

SMARTe Quality Assurance Project Plan

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Note: SMARTe development began in 2000. The QAPP for SMARTe is updated on an annual basis to document planned design modifications due to changes in technology and/or user feedback.

Abstract

Redevelopment of sites potentially contaminated with environmentally toxic or hazardous materials, (e.g., brownfields), is a global concern requiring a multi-disciplinary approach to mitigate the risks to human health and the environment. Extensive resources have been committed to address environmental, social, and economic issues related to the cleanup and redevelopment of contaminated sites. A remaining challenge is to determine how to capitalize on the available resources, expertise, and knowledge and effectively share and transfer that information to the organizations and individuals responsible for making decisions and implementing redevelopment. In 2000, the United States Environmental Protection Agency (EPA) and the German Federal Ministry of Education and Research (BMBF) continued an ongoing partnership to gain an understanding of each other's approach to the cleanup of chemical contamination in order to protect human health and the environment. This partnership has now entered its fourth phase with a new focus on providing a variety of tools, approaches, and technologies that could facilitate sustainable revitalization of potentially contaminated sites.

The EPA/BMBF partnership, along with the Interstate Technology and Regulatory Council (ITRC) comprises the U.S.-German Bilateral Working Group. The Bilateral Working Group is developing Sustainable Management Approaches and Revitalization Tools – electronic (SMARTe). SMARTe is a web-based decision support system that provides access to information, databases and analysis tools for developing and evaluating plans for land revitalization. SMARTe implements web-based decision tools that are intended to be used by revitalization project stakeholders for overcoming obstacles to revitalization such as: assessing both market and non-market costs and benefits of revitalization options, clarifying both private and public financing options, evaluating and communicating environmental risks, and easing access to pertinent state-specific information related to specific projects. SMARTe provides the analytical tools needed to implement and integrate each component of the revitalization decision process. SMARTe is designed to be free Open Source Software (OSS) based on World Wide Web Consortium (W3C) web specifications.

This QAPP has been prepared to plan the development, and continuous updates, of SMARTe and will be updated on an annual basis.

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1 Project Description

1.1 Background

Revitalization of sites contaminated with environmentally toxic or hazardous materials is a global concern requiring a multi-disciplinary approach to mitigate the risks to human health and the environment. Many countries have committed extensive resources to the effort to address environmental, social, and economic issues related to the cleanup and redevelopment of contaminated sites. The challenge is to determine how to capitalize on the available resources, expertise, and knowledge and effectively share and transfer that information to the organizations and individuals responsible for making decisions and implementing redevelopment.

In 1990, EPA entered into a Bilateral Working Group with the German Federal Ministry of Education and Research (Bundesministerium Für Bildung und Forschung [BMBF]). The purpose of this working group is to facilitate joint efforts toward developing and demonstrating remedial technologies as well as facilitating revitalization of potentially contaminated sites.

Phase 1 and Phase 2 activities under the Bilateral Working Group were completed between 1990 and 2000 and included demonstrations of 20 innovative remedial technologies. The U.S.-German partnership completed Phase 3 (2000 – 2005) with a focus on providing a variety of tools, approaches, and technologies that could facilitate streamlined, cost-effective cleanup and revitalization of potentially contaminated sites (for example, brownfield sites). The Interstate Technology and Regulatory Council (ITRC), a U.S. state-led organization, was also a significant partner in the third phase activities. Phase 4 (2006 – 2010) will continue the Phase 3 activities with an emphasis on sustainable revitalization. The primary tool being developed in the U.S. is called Sustainable Management Approaches and Revitalization Tools – electronic (SMARTe) and is the subject of this QAPP.

1.2 Description and Objectives

SMARTe is an open-source, web-based, decision support system for developing and evaluating future reuse scenarios for potentially contaminated sites. On the ITRC website (www.itrcweb.org), access to SMARTe is provided through the Technical Team Brownfields, Public Page. Note that the link to SMARTe is provided in the main text on that page. SMARTe can also be accessed from EPA's Office of Brownfields Cleanup and Redevelopment (OBCR) website, www.epa.gov/swerosps/bf and accessed directly at www.smarte.org.

The overall objective of the Bilateral Working Group is to develop tools and techniques to facilitate sustainable brownfield revitalization – specifically by removing obstacles to revitalization. The U.S.-German Bilateral Working Group goals are similar to EPA's

OBCR:

U.S.-German Bilateral Goals

- Facilitate environmentally, socially, and economically viable land use
- Facilitate transfer of information both Nationally and Internationally
- Allow more revitalization projects to be independent from public grants
- Enhance benefits to society and the environment.

EPA/OBCR Goals

- **Protecting the Environment** - Addressing brownfields to ensure the health and well-being of America's people and environment
- **Promoting Partnerships** – Enhancing collaboration and communication essential to facilitate brownfields cleanup and reuse
- **Strengthening the Marketplace** – Providing financial and technical assistance to bolster the private market
- **Sustaining Reuse** – Redeveloping brownfields to enhance a communities long-term quality of life

SMARTe is the tool being developed in the U.S. to meet the objectives/goals stated above. When complete, SMARTe will contain resources and analysis tools for all aspects of the revitalization process including: planning, environmental risk management, economic viability, and social acceptance. It is intended to be a holistic decision analysis system that integrates these aspects of sustainable revitalization while facilitating communication and discussion among all stakeholders through its presentation and document producing capabilities. A SMARTe schematic is provided in Exhibit 1.

SMARTe combines the power of the internet with analysis and presentation tools that can be used interactively to build decision models for solving revitalization problems. Specifically, SMARTe will include tools for:

- Identification of land use, revitalization and risk management options
- Environmental modeling (for example: inventory, source release, fate and transport, etc.)
- Human health and ecological risk assessment
- Economic analysis, which includes market costs and benefits associated with revitalization, including insurance, tax incentives, return on investment, etc.
- Financing, including public and private sector options from grants to loans
- Social analysis, including tools that can translate potential costs and benefits (for example, quality of life, sense of place, etc.) into market values

- Ecological analysis, which includes revitalizing a potentially contaminated site in lieu of using more green space; using “green materials” in construction; preserving a wetland; etc.

Development of SMARTe follows a phased approach (offset slightly from the U.S.-German Bilateral Working Group Phases) in which SMARTe components are built with each phase of development. The phases of development start, for each component of SMARTe, with relatively simple textual information and access to databases, followed by stand-alone numerical tools that support each component of SMARTe, and then completed by integrating all components using a multi-criteria decision analysis (MCDA) framework. Appendix A provides a general listing of components including the anticipated date the tool will be available in SMARTe. In its final form, SMARTe will be a cohesive, integrated presentation of the information and tools. The components will also be independently useful in the interim development of the final form.

The first phase of SMARTe development focuses on content, information and guidance so that the scope of brownfields revitalization efforts is covered, information is made available for brownfields practitioners and stakeholders on each aspect of the brownfields revitalization process, and the decision support tool is structured to accommodate adding numerical tools that will enhance the capabilities of SMARTe.

The second phase involves building stand-alone tools to support each of the components that are included in the SMARTe structure in the first phase. For example, environmental components are supported by numerical tools for sampling design for site characterization and monitoring, human health risk assessment, fate and transport modeling, and selection of remediation options. Economic and social components are supported by economic models that track market and non-market costs and benefits. In this second phase, the economic and social components consist of spreadsheet algorithms that compile the component costs and benefits of each revitalization option under consideration.

In the third phase, all the tools are brought together in a comprehensive MCDA. This includes expert system components that help the user sort through the many different options, costs and benefits that could be considered, and an MCDA integrator that captures the total costs and benefits of a completed user-supplied application.

Some other components are also necessary to complete SMARTe. These include Quality Assurance (QA) components such as review and feedback, navigation, providing access to supporting information, building an interface to each SMARTe component, creating search capabilities, and building a complex database structure to house input and information provided during a SMARTe application. These components are listed in Appendix A and the listing will be added to, or deleted from, based on users needs. These tools will be integrated into an MCDA framework to form a comprehensive decision analysis support tool that will allow stakeholders to evaluate various revitalization options. Using an iterative approach with extensive communication and discussion, stakeholders can review and evaluate optimal revitalization options in SMARTe.

Several components have been completed at the time of preparing this QAPP . These primarily include first phase components related to providing access to information, using checklists, access to databases, and QA components. For example, feedback and review capabilities are built in, versioning and tracking changes to SMARTe have been automated, an interface has been developed for each component, navigation tools have been built, and some search capabilities are operable. Checklists are available for potential stakeholder lists and financing options, templates are available for best practices, and a database is available for cultural heritage case studies. In addition, textual information is available for every component of SMARTe. The second phase components that have been developed include a numerical tool for human health risk assessment, data analysis for site characterization, simple tools for aggregating market costs, and a tool for choosing stakeholder involvement activities.

The current phase, SMARTe 2006 is available in beta version; however, some capabilities not fully available. The beta version is made available so that the application may be tested and feedback provided from users. Subsequent activities include annual revisions and improvements to the site with the full decision support capabilities (third phase) being available by October 2007. The U.S.-German Bilateral Working Group Phase 4 products/information will be incorporated between October 2007 and October 2010. A summary of the current components and tools development schedule is available in Appendix A and at:

www.smarte.org/smarte/resource/SMARTeStatusSummary.xml.

The QAPP for SMARTe is updated on an annual basis to document planned design modifications due to changes in technology and user feedback.

1.3 Approach

SMARTe is being developed and evaluated with a systematic process used in Phases 3 and 4 of the U.S.-German Bilateral Working Group:

- Step 1: Baseline workshops to **identify obstacles** to revitalization
- Step 2: Feasibility study to **determine which obstacles** the U.S.-German Bilateral Working Group could address
- Step 3: Research and develop **tools and techniques to overcome obstacles** to revitalization (e.g., SMARTe)
- Step 4: **Beta-test tools and techniques** to determine if they facilitate revitalization (e.g., by helping users overcome obstacles)

Joint workshops on the various components of brownfields redevelopment bring together recognized "experts" from Germany and the U.S. These workshops provide a comprehensive and practical foundation for SMARTe. Six workshops were conducted during Phase 3. Additional workshops are planned for Phase 4.

EPA, ITRC, and BMBF selected model projects (13 in the U.S. and 11 in Germany) that have had significant and positive impacts on the local economy, environment, and

community. Model projects are completed, or nearly completed, revitalization efforts that provide best practice examples regarding the important links between the social, economic, and environmental aspects of brownfields projects, including financing, cleanup, marketing, and land reuse issues.

Beta projects are brownfield projects that are in the beginning stages of site redevelopment or that have encountered an obstacle preventing the project from moving forward. Beginning in January 2006, up to nine brownfield projects per year will be selected to participate. Beta projects will provide feedback on the usefulness and usability of SMARTe along with providing input regarding future tools.

All new information received through workshops, model projects, and beta projects, in addition to the open literature, national and international conferences, experts, and review comments are incorporated into the appropriate tools within SMARTe by the SMARTe Technical Development Team (STDT). See Section 2 for more details about the STDT. See Section 5 for a more detailed discussion regarding incorporation of feedback and review comments.

1.4 Benefits and Outcomes

SMARTe is designed to integrate the business, environmental, social, and economic aspects of brownfields redevelopment. SMARTe will:

- Guide stakeholders through the difficult process of site redevelopment by providing ideas, resources, and best practice examples of successful revitalization efforts.
- Identify potential risks and opportunities for overcoming common barriers to revitalization.
- Provide an integrated approach to planning and documenting site revitalization by promoting sustainable revitalization
- Optimize information flow and communication between municipal officials, the local community, financial institutions, and investors.
- Evaluate environmental, social and financial risks and opportunities in an integrated decision framework.
- Assess both market and non-market costs and benefits of revitalization options.

By combining access to information and data with environmental risk, social acceptance and economic analysis tools, SMARTe will enhance the decision making process and help stakeholders overcome obstacles to revitalization.

By providing potential solutions for sites where many obstacles and few benefits are perceived (that is, facilitating the sustainable reuse of contaminated sites), SMARTe will promote sustainable brownfields revitalization. This will help preserve precious

greenspace and revitalize blighted urban areas.

1.5 Philosophy

SMARTe combines knowledge bases, expert system technology, database and GIS access, analysis tools (for example, environmental modeling, risk assessment, statistics, economic modeling, and decision analysis), documentation and presentation capabilities, to provide a truly interactive analysis of brownfields revitalization problems. The technical philosophy behind SMARTe follows the scientific method and uses the technical framework of probabilistic decision analysis. Probabilistic modeling requires specification of probability distributions for each input component. These distributions capture both what is thought to be known (for example, the best guess is the average value) and the associated uncertainty. Decision-making is best supported by a full characterization of uncertainty so that the quality of the final decisions that are made can be measured, the need to collect additional information can be evaluated, and sensitivity analysis can be performed to identify the most important factors in the model. Decisions are nearly always made in the face of uncertainty, and this probabilistic framework allows the uncertainty to be specified, evaluated and managed. This describes the essence of MCDA, which forms the foundation of the SMARTe decision analysis approach.

The technical objective of SMARTe is to provide an interactive technical guidance program with analysis capabilities that is developed solely with open-source software (OSS) (see Section 1.7 for more detail). The web-based components allow each of the technical components to be presented with guidance, interpretation and explanation of their functionality. SMARTe can be described as providing a complete decision management system for revitalization that is comprised of the following components:

- Guidance for each aspect and function of the SMARTe program. This includes interpretation of results and explanation of technical terms and methods.
- Access to and integration of project-specific knowledge bases with further access to the wealth of information available on the internet.
- Database management, including SQL queries and GIS access.
- Environmental modeling, risk assessment, statistics and decision analysis tools that use R as the analytical engine (R is an open-source statistical programming language (www.r-project.org), sometimes embedded in Java.)
- Expert system components that help the user navigate the technical choices available within the analysis tools (for example, risk assessment, financial, and social options, or statistical and decision analysis options).
- A decision analysis engine that computationally performs MCDA.
- A presentation system that can be tailored to the specific needs of the users.
- A document production system that can be tailored to any form of computational output (for example, web-based, PDF, Office products).

- QA that is continuously measured and evaluated through user supplied feedback as well as more traditional QA techniques.
- Interactive training in each aspect of the SMARTe system.

The philosophy of the systems approach that is taken in SMARTe is reflected by the open-source paradigm for sharing information and involving users in development of SMARTe applications. Consequently, SMARTe is built using templates to contribute content guidance and analysis capabilities to SMARTe, in which case SMARTe can be tailored to the needs of each user. In addition, the approach includes requirements for documentation, communication and presentation. This philosophy embraces open-source concepts such as continual development in response to feedback from the user community, and QA through internal testing and user participation.

The holistic approach facilitates defensibility, traceability and transparency for each application. The web-based tools that are used are completely open for inspection and review. There are no “black box” programs, every component of SMARTe is documented in detail, each application can be traced to the origins of the inputs, and the algorithms are peer reviewed and QA reviewed to ensure their accuracy. There is no proprietary code and the source code for every component of the SMARTe system is presented and available.

SMARTe is a unique environment for decision management. It combines aspects of guidance, help and expert system advice, with emphasis on presentation style, sharing of and accessibility to information, and decision analysis functionality. The goal is to provide an effective visualization tool for stakeholder consensus building.

1.6 Structure

SMARTe is structured as dynamic, interactive on-line documents that serve as interfaces to and integrators of information, database searches and technical analysis tools. These on-line documents provide various hierarchical levels of detailed information and technical guidance and analysis complexity. At the top or simplest level, SMARTe content provides user-friendly, web-based navigation. At the middle level of the hierarchy the on-line documents provide access to database searches and analysis tools with associated technical guidance on the uses of these tools. Access is provided to an analysis tool or database through a web user interface that collects information from the user, formats this user input in the form required by the analysis or search tool, implements the analysis tool or search, and returns results in a user friendly presentation. The most detailed and complex level of the hierarchy combines the user information, database search results, and analysis tool results in a decision framework. The decision framework is designed to comprehensively integrate all aspects of sustainable brownfields revitalization outlined in SMARTe content.

1.7 Technical Specifications

SMARTe is designed to be free OSS based on World Wide Web Consortium (W3C)

web specifications. All SMARTe content, including the user interface, has been developed using the Extensible Markup Language (XML). XML is software independent (that is, the content can be edited with any text editor) and platform independent (that is, Windows or Linux). In particular, SMARTe documents are written using DocBook (www.docbook.org). DocBook is a markup language defined in SGML/XML (that is, a set of XML tags) for describing documents. Use of the DocBook specification facilitates printing and distributing of SMARTe documents as paper documents or as displays in a browser with the full analysis capabilities discussed above. This separation facilitates providing web accessibility of SMARTe to the broadest possible audience using the W3C Web Accessibility Initiative specifications (for example, VoiceXML). By using XML as a content management tool, SMARTe content is separated from, and thus is independent of, presentation style, technique, and technology. Presentation is handled using the Extensible Stylesheet Language (XSL) and Cascading Stylesheets (CSS). This separation allows great flexibility and variety in the choice of presentation. SMARTe content, for instance, can be seamlessly transformed into HTML (for web browsing), and Adobe Acrobat PDF (for reporting). SMARTe is currently being served using Cocoon. Web browsers that SMARTe supports are Microsoft Internet Explorer 6 and higher on Microsoft Windows and Mozilla 1.4 (Firefox 1.0) under Linux and Microsoft Windows. Software tools for this type of web-based application are being continually developed, requiring constant research to ensure that the most up-to-date tools are being used in SMARTe. Another example of a software tool that shows substantial promise for building interactive graphical interfaces is Scalable Vector Graphics (SVG), which can be used to allow graphical user interfaces to move between SMARTe components, to house some expert system capabilities, and to interactively present analytical results.

1.8 Advantages of Design Using Open Standards

There are several obvious advantages of designing SMARTe using OSS standards, some of which are described below. Use of OSS is not only advantageous in terms of software licensing and cost, but also in terms of the philosophy that underlies the Open Source community. The Open Source philosophy is aimed at sharing information at all levels, gathering and responding to feedback for continuous improvement, and encouraging users to supply functionality and content. For SMARTe, this consists of sharing content and all resources (including code), operating a continuous feedback option, and encouraging users to submit case studies that can be shared with the SMARTe community of users.

The benefits of following the Open Source approach to the development of SMARTe include:

- By building SMARTe using only Open Source web-based tools, potential users are not encumbered with software licensing issues.
- SMARTe allows users to engage at various levels of complexity depending on their interest. Different levels of complexity might include, for each

component: an overview, access to supporting information, details of mathematical methods (for example, environmental modeling, risk assessment, statistics, economic modeling, and decision analysis), computer code (for example, XML, JAVA, R, BUGS), and case study examples.

- The holistic approach facilitates defensibility, traceability and transparency for each application.
- The approach promotes QA through internal testing and through user-supplied feedback. The open nature of the XML and R code allows every aspect of SMARTe to be thoroughly reviewed.
- SMARTe is a living web-based system that can be updated as new tools, technologies, and approaches become available.
- By using XML, SMARTe itself is a sustainable program. SMARTe is software independent, the content can be edited with any text editor. The SMARTe content can continually be built upon while the presentation can evolve and change as the content grows and analysis tools are added. The presentation of the SMARTe content can be dynamic and tailored to best meet the needs of the user community.

1.9 Section 508 Accessibility Requirements

One of the principal challenges in the development of SMARTe (indeed any web site) is to make the site accessible to those with vision, hearing, and mobility impairments, as specified in Section 508 of the Rehabilitation Act of 1973 (29 USC794d) and the Rehabilitation Amendments Act of 1998. Several opportunities for improving the accessibility of web sites are suggested and implemented at the following locations devoted to the topic:

- <http://yosemite.epa.gov/OEI/webguide.nsf/homepage>
- <http://www.section508.gov/>
- <http://www.epa.gov/ord/htm/accessibility.htm>
- <http://www.access-board.gov/508.htm>
- Special provisions are provided for the hearing-impaired. Transcriptions of the tutorial audio and any other aural information is provided as an option. Mobility impairments are not generally addressable in web design, since most of this type of accessibility is handled through the use of specialized hardware, such as mouse and keyboard alternatives (for example, several products by Madentec).

The principal issue for web design is one of accommodation of the visually-impaired. Some aspects of this are best handled at the operating system or internet browser level. Many browsers can adjust typefaces and font sizes to the user's preference. It is probably safe to assume that anyone in need of such features is using such a browser. For these

browser features to work well with a particular web site, the site must allow features such as font size to change based on the browser settings. The presentation of SMARTe is handled largely by CSS, a W3C specification. All font sizes in the SMARTe CSS are relative rather than fixed to a specific point size. In general, other than the SMARTe logo, text is not presented as an image. Relative font sizes and non-image text allows the browser to control the font size. All navigation and menuing is implemented using text rather than images and is configurable via the browser. Also, alternative color schemes can be implemented in the CSS and can be configured from a side bar menu. Operating systems also come equipped with tools to assist the visually- and mobility-impaired. For example, the family of Microsoft Windows operating systems comes with accessibility tools like the Narrator, which reads text from pages on the screen, and the Magnifier for enlarging specific areas of the screen.

In addition to these accessibility aids, the W3C provides resources through their Web Accessibility Initiative (WAI, [www.w3.org/WAI/]). The WAI also provides guidelines on improving web site accessibility, such as providing text alternatives to non-text elements, and assuring that all tables have appropriate row and column headers. There is a wide variety of approaches that can enhance accessibility under development. In particular, the possibility of embedding accessibility tools in the XML sources for the web pages is attractive (for example, VoiceXML). These technologies will continually be re-evaluated as they mature.

At the WAI, (www.w3.org/WAI/) there is an informative guide about web-based intranet and internet information and issues related to 508 compliance. This guide describes considerations that can be made for 16 listed items that are contained in the Section 508 legal requirements.

The 16 Section 508 legal requirements are referred to as "paragraphs (a) through (p) of Section 1194.22" of the Section 508 ruling. The methods by which SMARTe accommodates these requirements are described below:

- a) *A text equivalent for every non-text element shall be provided (for example, via "alt", "longdesc", or in element content).*

The only non-text elements SMARTe will use are images. All HTML **** tags will have an **alt** attribute with a text equivalent.

- b) *Equivalent alternatives for any multimedia presentation shall be synchronized with the presentation.*

SMARTe is not planned to have multimedia presentation.

- c) *Web pages shall be designed so that all information conveyed with color is also available without color, for example from context to markup.*

SMARTe will not use color as the sole method of conveying information.

- d) *Documents shall be organized so they are readable without requiring an associated style sheet.*

Documents in SMARTe will be available in several forms, including HTML and Adobe Acrobat, that do not require a style sheet to be readable.

- e) *Redundant text links shall be provided for each active region of a server-side image map.*

SMARTe will not use server-side image maps.

- f) *Client-side image maps shall be provided instead of server-side image maps except where the regions cannot be defined with an available geometric shape.*

SMARTe will not use server-side image maps.

- g) *Row and column headers shall be identified for data tables.*

All tables in SMARTe will have row and column headers.

- h) *Markup shall be used to associate data cells and header cells for data tables that have two or more logical levels of row or column headers.*

SMARTe is not planned to have tables that have two or more logical levels of row or column headers.

- i) *Frames shall be titled with text that facilitates frame identification and navigation.*

SMARTe will not use frames.

- j) *Pages shall be designed to avoid causing the screen to flicker with a frequency greater than 2 Hz and lower than 55 Hz.*

SMARTe will not have components that will cause screen flicker.

- k) *A text-only page, with equivalent information or functionality, shall be provided to make a web site comply with the provisions of these standards, when compliance cannot be accomplished in any other way. This content of the text-only page shall be updated whenever the primary page changes.*

SMARTe is largely text-based. When components of SMARTe that are not text-based do not meet the 508 standards, a text-based page will be generated.

- l) *When pages utilize scripting languages to display content, or to create interface elements, the information provided by the script shall be identified with functional text that can be read by assistive technology.*

SMARTe is not planned to utilize scripting languages to display content. If SMARTe does use this feature, functional text will be provided.

- m) *When a web page requires that an applet, plug-in or other application be present on the client system to interpret page content, the page must provide a link to a plug-in or applet that complies with §1194.21(a) through (l).*

SMARTe is not planned to use applets. If plug-ins are used for enhanced

graphical presentation then text based alternatives will also be provided.

- n) *When electronic forms are designed to be completed on-line, the form shall allow people using assistive technology to access the information, field elements, and functionality required for completion and submission of the form, including all directions and cues.*

SMARTe will use electronic form that will be designed to be accessible with assistive technology.

- o) *A method shall be provided that permits users to skip repetitive navigation links.*

SMARTe will provide several approaches for navigation that will allow repetitive links to be skipped.

- p) *When a timed response is required, the user shall be alerted and given sufficient time to indicate more time is required.*

SMARTe is not planned to have timed responses.

Note that the implementation of the Section 508 requirements will also be tested by the STDT using web-accessibility software such as IBM page reader.

2 Project Organization

2.1 Project Participants and Responsibilities

Ann Vega, National Risk Management Research Laboratory (NRMRL) is the EPA Task Order Manager (TOM) for SMARTe and is responsible for overseeing and managing Task Order activities, including review and concurrence on the contents of this QAPP.

The STDT is comprised of EPA and contractor personnel from Tetra Tech EMI (Tetra Tech) and Neptune and Company (Neptune). The STDT is responsible for SMARTe content and development and is identified in Table 1.

Nancy Porter, EPA OBCR, provides funds to NRMRL for the development of SMARTe. Ms. Porter is the EPA client for SMARTe and is involved in all decisions related to SMARTe.

Neil Stiber, Office of Science Policy, provides modeling and decision analysis expertise in addition to coordination of research across ORD.

Tom Stockton of Neptune is the primary developer of SMARTe and primary author of this QAPP.

Paul Black is the Neptune project manager for SMARTe.

Kelly Black and Pasha Minallah of Neptune are significant contributors to the development of SMARTe and of this QAPP.

Roger Argus is the Tetra Tech project manager for U.S.-German Bilateral Working

Group activities and provides content information for SMARTe.

Cecily Sabedra of Tetra Tech provides support for U.S.-German Bilateral Working Group activities and implements edits and updates of content information for SMARTe.

Table 1: SMARTe Technical Development Team.

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Specific domain experts or specialists are brought into the STDT on an as-needed basis to help develop each SMARTe component. Economists, environmental scientists, ecologists, and social anthropologists have contributed to the development of SMARTe through the STDT.

2.2 Quality Assurance Personnel

SMARTe is an Open Source product, and part of the Open Source philosophy is to provide all users with the capability to adapt or tailor a program to their needs. This capability is available in SMARTe; however, QA of user-supplied components is required before inclusion in the main SMARTe system. The responsibilities of the SMARTe user community in these cases will include completion of their topic specific QA plan, and obtaining QA and peer review by appropriate individuals or organizations through the STDT.

Each participating organization has designated personnel responsible for QA. This includes writing and review of this QAPP in addition to QA for SMARTe's tools and components. The following personnel will be responsible for QA:

Dr. Greg Swanson of Tetra Tech's San Diego office will serve as quality control coordinator for Tetra Tech and will review all project deliverables.

Kelly Black is the internal Neptune QA Officer for this project. She will organize QA activities within Neptune, including reviewing content, algorithms, code, user-interfaces, navigation, and databases.

Nancy Porter, EPA OBCR, will serve as QA reviewer and assist with the verification of SMARTe comments in Bugzilla.

Scott Jacobs is the QA Manager at NRMRL responsible for approving this QAPP and

subsequent revisions. Additionally, Mr. Jacobs will review each version of SMARTe prior to its release to the public.

3 Secondary Data

The data collected during this project will be secondary in nature and from diverse sources internationally. Specific sources of data will include:

- Published reports and articles relating to potentially-contaminated site revitalization and remedial technologies.
- Unpublished reports relating to case histories.
- Internet databases, documenting remedial technologies and their applications to revitalization, maintained by both government and private entities.
- Personal knowledge and experiences of members of the Bilateral Working Group or their associates.

Where alternative sources of the same or similar information are available, a preference will be given to published literature. However, due to the limited amount of formally published information currently available on revitalization of potentially-contaminated sites and the evolving nature of this field of endeavor, all of these sources will have to be utilized to maximize the usefulness of the Task Order deliverables. Because of the diversity of these sources, all data will be explicitly referenced as to its source in the Task Order deliverables.

There are no specific quality requirements for the secondary data to be collected and reported within this project. The quality of the secondary data will therefore not be evaluated by the EPA for this specific application and the following disclaimer (or one similar) will be added to project deliverables:

“This product is partially funded by the U.S. Environmental Protection Agency (EPA) through its Office of Research and Development and its Office of Brownfields Cleanup and Redevelopment. It is being developed collaboratively with the German Federal Ministry of Education and Research and the Interstate Technology Regulatory Council. By entering this Internet site and using SMARTe, I agree to the conditions of use. In particular, I understand that:

- *SMARTe is currently under development. The current version is available so that users can test it and provide feedback while new information, data, tools, and functionality are added. Although the information, data, and tools were peer reviewed and satisfied the requirements of the Quality Assurance Project Plan (QAPP) prior to its annual release, the product could have errors and omissions and might not always function as intended.*

- *SMARTe is a decision analysis and decision support tool that supports evaluation of alternative land reuse scenarios. It does not make decisions, it informs the decision making process by providing insights into the complexities of a revitalization and reuse project. SMARTe does not take the place of professional technical experts or project teams engaged in land revitalization projects, but provides information to help project teams make land reuse decisions.*
- *Some analysis tools require technical knowledge. Use of the tools without assistance from a technical expert could lead to misinterpretation of results.*
- *The information and data presented in this product were obtained from sources that are believed to be reliable. However, in many cases the quality of the information or data was not documented by those sources; therefore, no claim is made regarding their quality.*
- *Mention of trade names or commercial products does not constitute endorsement or recommendation by the U.S. EPA.*
- *Neither the U. S. Government nor any federal employee makes any warranty, express or implied, regarding the software contained within SMARTe. The U.S. EPA does not guarantee that this product is free from viruses. The U.S. EPA does not routinely provide user support, systems documentation, or periodic updates to users.*

Users are strongly encouraged to report any errors found in the product, including inactive URLs (Internet addresses), using the feedback buttons provided.

The user acknowledges having read this disclaimer and agrees to the conditions of use.”

The source of the secondary data will be specified and the rationale for selecting the source will be provided. This information will allow the user to determine if the data quality is appropriate for its intended use.

4 Software/Model Development

4.1 Overview

SMARTe is designed to provide the user access to increasing levels of technical details and analysis tools based on the needs of the user. The top or simplest level of SMARTe provides basic brownfields information and definitions for brownfields revitalization. The next level provides more detailed brownfields revitalization guidance and a

screening tool. Finally, the bottom or most complex level provides detailed technical guidance with the analysis tools needed to implement a MCDA approach to brownfields revitalization. SMARTe development will evolve in a phased approach progressing from providing basic revitalization information to providing access to technical analysis tools and integration of those tools into a decision framework. This phased approach will provide for the production of useful information and analysis tools without having to wait for development of complex and fully integrated decision analysis tools. Ultimately, this approach also provides the user with an interface to guidance and analysis tools at various levels of detail and complexity allowing the user to access the appropriate level of detail.

4.2 Components

Each level of SMARTe will potentially (based on the level of technical complexity) have one or more of the following components:

- Technical guidance
- A database that is queried by the user or that feeds into technical calculations
- A computational engine for performing technical calculations
- An expert system for guiding and providing interpretation of technical results
- A user interface linking guidance, databases, the computational engine, and the expert system
- Web server tools that provide a dynamic interactive web-based environment for serving SMARTe

4.2.1 Technical Guidance

SMARTe technical guidance documents are built based on the W3C specifications for XML (www.w3.org/XML/) with XSL (www.w3.org/Style/XSL/) and CSS providing for a separation between content (XML) and presentation (XSL and CSS). In particular, SMARTe content will be written using DocBook (www.docbook.org). DocBook is a markup language defined in SGML/XML (that is, a set of XML tags) for describing documents. Use of the DocBook specification facilitates printing and distributing SMARTe content as a paper document or displaying in a browser with the full analysis capabilities discussed in this document. This separation facilitates providing web accessibility to SMARTe to the broadest possible audience using the W3C Web Accessibility Initiative specifications (for example, VoiceXML). SMARTe content written based on W3C specifications will be checked using automated validators that ensure the documents meet all the requirements of the specification. Thus, use of W3C specifications, and associated validators, facilitates QA.

The web-based components allow each of the technical components to be presented with guidance, interpretation and explanation of their functionality. Technical guidance will

be integrated with the software using a process to ensure that changes in the software are synchronized with the appropriate changes in the documentation. Technical guidance will also include information regarding software and model evaluation.

4.2.2 Databases

Databases for SMARTe will be managed either in PostgreSQL or XML. PostgreSQL is a highly-scalable, Structured Query Language (SQL) compliant, Open Source object-relational database management system. User queries of PostgreSQL databases will be performed by SQL queries generated based on user interaction with a database search user interface. The user interface is presented in the user's browser as an HTML form. Form parameters are translated into an SQL query using Java and Javascript. User queries of XML-based databases also are based upon user interaction with an HTML form. However, for XML-based databases the form parameters are used directly in Java or Javascript to search the database. Database queries for use in technical calculations will be performed using pre-defined SQL queries from R or Java.

4.2.3 Technical Analysis

Technical analysis, computations, and algorithms will be programmed either in custom software or in existing free OSS. Custom software will be developed in the common web programming tools Java, Javascript, or XSL. An example of OSS that will be relied upon is R, a statistical computing, programming, and graphics language environment (www.r-project.org). Other modeling and computational tools will also be used for specific applications. Only those software components used in development of SMARTe and resulting in 508 compliant products will be used. Each component of the SMARTe program will be tested using web-accessibility software such as IBM page reader (see Section 1.9).

4.2.4 Expert Systems

The expert system component of SMARTe is the most difficult component to build. In general, expert systems include a set of rules and a knowledge base. A decision logic provides a visual depiction of the steps implemented in the expert system. In practice, the decision logic is built in XML (in the form of SVG) with the code needed to implement technical analysis implied by each node embedded in the code. When the analysis is run the decision logic XML will be parsed and the analysis code at each node run sequentially. Results are then stored in the nodes of the decision logic XML. The result of the application of the rules and knowledge base is a coded decision logic depicting the SMARTe recommended path and a textual interpretation of the analysis results with language targeted to a non-technical audience. The decision logic is displayed in the browser and the results of each node are displayed when the node is selected.

4.2.5 User Interface

The major components of the user interface (UI) for SMARTe include a system of pull-

down menus and a hyperlinked table of contents sidebar. The pull-down menus are implemented through an XML menu specification that are translated to meet the W3C specification for HTML forms. The UI is served dynamically to provide an interactive environment for the user.

4.2.6 Web Server and Programming Tools

SMARTe will be assembled using Extensible Stylesheet Language Transformation (XSLT), JavaScript, and Extensible Server Pages (in Java). SMARTe is designed and tested to be transparently served using these tools under Linux and Microsoft Windows 2000 and XP.

5 Quality Assurance and Review Activities for SMARTe

5.1 Review Cycles

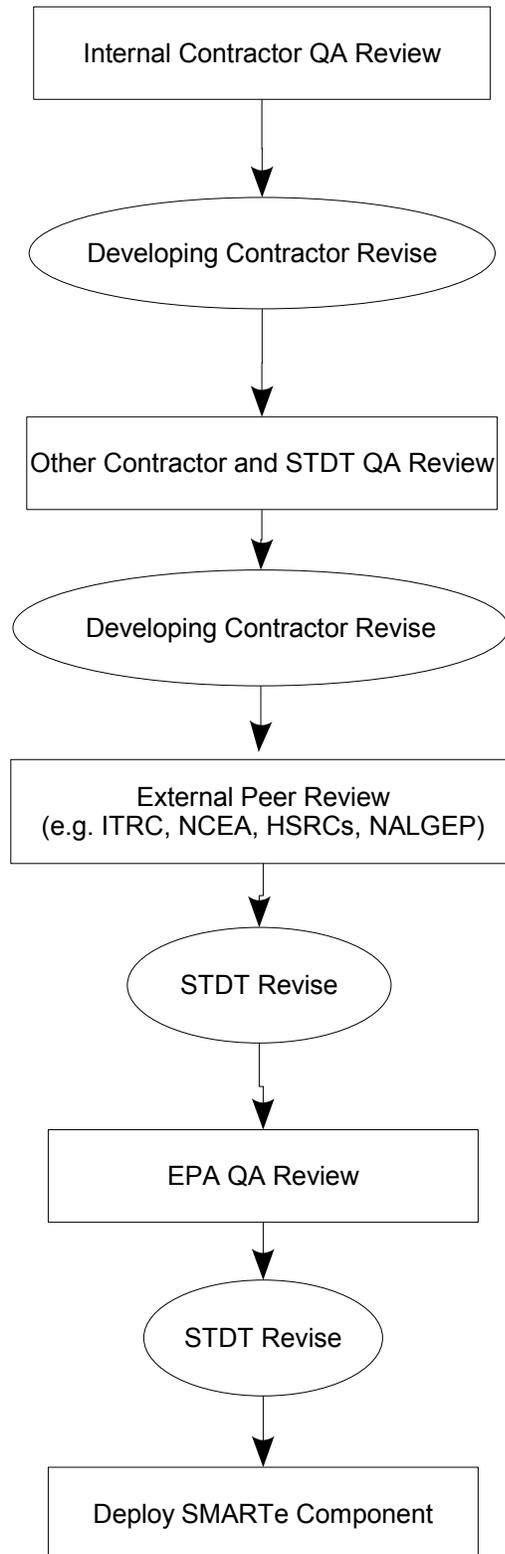
SMARTe consists of strategic, environmental, economic, and social components that are embedded in a complex system of information, databases, expert systems, analysis tools, and MCDA integration tools, that allow each component of SMARTe to be presented at different levels of detail in a web-based user interface. It is essential that each SMARTe component receive appropriate review prior to being deployed on the public SMARTe web site. These reviews will be performed for each of the component categories (that is, information or guidance, databases, analysis tools, expert systems, user interface, and integration tools). A standard series of reviews are available for each category, and these can be applied to each SMARTe component during the review process. Figure 1 demonstrates the linear review process that will occur for each component of SMARTe. Sections 4.2.1-4.2.5 of this Section provide clarification on the specific review needs of the different categories for each SMARTe component.

5.2 SMARTe Components

This section outlines the QA testing plan that is applied to each of the components of SMARTe. Each SMARTe component will undergo quality review under five review categories: technical guidance, database, technical analysis, expert systems, and user interface. Review questions to provoke critical thinking will be completed using a QA user protocol. The review questions are comprised of a series of yes/no questions for each of the five review categories. These review questions are outlined in the sections below. Technical QA review will be performed by the developing contractor, another contractor and the STDT, and finally (following an external peer review) by EPA personnel (see Figure 1).

Following the first three levels of QA review, each SMARTe component will be subjected yearly to two external peer reviews. The EPA TOM will identify and arrange for the external peer reviews. Expert peer reviewers will go on-line and review the component related to their area of expertise and provide their comments electronically using the feedback button. Once the peer review is completed and the STDT has

Figure 1 Quality Assurance Review Cycle



addressed comments received, the new function or component will undergo one final QA review by EPA. Every function and component that is part of the SMARTe deployment site will have undergone all stages of review described above and shown in Figure 1. For a new function or component to be included in the deployed or public SMARTe system, the complete 5 step review process must be completed. In addition, the details of the QA reviews and peer review are tracked, and comments are resolved and made available through SMARTe

Each applicable category of review is described in greater detail in Sections 5.2.1 - 5.2.5. The feedback buttons provide the capability for on-line review of SMARTe and the reviewers are guided to submit their comments in a format that will directly populate the comment database.

Once a review is submitted, it is stored in the feedback database. Resolutions of review comments are stored in this database with the review comments once the STDT has completed the revision. A field providing the status of EPA NRMRL approval is also included in the review database. The user has access to all previous reviews and comment resolution through the review user interface.

5.2.1 Technical Guidance

The quality objective for the technical guidance is to provide appropriate guidance using consistent and standard terminology.

Quality objectives for the technical guidance will be met through internal and external peer review by appropriate specialist(s) as determined by the EPA TOM. Peer review by both specialists and non-specialists will help ensure that the technical discussions are theoretically sound and understandable. Affirmative answers to the following table of questions should ensure that quality objectives are met.

- Does the guidance use consistent and standard technical terminology?
- Does the guidance present appropriate interpretation of technical concepts?
- Are technical terms explained adequately and referenced in a glossary?
- Are technical concepts explained adequately for the purposes of the software system?
- Is the guidance user friendly?
- Will the guidance be understood by the user?
- Do you have any other comments on the technical guidance found in SMARTe?

5.2.2 Databases

The quality objective for the database searches is to produce accurate and expected results. Search results are presented in a form that meets the users information needs.

Databases for SMARTe will be managed either in PostgreSQL or XML. Database queries will be performed using either SQL queries of PostgreSQL databases or direct XML database searching using R, Java, or Javascript. Search results will be presented in the user's browsers in an HTML table.

The quality expectations of the databases will be assessed by answering each of the following questions:

- Are the database search results appropriate and accurate given the user input?
- Do the database search results appear to be comprehensive given the database disclaimer?
- Is the presentation of results user friendly?
- Are hyperlinks in the results table active and appropriate?
- Do you have any other comments on the databases found in SMARTe?

5.2.3 Technical Analysis

The quality objective for the technical computations is to produce accurate and expected results.

Technical computations will be performed in R (an Open Source statistical programming language), computer codes called by R, JavaScript, Java, WinBugs (free decision analysis software), or XSLT. In general, the QA provided by R developers and the R user community provide a high level of QA for the SMARTe technical engine. In most cases, computer codes that need to be compiled include documentation with example datasets and results. Once a SMARTe component has been programmed, these examples will be run and compared to the documented results. Each SMARTe function will include an example dataset with known results (typically from a textbook or other references). Comparison with known results will lend confidence the functions are performing as expected. Links will be provided in each case to documentation of functions that are included in SMARTe. These will be made available through the QA interface. The quality expectations for the technical analysis will be assessed by answering each of the following questions:

- Do the technical analysis results compare favorably with the known results from the example datasets?
- Has the technical tool or method had sufficient QA to provide adequate defense of the data analysis results?
- Are assumptions and limitations described in such a way that the end user can make intelligent decisions regarding use of the method?
- Are examples of appropriate use given?
- Do you have any other comments on the technical methods found in

SMARTe?

5.2.4 Expert System

The quality objective for the expert system is to provide the appropriate technical procedures in a user-friendly manner for the non-specialist.

The QA for the expert system is similar to the technical guidance QA but also has a programming QA aspect. The expert system decision rules will be peer reviewed by a specialist(s). Affirmative responses by the reviewer to table questions will ensure quality objectives are met for the decision rules.

- Do the decision rules use consistent and standard technical terminology?
- Do the decision rules present appropriate interpretation of technical concepts?
- Is the technical interpretation presented in language understandable by the non-specialist?
- Are terms explained adequately and referenced in a glossary?
- Is the decision logic adequately explained and presented to the user in as transparent a manner as possible?
- Do you have any other comments on the decision rules in SMARTe?

5.2.5 User Interface

The quality objective for the user interface is to provide an intuitive, user-friendly user interface that accurately generates input arguments for analysis functions.

The user interface will largely be based on HTML forms, Javascript, and, potentially, Java applets. The interface will be designed to intuitively elicit user responses and provide for easy navigation. User responses are collected through user interfaces in the form of HTML parameters and are then translated using Java, Javascript, XSL, and R to database search or technical analysis appropriate inputs.

The quality expectations of the user interface will be assessed by answering each of the following questions:

- Are the module user interface requirements consistent with framework specification requirements?
- Does the user interface use standard terminology and definitions throughout?
- Do interface requirements define the required responses to potential types of errors and failure modes identified?
- Are requirements organized to allow for modifications?
- Are there requirements addressing fault tolerances and graceful degradation?

- Does the interface have guidance to aid the user?
- Are functional requirements in modular (object oriented) form?
- Is there a test defined for each general requirement?
- Do you have any other comments on the SMARTe user interface?

6 Documentation, Version Control, Deployment, Feedback, Archival and Security

6.1 Documentation

SMARTe electronic documentation provides information on:

- How to use SMARTe
- The technical components and methods SMARTe employs
- General guidance
- The review status of each SMARTe component
- Feedback and resolution to comments

The documentation will be updated regularly to reflect functional changes in SMARTe. The most recent version of the documentation will be made available on the SMARTe website.

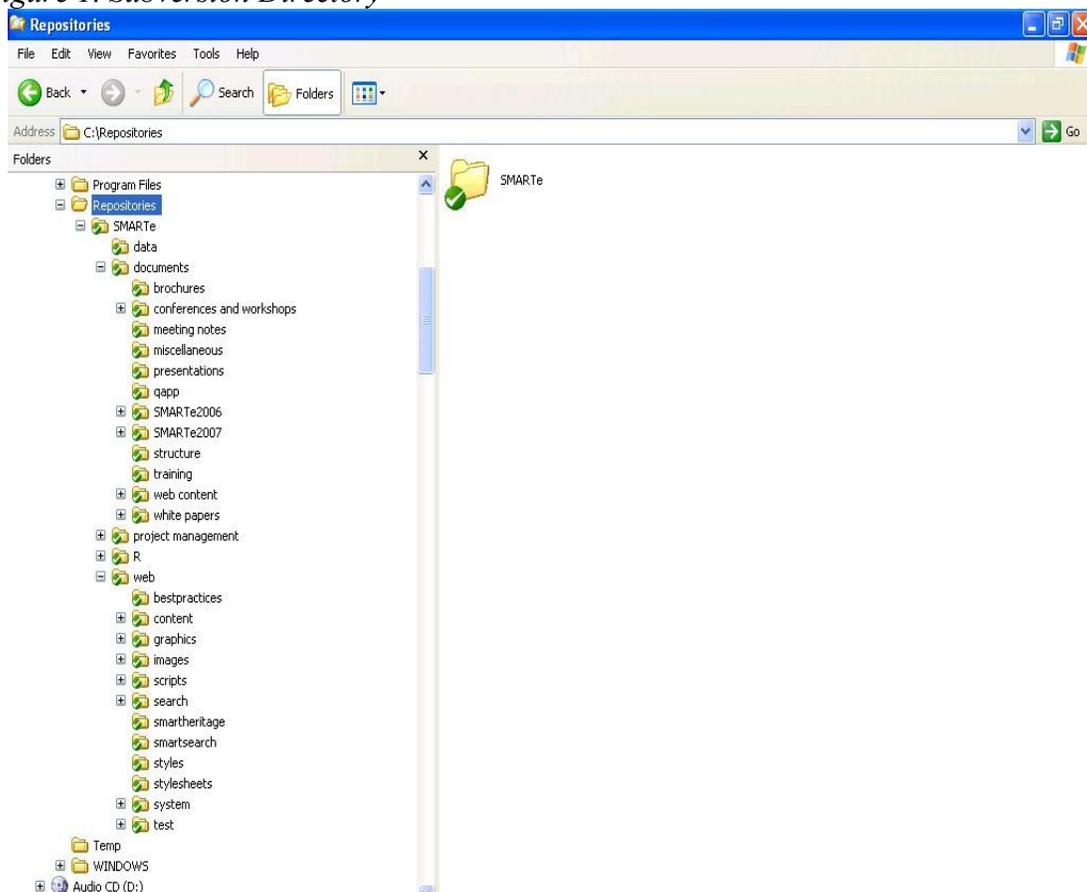
6.2 Version Control

SMARTe is currently managed under Subversion. Subversion (subversion.tigris.org) is an open-source version control system that keeps track of changes to files and folders in a project repository. It acts as a central repository of the most up-to-date project files and allows users, contributors, and developers to share them conveniently. It is also used to tag and archive various releases of project deliverables. A view of the Subversion directory is shown in Figure 2.

In Subversion, the SMARTe repository is divided into two major branches of development: A development branch for the web development team and a main branch for users and contributors. The development branch contains programming components such as source code, programmer documentation, and libraries whereas the main branch predominantly contains content such as SMARTe guidance and user documentation.

When updates to SMARTe are ready to be deployed, build scripts, located in the development branch of the SMARTe repository, are executed. These scripts bring together content from the main branch and web components from the development branch to produce the web site.

Figure 1. Subversion Directory



6.3 Deployment

The SMARTe system undergoes a three-phase deployment process: development, beta-testing, and deployment. In the development phase, the running system undergoes continual testing on individual development machines as the upcoming release of SMARTe is being developed. That is, each of the new functions and components are continuously tested. This matches Stage 1 of the QA review process described in Section 4. At the end of the development phase, the new functions and components are deployed on a test server. In the beta-testing phase, a review of the content and function of the new SMARTe functions and components is conducted by Tetra Tech and appropriate members of the STDT. After that review is complete and concerns have been addressed, a further review of those new functions and components will be conducted by the full STDT. Neptune and Company will then address STDT comments. Peer review follows these QA reviews. The STDT will determine which peer comments will be immediately addressed, not addressed (with rationale), or postponed. The new functions will then be reviewed by EPA QA. Once EPA QA approves the modified system in the beta-testing phase, the running system is deployed onto the deployment

server and made available through the ITRC website and directly at www.smarte.org in the deployment phase. Major releases are generally deployed on an annual basis.

Once a major release of SMARTe has been deployed for public use, further review by the user community (i.e. Feedback) can be performed and those comments will be addressed by the STDT as quickly as possible. On the ITRC website, access to SMARTe is made through the Brownfields Team Public Page from the ITRC website home page at www.itrcweb.org. Note that the link to SMARTe is provided in the main text on that page.

6.4 Feedback

Feedback on SMARTe (components, content, tools) is encouraged in several forms. Comments may be received through the ITRC, from workshops and conferences, via email, etc. Any comments received through this or any other mechanism will be added to a database of comments. This database will be reviewed periodically and the actions taken, if any, in response to each comment will be recorded.

The primary method of feedback is the “feedback” link in SMARTe. Users who click on the feedback button will be directed to a feedback screen where they will be encouraged to provide comments. These comments will be immediately uplinked to the SMARTe feedback database. All members of the STDT will have access to this forum and, as with other comments, a record of how these are addressed will be recorded and made available in the same forum. Feedback from all mechanisms will be used to ensure that SMARTe is meeting the needs of its intended audience.

Comments and comment response will be tracked using Bugzilla (<http://www.bugzilla.org/about/>). Bugzilla is an open-source tracking system used to document the comment, assign responsibility for a comment to a member of the STDT, and document in the feedback database how the comment was addressed. Details of the comment response procedure can be found in Appendix B.

6.5 Archival and Backup

All major releases of the SMARTe system, source code, and documentation are tagged and archived in Subversion. In addition, the entire Subversion system is backed up on a daily basis and an off-site backup is performed weekly. The EPA TOM will receive copies of each completed version on a compact disc for archival purposes.

6.6 Security

SMARTe is developed on Windows and Linux machines located at Neptune's Los Alamos, New Mexico and Evergreen, Colorado offices. Both offices are secured by software firewalls, Anti-Virus software, and a combination of two to three Anti-Spyware programs for all Windows servers and desktops. Anti-Virus definitions are updated daily on all machines. Anti-Virus scans are run daily on servers and weekly on desktops. As the deployment site, the Los Alamos office has an added layer of security in the form of a

hardware firewall. All servers and desktops at Los Alamos sit behind the hardware firewall.

The servers used for SMARTe beta-testing and deployment are Linux servers running the Fedora Core 3 operating system. Linux was chosen as the preferred operating system for deployment and testing because it offers superior performance to Windows and is inherently more secure because the majority of viruses and malicious software is written specifically targeting Windows. Linux is immune to these threats. Updates on Linux are automatically downloaded and installed nightly. The servers also implement a RAID-5 configuration to protect from hard drive failure and use Uninterrupted Power Supplies.

7 Summary

SMARTe is designed to be free OSS based on W3C specifications. All of the SMARTe content, including the user interface, is developed using XML. XML is software independent (that is, the content can be edited with any text editor and doesn't require proprietary, commercial software) and platform independent (that is, Windows or Linux). This also means that SMARTe will be compatible with future upgrades of operating systems. All SMARTe products and functions can be "presented" as, amongst others, HTML in a web browser or as an Adobe Acrobat pdf. SMARTe uses the DocBook XML specification which facilitates this translation from content to presentation.

The flexibility offered by SMARTe is unprecedented in statistical software. We expect that the machinery and technology underlying SMARTe represents the wave of the future in terms not only of use of statistical decision support software, but also in terms of how new technology is used to share and present information, build projects and reports, support decision making, and communicate effectively among various stakeholder audiences (for example, project teams, communities, etc.). In this way, we anticipate that SMARTe will become as invaluable as office tools such as word processors, spreadsheet programs, and presentation programs are today.

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Appendix A. SMARTe Development Status

The Sustainable Management Approaches and Revitalization Tools—electronic (SMARTe) web-based tool has been under development since 2002. SMARTe integrates key elements of restoration including future land use, project participants, community involvement, preliminary environmental assessment, human and ecological risk management, economic analysis, sources of money, and liability. The initial development of SMARTe focused primarily on urban sites; however, future development will specifically address rural areas, mine-scarred land, methamphetamine sites, UST sites, Superfund sites, regional and local land revitalization planning, sustainable project management (including long-term stewardship), and sustainability criteria for revitalized sites. The current version of SMARTe (Beta Test Version 2.0) is currently available for beta testing at www.smarte.org or through the ITRC website (www.itrcweb.org) on the Brownfields Team public page. Beta Test Version 2.0 is intended for users to develop a familiarity with the information and tools contained in SMARTe and to provide feedback regarding how it could be improved. The schedule for completion of SMARTe content and tools is presented below. In its final form, SMARTe will be a cohesive, integrated presentation of the information and tools listed below.

The following components have been completed and are currently undergoing beta testing:

- SMARTe Resource
- SMARTe Technologies
- QA Review Cycle, including internal testing, peer review (for example, ITRC) and EPA review
- SMARTe best practices
- Checklist of potential stakeholders
- Table of land use options
- Feedback capability
- Update navigation system for SMARTe from "Puzzle Pieces" to a menu system
- Implement comment database, address comments received prior to March 2005
- Back button from another site - back to previous SMARTe page
- Write a tutorial on how to navigate SMARTe
- SMARTe Resource search function
- Reuse scenario template (text)
- Revitalization plan template
- Characterization/monitoring data analysis and presentation tools
- Human health risk assessment calculator
- Economic tool for tracking: development costs, insurance costs, legal liabilities, remediation costs, revenue, tax credits, cost of money, marketing and advertising, modeling costs, project team costs
- Checklists for identifying private financing
- Checklists for identifying public financing
- Tool for selecting stakeholder involvement activities

The following list of components is scheduled for completion by May 1, 2006. The review process will commence with Beta Test Version 3.0 being made available to the public in October 2006. These components include numerous additional tools and calculators. These components

are designed for both new stakeholders to the revitalization process as well as experienced practitioners.

- Personal project page (appears after log-in)
- Additional checklists (For example, How to hire a consultant, property acquisition checklist)
- SMARTe Technologies search function
- SMARTe best practices search function
- Reuse scenario templates (drawings)
- Community benefits plan template
- Regulation access function
- Site characterization sampling design tool
- Human health risk screening calculator
- Human health risk assessment and modeling interface
- Ecological risk screening calculator
- Monitoring design template
- Market Analysis Template
- Tool for identifying financing opportunities based on non-market benefits
- Valuing tool for non-market benefits, including: community benefits, quality of life, environmental justice, impact on crime rates, cultural heritage, ecosystem protection and restoration, removing stigma
- SMARTe prototype
- SMARTe map showing where a user is on the site (breadcrumbs)
- Database of links and related documents
- SMARTe case study template
- Information needs and sampling design tool linked to the risk assessment
- Tool for determining relevance of human health risk numbers in regulatory context (local, state, and federal)
- Tool for incorporating project vision into human health risk assessment
- Tool for evaluating monitoring options
- Tool for determining relevance of monitoring results in regulatory context (local, state, and federal)
- Tool for capturing the costs/benefits of risk reduction vs. the cost of the monitoring options
- Multi-criteria decision analysis tools addressing:
 - Market cost and benefits and non-market costs and benefits
- Decision analysis for financing tools and stakeholder involvement
- Tool for characterizing non-market costs and benefits
- Tool for comparing the cost of collecting additional site assessment data and the associated reduction in risk uncertainty
- Tool for comparing all decision options (revenues, development costs, financing, remediation, monitoring)
- Green buildings/materials database
- Energy conservation technologies and approaches database, best practices, and

case studies

By May 1, 2007, the expert systems and multi-criteria decision analysis components of SMARTe will be fully functional. The review process will commence with Beta Test Version 4.0 being made available to the public in October 2007. These features incorporate the following components.

- Access to other documents relevant to SMARTe users
- Fate and Transport Calculator with modeling interface
- Fate and Transport Calculator sensitivity analysis and uncertainty analysis
- Human Health Risk Assessment Calculator sensitivity analysis and uncertainty analysis
- Ecological Risk Assessment Calculator with modeling interface
- Ecological Risk Assessment Calculator sensitivity analysis and uncertainty analysis
- SMARTe Search
- Link SMARTe Templates to SMARTe multi-criteria decision analysis function
- Implement feature linking characterization choices into SMARTe multi-criteria decision analysis function
- Tool for model choice and parameter choice
- Feature linking modeling choices into multi-criteria decision analysis function
- Feature for determining relevance of ecological risk numbers in regulatory context (local, state, and federal)
- Feature for translating project vision into ecological risk assessment with potential links to risk databases
- Feature for characterizing remediation options (e.g., natural attenuation, removal, containment, treatment)
- Feature for capturing the cost/benefits of risk reduction vs. the cost of the remediation options and linking to SMARTe multi-criteria decision analysis function
- Feature for updating probability distributions as new information becomes available

Appendix B. Standard Operating Procedure For Responding To SMARTe Comments Using Bugzilla (June 2006)

- 1.0 Comment input by user. Gets assigned status of “new” automatically to admin@neptuneinc.org
- 2.0 Neptune reassigns comment (leaves status as “new”) to a person within Neptune, Tetra Tech, or EPA. Email automatically goes to assignee; however, assignee needs to periodically check for “new” comments or else receive reminder emails.
- 3.0 Assignee reviews “new” comment and determines if they are the correct assignee. If not, they reassign the comment (leaving status as “new”). If so, they will accept the comment by changing the status to “assigned.”
- 4.0 Assignee addresses comment and edits the feedback database using the following guide (do NOT use resolution options “invalid,” “later,” or “remind”):

Status	Resolution	Scenario	Additional Comment
Resolved	Fixed	Use when changes are made to SMARTe. Changes may be made to the structure, which in essence “fixes” a comment or multiple comments.	<ul style="list-style-type: none"> - Changes made - Options removed - Options added - Text removed - Text added - Structure changed - Links fixed - Links removed - Links added - Interface changed
Resolved	Wontfix	Use when changes won’t be made to SMARTe because: <ul style="list-style-type: none"> - We prefer not to - We are required to do it the way it is. - The suggestion is no longer applicable - The comment refers to something that’s not SMARTe-related. - No change is needed (misunderstanding) 	This change will not (or cannot) be made because... Or No change is needed because...
Resolved	Duplicate	Use when comment is duplicate of a previous comment.	Duplicate
Resolved	Worksforme	Use when: <ul style="list-style-type: none"> - Comment describes something happening on site that cannot be 	- Explain what was tried and the results

		replicated - No fix is requested (e.g., positive feedback)	- Thank You.
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- 5.0 Use “white board” if the comment cannot be addressed within one month. Type: “Delay” and indicate why there is a delay and the expected time frame for completion. The proposed action can be entered into the additional comments if desired. Once comment is addressed and the appropriate response is added, erase white board.
- 6.0 If more information is needed from the reporter before an issue can be addressed, mark this on the whiteboard. Follow up with the reporter once. If the reporter does not respond, mark resolved, won’t fix, add a comment explaining that additional information could not be obtained from reporter and erase the whiteboard.
- 7.0 Priority – assign priorities based on the following:
- 7.1 P1/P2: Issue is causing/could cause extreme frustration to users.
 - 7.2 P3: Issue is important, but not causing major problems.
 - 7.3 P4/P5: Issue is an enhancement only – does not affect usability of site.
- 8.0 Verification and Closure: EPA shall verify that changes were made.
- 8.1 EPA reviews all resolved comments.
 - 8.1.1 Resolved Fixed: EPA reviewer shall verify that the change was made as stated.
 - 8.1.2 Resolved Wontfix: EPA reviewer shall verify agreement with the decision made not to fix.
 - 8.1.3 Resolved Duplicate: EPA reviewer shall verify that the duplicate entry was resolved satisfactorily.
 - 8.1.4 Resolved Worksforme: EPA reviewer shall verify that no changes are needed.
 - 8.2 If the EPA reviewer agrees with the comment resolution, he/she shall note this in the additional comment box, mark “verified”, and then commit.
 - 8.3 If the EPA reviewer does not agree with the comment resolution, he/she shall note this in the additional comment box (indicating why he/she does not agree and what needs to be done to resolve the comment), mark the “reopen” box and commit. After the comment is reopened, the EPA reviewer shall go back into that comment and reassign the comment to the person who marked it “resolved.”
- 9.0 Once SMARTe version is uploaded onto public site, Neptune should close all previously verified comments.