibility of data collection.

The results of the pretest have additional implications, both in terms of RTI's experience in completing the study and in formulating recommendations to pass along to SSD. From conversations with several stakeholders in the existing VCS and NTTAA compliance process, it appears that federal agencies and their standards representatives have had a great deal of difficulty obtaining the information needed to meet their annual reporting requirements to NIST and, in turn, to OMB. The reasons for this difficulty are not relevant to our study, but the implied lack of time for VCS issues is critically important if SSD is considering adding an additional reporting burden by means of implementing our proposed methodology.

This dilemma is especially acute in view of the lack of solid benefit-cost analysis now available. Aside from the excellent DoD case studies mentioned earlier in this report, there are few published reports, either inside or outside government. However, DoD's tremendous success with Milspec reform, and its willingness to invest resources in documenting some of DoD’s key

successes, suggests a final implication of our study. We would look to the agencies themselves to make a decision on whether to invest the (perhaps considerable) resources required to perform a solid benefit-cost study on a selected group of voluntary standards, or perhaps on the agency as a whole. Despite a lack of confirmation from the pretest, we believe that the methodology and metrics developed in this project are appropriate and sufficient to perform the type of analysis required. Agency personnel would also have an easier time establishing access to information owned by other key stakeholders, such as SDO and industry representatives.

5.3 RECOMMENDATIONS ABOUT NEXT STEPS

The project assignment as we received it from NIST involved background research, development of an analytical framework, and creation and pretesting of one or more case studies. It was clear from the outset, however, that SSD intended to conduct the case studies, or otherwise collect data from compliant agencies, as soon as the methodology was tested and proven feasible. Based on our experience in the last couple of stages of this study, RTI would urge SSD to consider carefully before making a decision to proceed with data collection. In this final section of the study, we make some alternative recommendations for next steps.

As detailed earlier in this section, we now believe that agencies may have a great deal of difficulty providing the necessary information to inform our metrics and net-benefit measures. Given the potential difficulty of obtaining accurate and useful data, agencies would face two difficult choices:

- to invest a substantial amount of effort and cost in searching out the necessary data; or
- to provide guesses as to the magnitude of effort and costs requested in the interview guides.

In either case, SSD is unlikely to achieve the objectives it sought when conceiving this study.

In lieu of this option, RTI offers the following suggestions for next steps along the path to estimating the benefits of NTTAA:

- Enlist the help of willing federal agencies or departments to gather the detailed information necessary to test the methodology and to estimate benefits, from one or more projects or for the entire agency. This approach, which RTI attempted but did not complete, might be easier to execute through the interagency working group than by an outsider. A successful trial, with a demonstration of significant agency benefits, might go a long way toward building energy for NTTAA reporting and building support from currently uninvolved agencies.
- Work with an SDO or an umbrella organization, such as ASTM or ANSI, to rigorously evaluate one or more standards they developed to replace government-specific standards, using a comprehensive benefit-cost approach like the one specified in this report. Cooperation from the agency would be critical, but the SDO should be in a position to obtain that cooperation. One of the curious findings on this project was the lack of involvement by SDOs in performing benefit-cost analysis for use as a marketing tool in their day-to-day efforts. The few studies we saw were not thorough and often misidentified costs and benefits in the analysis.
- Begin to request data from agencies that would support this type of economic analysis in the future. As a part of the annual report for OMB, SSD could ask agencies to share some data on key elements from the interview guides, such as effort hours or FTEs of personnel involved in VCS support, training costs, travel expenditures for various standards-related activities, etc. Because the number of new and existing standards supported by the agency is already requested, measures of costs and benefits, or at least relative efficiency, could be calculated.

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Appendix – Interview Guides for Case Studies

A.1 INTERVIEW GUIDE FOR GOVERNMENT AGENCIES ON THE USE OF VOLUNTARY CONSENSUS STANDARDS IN PROCUREMENT ACTIVITIES

This interview guide has been designed for use by agencies that reference standards in procurement. This instrument focuses on the choice agencies face to develop and maintain their own standards or to rely on standards development organizations (SDOs) to coordinate these activities. Our intent is to gather relevant information about costs and benefits from the use of Voluntary Consensus Standards (VCSs) in procurement, in regulation, and in laboratory accreditation, as part of a study undertaken for NIST's Standards Services Division.

Please answer the following questions about your operations over the past several years, including as much numerical data as possible. These responses will be used to construct an aggregate measure of the net benefits generated from governmental agency use of voluntary consensus standards. Individual responses will be kept confidential by NIST, except that total realized benefits for each agency may be included in future annual reports about the implementation of the NTTAA.

[This Interview Guide has been tailored for use in agencies that are engaged in facilities construction, especially those connected to the Department of Defense. Our understanding is that their conversion to private-sector standards is fairly recent, and there would be knowledgeable experts in these agencies who could respond to questions about costs under both procurement regimes.]

I Questions about standards-related DoD expenditures during era in which agency-specific standards (primarily Milspecs) were in use

1. Please estimate the annual expenditures on construction activities undertaken by your agency or division during this

period. (Select any recent year for which records can be easily gathered.)

2. Did your agency/division have a separate standards organization during this period? If so, approximately how many people (in FTEs) worked in this standards group? Do you have an estimate as to their annual budget?

3. Please estimate the annual labor effort (in FTEs) expended by personnel in developing new standards. Can you partition this number by skill level, i.e. how many engineers, technicians, administrative support staff?

4. How much training and development effort was required for these people, including both initial training and continuing education? Can you quantify this in terms of out-of-pocket dollars (materials and travel), effort hours, and supervisory expenditures?

5. Please estimate the annual labor effort expended in maintenance and improvement of existing standards. Were the people involved in these activities similar in skill level to those developing new standards?

6. What other annual expenditures were involved in maintaining existing standards? (Information systems hardware and software purchase, service and support; travel cost for conferences or seminars; others)

7. What standards-related expenses were incurred as a part of contract development and negotiation? Did purchasing agents and legal support staff need relevant training or technical support for their roles? Can you estimate annual effort required from these highly-compensated individuals?

II Questions about contractor expenses during period in which agency-specific standards were in use (which affect prices of construction goods & services)

1. What would you estimate to be each contractor's effort required to interpret and comply with Milspec standards? (It may be easiest to estimate all of the quantities in this section as a percentage of contract value.)

2. How would these contractors train and develop their Milspec experts? Can you estimate the annual effort for these activities, including supervisory costs?

3. Contractors need to maintain databases and support change control for existing standards. Can you estimate the information systems costs, and supervisory effort required for each contractor?

4. Would contractors experience contract development and negotiation costs of similar magnitude to those faced by DoD? If not, can you estimate these costs?

III Questions about conformity assessment during period in which agency specific standards were in use

1. How did you assess conformance to the standards specified in your procurement systems? (Supplier declarations, supplier test results, third-party analysis, in-house testing, or other)

2. Can you estimate the effort expended by DoD in reviewing documents (including Certificates of Conformance) for conformity to standards?

3. If measurements, chemical analyses, or other tests were required, how were the capabilities of the organizations performing the tests assessed? Was formal accreditation required? Did DoD act as an Accrediting Body (AB)?

4. Can you estimate the costs to contractors or third-parties, including laboratories, for demonstrating conformity? (This may include testing fees, hosting inspections, document preparation, etc.)

IV Questions about current standards-related DoD expenditures, with non-governmental standards having replaced many of the Milspecs

1. What fraction of the total construction-related standards have been converted from Milspecs to non-governmental VCSs? Approximately how many Milspecs are still being used by your division? Are any new Milspecs being developed?

2. Does your agency/division have a separate standards organization in today's regime? If so, approximately how many people (in FTEs) work in this standards group? Do you have an estimate as to their annual budget?

3. Please estimate the annual labor effort (in FTEs) expended by personnel in developing new standards. Can you partition this number by skill level, i.e. how many engineers, technicians, administrative support staff?

4. How much training and development effort is required for these people, including both initial training and continuing education? Can you quantify this in terms of out-of-pocket dollars (materials and travel), effort hours, and supervisory expenditures?

5. Please estimate the annual labor effort expended in maintenance and improvement of existing standards. Are the people involved in these activities similar in skill level to those developing new standards?

6. What other annual expenditures are involved in maintaining existing standards? (Information systems hardware and software purchase, service and support; travel cost for conferences or seminars; others)

7. What standards-related expenses are incurred as a part of contract development and negotiation? Do purchasing agents and legal support staff need relevant training or technical support for their roles? Can you estimate annual effort required from these highly-compensated individuals?

8. Please estimate the annual support costs for the non-governmental standards now being used by your division. Include annual fees and travel expenses for participation in SDOs, purchase costs for hard-copy standards, or other expenses.

A.2 INTERVIEW GUIDE FOR GOVERNMENT AGENCIES ON THE USE OF VOLUNTARY CONSENSUS STANDARDS IN REGULATORY ACTIVITIES

This interview guide has been designed for use by agencies that reference standards in their regulations. This instrument focuses on the choice agencies face to develop and maintain their own standards or to rely on standards development organizations (SDOs) to coordinate these activities. Our intent is to gather relevant information about costs and benefits from the use of Voluntary Consensus Standards (VCSs) in procurement, in regulation, and in laboratory accreditation, as part of a study undertaken for NIST's Standards Services Division.

Please answer the following questions about your operations over the past several years, including as much numerical data as possible. These responses will be used to construct an aggregate measure of the net benefits generated from governmental agency use of voluntary consensus standards. Individual responses will be kept confidential by NIST, except that total realized benefits for each agency may be included in future annual reports about the implementation of the NTTAA.

[This Interview Guide has been tailored for use in agencies that create and implement their own standards and also make reference to voluntary consensus standards developed by third-parties. The target agency for this data collection effort is the Consumer Product Safety Commission (CPSC). The background below is specific to the CPSC]

Background: We understand that the Consumer Product Safety Commission is obligated by law to make use of industry-developed or other voluntary consensus standards for product safety, if in the expert judgment of the CPSC, an existing standard will adequately protect the public. If there is no such standard in place, the CPSC must develop an agency-specific standard. This offers RTI (and NIST) an ideal opportunity to make a side-by-side comparison of the costs of these two modes of operation. We hope that you can help us quantify some of the benefits of the NTTAA's requirement for VCS.

I Questions about standards-related expenditures within the CPSC in cases where the Commission develops new standards to insure product safety

1. Do you have data on the average number of new standards you initiate each year? By comparison, how many third-party standards (VCSs) do you accept annually?

2. Please estimate the annual labor effort (in FTEs) expended by CPSC personnel in <u>developing new standards</u>. Can you partition this number by skill level, i.e. how many engineers, technicians, administrative support staff?

3. How much training and development effort is required for these people (in support of new standards development), including both initial training and continuing education? Can you quantify this in terms of out-of-pocket dollars (materials and travel), effort hours, and supervisory expenditures?

4. Please estimate the annual labor effort (also in FTEs) expended in maintenance and improvement of existing CPSC standards. Are the people involved in these activities similar in skill level to those developing new standards?

5. What other annual expenditures are involved in maintaining existing CPSC standards? (Include information systems hardware and software purchase, service and support; travel cost for conferences or seminars; other expenditures.)

6. How do you assess conformance to the standards you issue? (manufacturer declarations, product test results, third-party analysis, in-house testing, or other)

7. Can you estimate the annual effort expended by CPSC personnel in reviewing documents for conformity to standards?

8. If physical measurements, chemical analyses, and/or other tests are required, how are the capabilities of the organizations performing the tests assessed? Does CPSC require formal accreditation? Does the Commission serve as an Accrediting Body (AB), or do you support third-party accreditation?

II Questions about product manufacturer expenses in the case that CPSC develops agency-specific standards.

5. What would you estimate to be each manufacturer's labor effort required to interpret and comply with a CPSC standard? Will this level of effort vary with the size of the company? …with the annual unit volume of production of affected products? …with the number of unique products affected?

6. How do these manufacturers train and develop their standards experts? Can you estimate the annual costs for these activities, including supervisory costs?

7. Manufacturers need to maintain databases and support change control to support existing standards. Do you have an estimate of their information systems costs, and the supervisory effort required for standards maintenance and support?

8. Does CPSC or its designee audit manufacturers for compliance to standards? If so, are the producers subject to multiple audits on an annual basis? Can you estimate the effort hours involved in supporting an audit?

III Questions about standards-related expenditures within the CPSC in cases where the Commission adopts industry standards or other VCSs

1. Please estimate the annual labor effort (in FTEs) expended by CPSC personnel in supporting development of new VCSs. Can you partition this number by skill level, i.e. how many engineers, technicians, administrative support staff?

2. How much training and development effort is required for these people (in support of new standards development), including both initial training and continuing education? Can you quantify this in terms of out-of-pocket dollars (materials and travel), effort hours, and supervisory expenditures?

3. Please estimate the annual labor effort (also in FTEs) expended in maintenance and improvement of existing VCSs. Are the people involved in these activities similar in skill level to those developing new standards?

4. What other annual expenditures are involved in maintaining existing CPSC standards? (Include information systems hardware and software purchase, service and support; travel cost for conferences or seminars; other expenditures.)

5. Please estimate the annual support costs for the third-party VC standards now being supported by the CPSC. Include annual fees and travel expenses for participation in SDOs, purchase costs for hard-copy standards, or other expenses.

6. Who accepts the responsibility for assessing conformity with a VCS, the SDO issuing a standard or the CPSC? If the Commission retains ownership of this responsibility, how do you assess conformance to the VC standards? (audits, manufacturer declarations, product test results, third-party analysis, in-house testing, or other)

7. Can you estimate the annual effort expended by CPSC personnel (if any) in reviewing documents for conformity to standards? …in conducting audits? …in operating or supporting accreditation systems?

IV Questions about product manufacturer expenses in the case that CPSC adopts a VC standard.

1. Would you expect manufacturers to experience a different level of labor, training, or information systems costs in complying with a VCS versus CPSC standard? If so, what would cause the costs to differ?

2. Can you estimate the annual costs to a manufacturer for the following expenses specific to voluntary consensus standards: annual fees and travel expenses for participation in SDOs; purchase costs for hard-copy standards; and other costs?

A.3 INTERVIEW GUIDE FOR GOVERNMENT AGENCIES ON THE USE OF THIRD-PARTY LABORATORY ACCREDITATION

This interview guide has been designed for use by agencies that require laboratory accreditation in their regulatory or procurement activities. Accreditation is a critical element in the conformity assessment process, allowing affected firms and government agencies to have confidence that the required analyses, measurements, and/or calibrations are being conducted by competent laboratory organizations. This instrument focuses on the choice agencies face to develop laboratory accreditation processes and serve as an accrediting body (AB) or to rely on third-party organizations to coordinate the necessary accreditation activities. Our intent is to gather relevant information about costs and benefits from the use of Voluntary Consensus Standards (VCSs) in procurement, in regulation, and in laboratory accreditation, as part of a study undertaken for NIST's Standards Services Division.

Please answer the following questions about your operations over the past several years, including as much numerical data as possible. These responses will be used to construct an aggregate measure of the net benefits generated from governmental agency use of voluntary consensus standards. Individual responses will be kept confidential by NIST, except that total realized benefits for each agency may be included in future annual reports about the implementation of the NTTAA.

[The target organization for this interview guide is EPA's National Environmental Laboratory Accreditation Program (NELAP), which has recently undergone a transformation from a voluntary consensus SDO to one completely within the purview of the EPA. This experience should be useful in helping highlight the differences between the two operating regimes.]

I Questions about agency costs incurred in support of a role as an accrediting body (AB) and accreditation services provider:

1. Do you manage laboratory accreditation activities within your organization, or employ an outside organization under contract to manage these processes?

2. Approximately how many laboratories are currently accredited by your agency? What is the population of other laboratories seeking accreditation but not yet accredited by your agency?

3. Which outside organizations recognize your agency accreditations (if any) and what form does this recognition take?

4. Please estimate the following internal agency costs or contractor expenses for operating your accreditation programs:
    - Administrative costs - management and staff salaries, capital expenditures (including computer hardware & software), database management

- Travel and salary costs for site inspection visits
- Operating expenses for proficiency testing (PT) programs
- Revenue from accreditation fees, PT program charges (subject to government regulation on these sources of revenue)

5. For those positions that involve agency personnel, can you estimate the annual labor effort (in FTEs, if possible) expended in performing the activities enumerated above? How is this effort partitioned across skill levels – i.e., how many professionals, technicians, administrative support staff?

6. How much training and development effort is required for these people (for support of new accreditations and management of the existing infrastructure)? Can you quantify this in terms of out-of-pocket dollars, effort hours, and supervisory expenditures?

7. Can you describe any activities your agency is involved in to extend recognition of this accreditation across: additional government agencies, geographies, or to new types of analytical tests? Please estimate annual travel and salary costs for negotiating and maintaining MOUs for mutual recognition agreements (MRAs), including third-party, interagency, international, or state-by-state agreements.

8. What other annual expenditures are incurred by your agency in acting as an accrediting body and/or managing accreditation processes?

II Questions about costs borne by laboratories and/or third-party organizations who participate in agency-led accreditation processes

1. From discussions you have had with participating laboratories, what is the cost to each laboratory of analyzing PT samples, providing required documentation, conducting mandatory training, and hosting inspections for accreditation? Do any of these costs apply only to initial accreditation or are they incurred annually?

2. Are there fees charged to laboratories by your agency or authorized contractors for participation in the accreditation process? Are these one-time charges or annual fees? Do the laboratories have to pay third-party organizations for required documents or services performed? What is the annual cost to each laboratory for these charges and fees?

3. If the laboratories are subject to multiple inspections (by different agencies or jurisdictions), how many separate inspections and/or performance tests must be supported for the laboratories to function? Are there geographic areas or agencies not served by laboratories due to this lack of mutual recognition?

4. In the cases where mutual recognition is not in place, what types (and magnitudes) of costs are incurred by ABs in supporting these separate processes? Are their costs similar in magnitude to those incurred by the agency? [As an example, if each state requires an accreditation separate from that of the USEPA, do the state EPAs expend similar amounts of effort to that of the federal agency?]

III Questions about agency costs incurred in support of accreditation if a third-party organization acts as an AB and provides accreditation services:

This situation may be more difficult to estimate as we have few good examples of 'outside management of accreditation' within EPA. As a result, I expect that responses to this section will be somewhat speculative – more of a description of an ideal state, rather than a realized alternative.

1. Can you estimate administrative costs in the case that a non-governmental third-party managed all accreditation activities (even if the agency retains final authority over decisions on whether or not to accredit a specific laboratory)? Include all of the cost areas described in question I-4 above.

2. How much would you estimate the agency would be required to pay for hard-copy documents, reports, and access to databases? Do you have any relevant examples of situations in which these costs are being incurred today?

3. It is likely that travel and meeting costs may increase substantially in the case that a voluntary consensus organization takes a leadership role in accrediting. What would you estimate as the annual cost, in terms of out-of-pocket expense and staff time (annual hours or FTEs) to support this type of a structure?

4. Can you quantify the costs of any additional oversight or risk mitigation effort that the agency would require in evaluating the effectiveness of the organization managing the accreditation and recognition tasks?

IV Questions about costs borne by laboratories and/or third-party organizations who participate in third-party managed accreditation and recognition processes

1. We would take an initial position that the costs for managing inspections, databases, and PT sample programs would remain constant in this new scenario, i.e., that the federal government is no more or no less efficient in providing these services than an outside organization. Are there any aspects in which these costs would likely differ? Are there economies of scale or scope that one organization or the other would be able to bring to this management task?

2. An annual accreditation fee would undoubtedly be charged to the laboratories by the AB, as one of its major sources of revenue. The magnitude of this charge does not affect the overall economics under consideration, as it is merely a transfer from one private-sector firm to another. Still, it might be interesting to estimate the likely amount of this charge. Do you have any thoughts on this?

3. Participating laboratories would also have to purchase documents from the AB and any organizations coordinating mutual recognition. It seems reasonable to estimate the same cost per document to these firms as that incurred by the agency. How many documents would be needed for an average laboratory?

4. Finally, a training and development infrastructure would be needed for bringing new laboratories, technicians, agency personnel, and outside organizations up to speed on details of the programs involved. Does the agency have any information on the costs of this type of a program in the private (or government) sector?