

CDC's National
Environmental Public Health
Tracking Program:

National Network
Implementation Plan (NNIP)

Version 1.0

August 2006

CDC/NCEH/EHHE/EPHT
1600 Clifton Road, NE Mailstop E-19
Atlanta, GA 30333

Phone: 1-404-498-2170 (Local)
1-888-232-6789 (Toll-free NCEH hotline)
404-498-1313 (Fax)
Email: epht@cdc.gov
Web: <http://www.cdc.gov/nceh/tracking>

Acknowledgement:

Thanks to Ross & Associates, Environmental Consulting, Ltd. for assistance in development of this document.

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Executive Summary

In January 2001, the Pew Environmental Health Commission called for the creation of a coordinated public health system to prevent disease in the United States by tracking and combating environmental health threats. In response, the U.S. Congress appropriated funding to the Centers for Disease Control and Prevention (CDC) in Fiscal Year (FY) 2002. This funding enabled CDC to develop the National Environmental Public Health Tracking Program (referred to as Tracking Program).

The purpose of the CDC's Tracking Program is to establish a nationwide tracking network to obtain integrated health and environmental data and use it to provide information in support of actions that improve the health of communities. CDC is establishing the Tracking Network by drawing from a wide range of stakeholders with expertise from federal, state, and local health and environmental agencies; nongovernmental organizations (NGOs); state public health and environmental laboratories; and schools of public health. The difference between the Tracking Program and the Tracking Network is that the Tracking Program is much broader and includes not only the Tracking Network but the people, resources, and program management involved in building this network. The Tracking Network is a discrete product of the Tracking Program.

The Tracking Program can use data gathered from the Tracking Network to identify areas and populations most likely to be affected by environmental contamination and to provide important information on the health and environmental status of communities. Analyses of data from the Tracking Network will provide valuable information on changes or trends in levels of pollutants, population exposure, and occurrence of noninfectious health effects and enable environmental public health practitioners and researchers to examine the possible relations among them. The information can be used to drive public health policy and actions that ultimately will reduce the burden of adverse health effects on the American public.

This document, *CDC's National Environmental Public Health Tracking Program: National Network Implementation Plan (NNIP)*, outlines the path that the Tracking Program is taking to develop and implement the Tracking Network over the next 5 years. The plan supports achieving success in both immediate and long-term time frames while providing direction and guidance to the many stakeholders who contribute to the Tracking Network's ongoing development as well as the overall program's implementation. The NNIP gives insight into the topics and approaches that lead to improved network performance, sustainability, quality, and focus. The NNIP outlines CDC's strategy for developing and implementing the Tracking Network by clarifying functions and components and describing approaches to developing the components. Specifically, the NNIP

- describes the background, context, needs, and goals of the Tracking Network;
- outlines the principal functions and components of the Tracking Network;
- discusses the steps needed to implement the components; and
- identifies the entities responsible for taking the implementation steps.

The complex development and implementation effort requires ongoing design, evaluation, testing, redesign, and implementation. Tracking Network implementation is a process that does not end with the NNIP but that will continue as network functions are built, stakeholders interact,

new data and other content are made available, technology changes, and funding and other resources are committed.

CDC has funded state, local, and academic efforts for the last several years to develop environmental public health tracking capacity and science; initiate state and local projects to improve hazard, exposure, and health effects tracking; and test the feasibility and utility of linking the data obtained from the Tracking Network. These efforts have provided “proof of concept” and have enhanced the availability of resources and skills. Development of the Tracking Network is moving from planning to implementation. The concepts, guidelines, and implementation steps outlined in the NNIP provide the framework to coordinate CDC and stakeholder activities to continue development of the Network.

The major functions of the Tracking Network are to enable compilation of a core set of nationally consistent health and environmental data and measures; to discover, describe, exchange, analyze, and manage data; to make tools available for managing and analyzing the data; and to provide environmental public health information to the public. Building a network to carry out these functions requires that many individuals and organizations coordinate efforts to develop and integrate various components to make data and information more accessible and more usable. The components of the Tracking Network will include the following:

- CDC Tracking Network portal and gateway;
- grantee Tracking Network interfaces;
- stakeholder Tracking Network interfaces;
- portfolio of services;
- core set of nationally consistent data and measures; and
- Tracking Program data and assets.

The first three components create the main infrastructure of the Tracking Network and enable access to data and services. The portfolio of services is a collection of tools and services by which users can search, discover, describe, access, analyze, manage, display, and exchange data. The last two components are the content of the Tracking Network. Activities for implementation are listed in the chapters and appendixes of this report.

1. Introduction

“CDC’s National Environmental Public Health Tracking Program is building a national integrated environmental and public health information system that supports national efforts to standardize and facilitate the electronic exchange of information. Linking environmental and health data will enable a timely response to potential health problems related to the environment.”

*Dr. Julie Louise Gerberding, MD, MPH
Director, Centers for Disease Control and Prevention*

1.1 Overview of the National Environmental Public Health Tracking Program

CDC’s National Environmental Public Health Tracking Program (Tracking Program) is a multi-disciplinary collaboration that involves the ongoing collection, integration, analysis, interpretation, and dissemination of data from environmental hazard monitoring, human exposure surveillance, and health effects surveillance. As part of Tracking Program efforts, CDC is currently leading the initiative to build a National Environmental Public Health Tracking Network (Tracking Network). The Tracking Program, with the Tracking Network as its cornerstone, is CDC’s response to calls for better understanding of how the environment can affect people’s health. Although the Tracking Network is the tangible goal of this tremendous effort, the Tracking Program encompasses the people, technology, and information needed to accomplish this undertaking.

A critical responsibility of the Tracking Program is to disseminate information from the Tracking Network that can improve the practice of environmental public health. For the last several years, CDC has funded cooperative agreements in state and local government agencies (hereafter referred to as “grantees”) to develop environmental public health tracking capacity and to identify, organize, and improve the quality of relevant data. CDC also has funded cooperative agreements with several academic institutions (hereafter referred to as “academic partners”) to conduct research relevant to tracking and to assist with developing methodologies that can be used in tracking. Additionally, CDC has established formal agreements with other federal agencies such as the U.S. Environmental Protection Agency (EPA), the National Aeronautics and Space Agency (NASA), and the United States Geological Survey (USGS) (hereafter referred to as “federal partners”). Many other agencies and organizations (hereafter referred to as “participants”) may be involved in tracking as contributors of data, users of data, and supporters of the program. Collectively, the grantees, partners, and participants are the “stakeholders” in the Tracking Program. The Tracking Program, by its nature, depends on the health and environmental data collection efforts of many agencies that must be leveraged and integrated to better understand environmental determinants that affect public health. The Tracking Program is working on several fronts and with stakeholders to ensure that the capacity exists to continue to organize, integrate, analyze, and use environmental public health information. Exhibit 1-1 provides a visual overview of a conceptual model for environmental

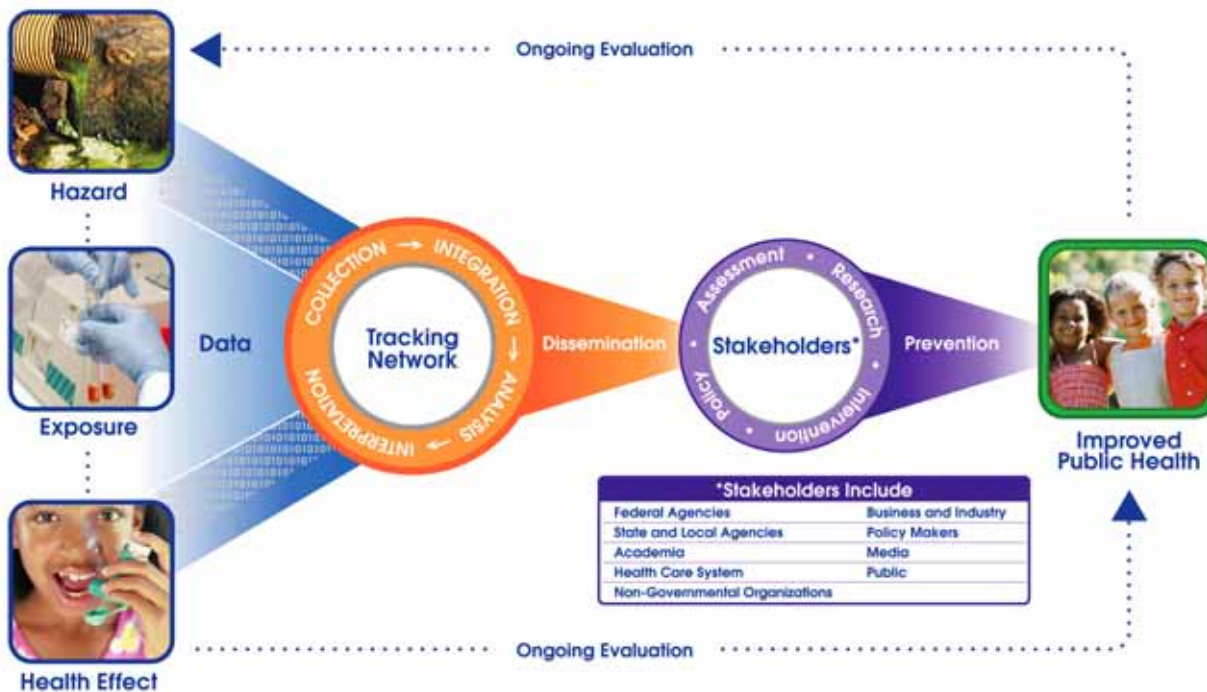


Exhibit 1-1: Model for Environmental Public Health Tracking

public health tracking that demonstrates the flow of information from the Tracking Network to those who can use it to improve the health of Americans.

Another important component of tracking that is illustrated in Exhibit 1-1 is the need for ongoing evaluation of program performance. CDC must ensure that the Tracking Network, other program activities, and the activities of funded partners are achieving their intended outcomes. Evaluation of key program components are explicit in milestones set by CDC in its strategy for the overall program (published in 2005) and in the implementation steps outlined in this NNIP.

1.1.1 Tracking Program: Vision, Mission, and Goals

The vision, mission, and goals of the Tracking Program were established in *CDC's Strategy for Environmental Public Health Tracking, Fiscal Years 2005 to 2010* (see Exhibit 1-2). The five goals of the program chart the course by which CDC will work to create a positive impact in environmental public health. Accomplishing these goals will require a coordinated effort from CDC and other stakeholders through partnership, collaboration, commitment, and dedication to environmental public health tracking. This report, the NNIP, addresses Goal 1, "Build a Sustainable National Environmental Public Health Tracking Network." Some work being done to achieve Goals 2 through 5 will support network development and functionality (for example, research conducted under Goal 4 can provide methods and tools to be incorporated in the Tracking Network).

<p><u>Vision:</u> Healthy informed communities</p>	<p><u>Goals</u></p> <p><u>Goal 1:</u> Build a Sustainable National Environmental Public Health Tracking Network</p> <p><u>Goal 2:</u> Enhance Environmental Public Health Tracking Workforce and Infrastructure</p> <p><u>Goal 3:</u> Disseminate Information to Guide Policy, Practice, and Other Actions to Improve the Nation's Health</p> <p><u>Goal 4:</u> Advance Environmental Public Health Science and Research</p> <p><u>Goal 5:</u> Foster Collaboration Among Health and Environmental Programs</p>
<p><u>Mission:</u></p> <p>To provide information from a nationwide network of integrated health and environmental data that drives actions to improve the health of communities</p>	

Exhibit 1-2: Tracking Program Vision, Mission, and Goals

1.1.2 Tracking Program Stakeholders

CDC encourages interested stakeholders, including environmental and public health practitioners, government agencies, healthcare providers, academic partners, community groups, policy makers, NGOs, industry, and others, to participate in the Tracking Program. Regular input from these stakeholders is needed to help guide the Tracking Program in advancing all of its goals. Stakeholder involvement is important because the data to support environmental public health tracking will come from and must be useful to a broad cross-section of stakeholders. Exhibit 1-3 depicts how various stakeholders will be involved in the Tracking Program, most of whom also will participate in the Tracking Network. Through involvement of these stakeholders,

- diverse perspectives will provide insight and more solutions for creating a Tracking Network;
- sharing personnel and assets will lead to more efficient use of such resources; and
- expertise will provide tailored, community-based approaches that can help the Tracking Program achieve its mission.



Exhibit 1-3: Stakeholders in the Tracking Program

1.2 Overview of the Tracking Network

The Tracking Network is a Web-based, secure, distributed network of standardized electronic health and environmental data. The Tracking Network draws data and information from state and local tracking networks as well as national-level and other data systems. It will provide the means to identify, access, and organize hazard, exposure, and health data from these various sources and to examine and analyze those data on the basis of their spatial and temporal characteristics. It will support the environmental public health tracking efforts of its stakeholders by improving information standardization. Information standardization will be improved through developing a core set of nationally consistent environmental and health data and measures and providing exchange and analysis tools. Exhibit 1-4 shows the conceptual design of the Tracking Network.

The primary feature of the Tracking Network is its enabling access to a variety of widely dispersed environmental and public health data and its support of data exchange among stakeholders. Levels of access to data will vary among stakeholders depending on the individual stakeholder's role and intended purpose. The Tracking Network will provide the necessary security to protect sensitive or critical data and systems. It will also provide a toolset for data analysis, visualization, and reporting to facilitate use of the data.

Key benefits of the Tracking Network include the capability to (1) provide timely and consistent information for stakeholders; (2) provide access to and ability to integrate local, state, and national databases of environmental hazards, environmental exposures, and health effects; (3) enable broad analysis across geographic and political boundaries; (4) promote interoperable systems through compliance with standards; (5) increase environmental public health capacity at the state and local levels; (6) provide the ability to enhance and improve data; and (7) provide a secure, reliable, and expandable ability to link environmental and health data.

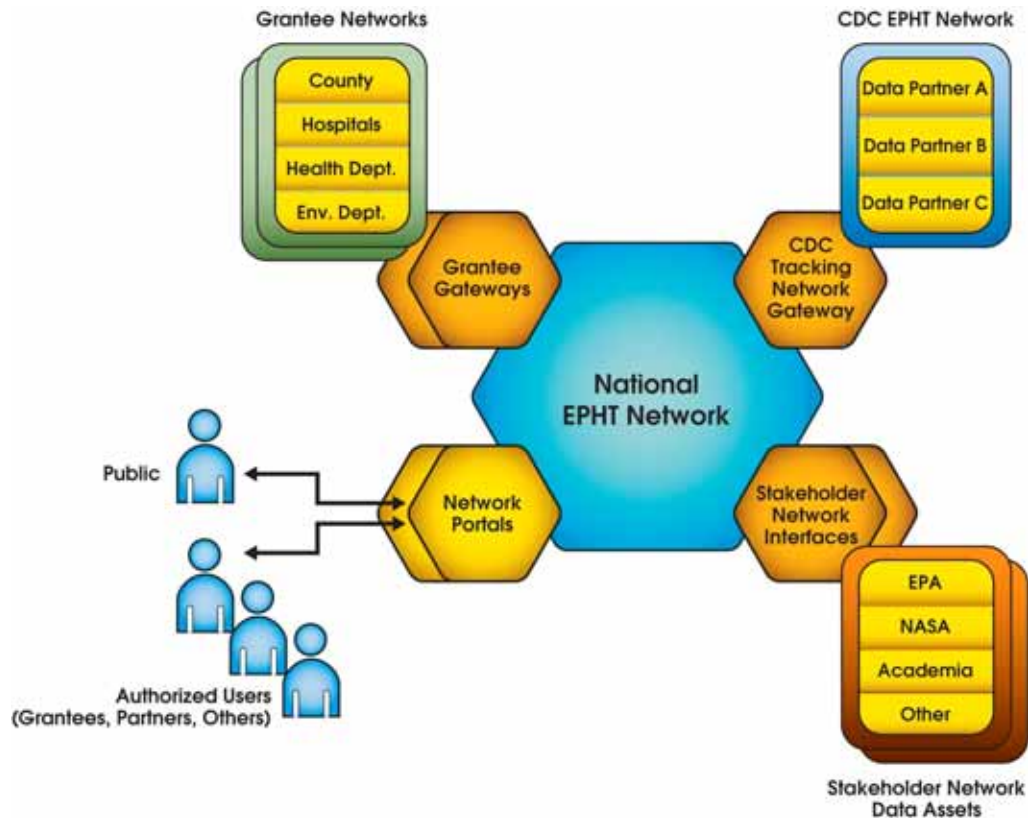


Exhibit 1-4: Overview of the Tracking Network

1.2.1 The Need for the Tracking Network

The link between environmental risk factors and noninfectious disease is still largely unknown. However, it is known that diseases such as cancer, asthma, heart disease, and diabetes are responsible for seven out of ten deaths in America. These diseases strike more than a third of the population—over 100 million women, children and men—and the costs of caring for people with chronic diseases account for more than 75% of the nation's \$1 trillion health care budget.

Without adequate tracking, local, state, and federal officials cannot know the true scope of existing health problems and may not recognize new diseases until many people have been affected. Much of the public health surveillance currently in place in the United States focuses on infectious diseases. An urgent need exists for a more comprehensive national approach to collecting and analyzing data on noninfectious diseases and to integrating that information with environmental hazard and exposure data. The availability of these types of data in a standardized Tracking Network will enable researchers, public health authorities, healthcare practitioners, and the public to begin to understand the possible associations between the environment and adverse health effects.

The success of the Tracking Network will depend on its ability to improve public health by helping public health practitioners and others address their information needs. This is true whether stakeholders are government, not-for-profit, public, or private entities. The Tracking Network will enable environmental and public health professionals to address environmental health concerns more efficiently and evaluate public health impacts. Specifically, the Tracking

Network will provide information that may be used by environmental and public health professionals to take immediate public health action, plan and evaluate environmental and health programs, and identify relations between people’s health and their environments. Exhibit 1-5 shows examples of the needs that the Tracking Network will address.

Exhibit 1-5: Examples Illustrating the Need for and Potential Uses of the Tracking Network

Problem Statement	Questions to Be Answered	Example Challenges	Potential Uses
<p>A city public health official is interested in the potential correlations between ozone levels and myocardial infarctions (MI). The official would like to aggregate data across jurisdictional boundaries to understand broader air pollution trends and sources, and then compare to MI hospitalization data.</p>	<p>What is the variability in ozone concentrations? What other factors may contribute to the MI hospitalizations? How many, when and where have MI hospitalizations occurred in the city and neighboring jurisdictions in the past X years? Are ozone levels and MI hospitalizations correlated?</p>	<p>The pollution is affected by sources from and conditions in adjacent jurisdictions. Suburban residents living in other states commute to work and obtain health care in the city. Air monitors are located in more urban than rural areas. It is more difficult to get accurate exposure estimates for rural areas.</p>	<p>search detailed metadata that describe available data sets to identify and assess the relevance of available data download the data via a secure mechanism access methodologies and software tools to model and analyze air quality with MI hospitalization data</p>
<p>A state public health director has recognized that mercury in fish may be causing a health hazard within his state. The sources of mercury and the locations where fish are being contaminated are in adjacent states, as well as his own.</p>	<p>What are the sources of mercury? How much fish are people eating? Where do fish being consumed come from? What are the mercury levels in the fish that people eat? What are appropriate fish consumption guidelines for the state?</p>	<p>Mercury levels in fish are sometimes high, and mercury is a well known neurological toxicant, some groups, e.g., pregnant women and young children) can be more susceptible to health effects of mercury exposure. Fish are imported from all over the world and few studies of mercury levels in store-bought fish have been conducted.</p>	<p>identify sources of mercury contamination in nearby jurisdictions search metadata to identify relevant fish contamination data sets access existing fish contamination data from multiple jurisdictions in consistent formats</p>
<p>The co-chair of an environmental advocacy group is interested in assessing levels of exposure to arsenic in rural areas of western states relative to exposures in other rural areas of the nation.</p>	<p>What is arsenic? Where does it come from? What are health concerns related to arsenic? Does the drinking water in my city have arsenic? How do the levels of arsenic in my drinking water compare to levels in other parts of the country? What can be done about arsenic in drinking water?</p>	<p>Some relevant information for public water supplies is available on the Internet through the Safe Drinking Water Information System (http://www.epa.gov/safewater/dwinfo/wa.htm). For more rural areas, with private wells, less information is publicly accessible and may need to be derived and organized from site-specific studies.</p>	<p>Search for studies and data on arsenic conducted by grantees and other partners. Potentially access and manage data from multiple studies to begin to develop comprehensive statistics on arsenic occurrences. Organize data from multiple site studies with data from EPA and water providers to characterize patterns of arsenic occurrence.</p>

1.3 Overview of the Tracking Network Implementation Plan

This National Network Implementation Plan (NNIP) outlines the phased implementation of the Tracking Network over the next 5 years. The plan supports CDC's vision for achieving success in both immediate and long-term time frames while providing clear direction and guidance to the many stakeholders who contribute to the Tracking Program's ongoing development and Tracking Network implementation. The NNIP gives insight into the topics and approaches that lead to improved network performance, sustainability, quality, and focus. The purpose of the NNIP is to guide the development of the Tracking Network by clarifying its functions and components and describing approaches to develop the components. Specifically, the NNIP provides the following:

- description of the background, context, needs, and goals for the Tracking Network;
- outline of the principal functions and components of the Tracking Network;
- discussion of the steps needed to implement the components; and
- identification of the entities responsible for taking the steps to implement the Tracking Network.

The following chapters give details about implementation of the Tracking Network. Chapter 2 outlines the major functions of the Tracking Network, identifying users and uses of the Network, and the coordination needed to support Tracking Network development. Chapter 3 provides an overview of the components that will be built and implemented to support the functions. These components are then addressed in detail in Chapter 4 (Access), Chapter 5 (Services), and Chapter 6 (Content). Each of these three chapters includes detailed steps and activities needed to develop the components. Chapter 7 summarizes the steps of Tracking Network implementation by fiscal year. Appendix A provides additional information on implementation activities, organized by responsible entity; Appendix B is an overview of the process used to develop the NNIP; and Appendix C is a list of acronyms and abbreviations.

2. What are the Functions and Uses of the Tracking Network?

The Tracking Network enables data related to environmental health to be collected, organized, managed, analyzed, and displayed, and it provides access to interpreted environmental public health information. The Tracking Network will perform several important functions for many different stakeholders. Enabling these functions through Tracking Network implementation requires coordination and interaction among stakeholders. These topics are covered in the following sections.

2.1 Functions of the Tracking Network

The Tracking Network will perform several functions. These functions represent the value that the Tracking Network will add to the practice of environmental public health. Not all functions will be implemented at once. The functions are listed below and discussed in more detail in the following sections. The remaining chapters in this NNIP identify implementation activities that will result in a Tracking Network that provides the following functions:

- compile and provide access to a core set of nationally consistent data and measures;
- describe and discover data;
- exchange data (conduct bi- or multi-lateral exchanges, make data available, access data);
- provide data management, analysis, and visualization tools; and
- inform and interact with the public.

2.1.1 Compile and Provide Access to a Core Set of Nationally Consistent Data and Measures

Entities interested in environmental public health tracking often need to examine patterns of health and environmental conditions across state and other boundaries. Satisfying this need requires that data be standardized so it can be compiled or compared across localities, states, and regions. The Tracking Network will focus on two basic areas for establishing standards to ensure that a core set of environmental and health information is provided consistently within the network: (1) adopting or establishing standards for specific data; and (2) adopting or establishing standards for a core set of measures to represent these data that are scientifically based and relevant for specific audiences. Examples of “measures” would be rates of asthma hospitalizations in a city for specific years or the annual number of premature births by county. A “measure” typically describes the occurrence of an event, whether hazard, exposure, health effect, population characteristic, or some combination of these factors as they related to specific places, times, or both. The term “nationally consistent measures” means that data from multiple jurisdictions will be analyzed, presented, and interpreted using agreed upon standards so results are comparable. Developing a core set of nationally consistent measures (also referred to as “core measures”) requires consideration of issues such as how the underlying data were collected, spatial and temporal characteristics and completeness of the available data, privacy, and analytic methods used. Because the data included in these measures may not be collected

consistently, stored in standard formats, or analyzed in similar ways, CDC is involving grantees, state data owners/stewards, academic partners, federal partners, and others in a workgroup process to identify and recommend standards for a core set of nationally consistent data and measures. To achieve the goal of a distributed data network, most of the data organized according to national standards will be maintained within the jurisdiction where it was collected. The Tracking Network will provide access to information on the basis of the roles and purposes of the users.

2.1.2 Describe and Discover Data

A variety of data sets is important for environmental public health practice and is of interest to the Tracking Program. Most of these data sets currently are inconsistently compiled, and their development and use is tied to specific purposes (for example, regulatory monitoring of specific pollutants in specific geographic regions or reimbursement of medical services). Some data, such as air quality measurements compiled by EPA, are available in consistent forms from much, but not all, of the United States. Some unique data are collected by Tracking Network grantees and federal partners. This function recognizes the need for data owners and stewards to describe their data and the ability for potential users of the data to search for and find environmental and health data (on the basis of access to the accurate descriptions developed by data owners).

This function is based on establishing common ways to describe data, to share and manage those descriptions, and to use the Tracking Network to search the descriptions to identify data sets of interest (e.g., using PHIN vocabulary standards). The data descriptions are called “metadata,” or data about data, and include topical, location, and temporal information, as well as how the data were collected and how they may be accessed, their quality, ownership, frequency of updates, etc.

Describing and discovering (i.e., finding) data are two different activities. Data description depends on setting guidelines for the specific characteristics that must be captured about a data set. Data description can be automated to some extent, that is, templates and tools can be provided for data owners to describe their data. Data discovery requires tools that enable the ability to search different sites on the Tracking Network and means to identify those data sets that might meet specific needs of the searcher. Agreements are needed to determine appropriate levels of access to both metadata and data.

2.1.3 Exchange Data

The ability to move or share data among various stakeholders is an important aspect of tracking. Tracking Network stakeholders will identify or develop data that stakeholders will want to access through the network. Three different but related aspects of data exchange are discussed in the following sections, including the ability to directly exchange data with others with whom data-sharing agreements exist, the ability to generally provide access to Tracking Network data, and the ability to download or access data on the network.

2.1.3.1 Conduct Bi- and/or Multi- Lateral Exchanges

Tracking Network stakeholders need to be able to securely exchange data. Standardized protocols and mechanisms will ensure security. Exchanging data securely will require

identification or development of standardized procedures for content and technology; an appropriate level of automation given the frequency (or infrequency) and nature of the exchange and the costs compared with a more manual solution; and establishment of data-sharing agreements.

2.1.3.2 Make Data Available on the Tracking Network

A critical function of the Tracking Network is the ability to make environmental or health data available among stakeholders. This function recognizes that grantees, partners, and other stakeholders will use the network to make data available to others with appropriate access rights. The Tracking Network will provide the means to automate identification and authentication of users and their rights and provide the technical infrastructure needed to support making data available.

2.1.3.3 Access Data

The ability to securely access information is important for stakeholders to be able to retrieve data from grantee, partner, or other stakeholder sites on the Tracking Network (given adequate access rights). The Tracking Network will provide the means to identify available data and use data without requiring human intervention to support every transaction. This will be accomplished by establishing appropriate levels of access to information for different stakeholders depending on their role in the Tracking Program. This is referred to as “role-based access.” Important issues to address in establishing role-based access include defining the data or information that will be shared; identifying roles, assigning roles to stakeholders; and matching data to roles. Another way to define the level of access for different stakeholders is to establish data sharing agreements (also commonly referred to as Trading Partner Agreements). The requirements for these agreements will be defined as the Tracking Network is developed, as will means to manage multiple data sharing agreements.

2.1.4 Provide Data Management, Analysis, and Visualization Tools

An essential requirement of tracking is the ability to manage, analyze, and display health and environment data and identify relations among the data. Examples of managing data include changing from one format to another, organizing data by various file names, and ensuring that the most current data are available. Examples of analysis include examining trends over time or the correlation between health and environmental factors on the basis of location. Establishment of this function recognizes that software tools or services, such as geocoding, map-making, statistical analyses, de-identification routines, and data linkage and analysis programs, are needed within the Tracking Network. Given the need to protect privacy, some tools may require secure environments. For example, although data owners / stewards may have an interest in identifying geographic coordinates for their data (known as geocoding), they may be reluctant or unable due to privacy constraints to include data with addresses in the Tracking Network.

Decisions about which tools may be actually available on the Tracking Network (versus those that may be accessible or shareable, but not invoked on the Tracking Network) will be based on several factors. These include the common needs for tools identified by different stakeholders; the ease with which tools can be provided to multiple users in a common format with a common

interface without sacrificing utility, the level of training needed to use specific tools and capacity to provide that training; and the licensing requirements that may apply to the tools.

2.1.5 Inform and Interact with the Public

Members of the public are interested in environmental public health information and will use the Tracking Network for access to information and data. Due to privacy laws and regulations, what is accessible to the public will likely vary from what is accessible to environmental and public health practitioners with established access rights. The Tracking Network will provide information to the public that is clearly stated and conveys appropriate risk and prevention strategies. Tracking Network participants with data to share will be asked to provide their most accurate and current information. There will be links for more information on specific topics. These links will require coordination with partners to ensure consistency of messages.

2.2 Users of the Tracking Network

There are potentially many different users of the Tracking Network. Initially, at least three different categories of user are envisioned: (1) environmental and public health practitioners; (2) policy-makers and the public; and (3) researchers.

Environmental and public health practitioners require access to various types of data to perform functions associated with tracking such as quantifying the magnitude of a problem; generating hypotheses; seeking unusual trends and occurrences; documenting the distribution and spread of environmental hazards or health events; identifying populations at risk; and planning and evaluating prevention and control measures. The Tracking Network will provide access to a core set of nationally consistent data and measures so that environmental and public health practitioners can analyze data across jurisdictions more quickly than is currently possible. Access to metadata will allow environmental and public health practitioners to quickly identify existing data to help perform public health functions. Data may then be accessed based on need and rights determined by data owners / stewards.

The Tracking Network will also provide information for policy-makers and the public. This information will be coordinated with the environmental or public health data owners / stewards who have responsibilities to protect the identities of individuals included in their data. Information for policy makers and the public can also inform clinical care providers who may use it to provide anticipatory guidance, and environmental scientists who may implement environmental regulatory actions.¹ Requirements gathering for the Network in its planning stage cannot identify the full range of its use by the public or policy-makers. Uses of the Tracking Network will be evaluated as the Tracking Network is implemented.

Researchers will be able to access metadata that will help them to identify data useful to their needs, including who to contact for more information about accessing detailed data that may not necessarily be directly accessible on the Tracking Network. Researchers also will be able to

¹ Thacker SB. Historical development. In: Teutsch SM, Churchill RE, eds. *Principles and Practice of Public Health Surveillance*. 2nd ed. New York: Oxford University Press; 2000. (as cited in Tracking Strategy <http://www.cdc.gov/nceh/tracking/pdfs/strategy.pdf>)

directly download data if they have established appropriate rights of access. Institutional Review Board (IRB) approval may be needed for access, depending on the type of information requested.

2.3 Coordination in Developing the Tracking Network

Many stakeholders have roles and responsibilities in development of the Tracking Network. The diversity and complexity of the tasks requires significant coordination to successfully manage specific steps and the overall process of Tracking Network implementation. CDC has established various workgroups to address specific aspects of network development and make recommendations to CDC.

Current workgroups and their subgroups and teams are depicted in Exhibit 2-1. The Standards and Network Development Workgroup (SND) and the Program Marketing and Outreach Workgroup (PMO) were formed in 2003. The Content Workgroup (CWG) was established in 2006. Workgroups are co-chaired by CDC and grantees. Representatives of all grantee sites and academic partners are required to participate in the workgroups. Federal partners are invited to participate. Workgroups provide overall coordination for the activity areas identified in their operational plans and work plans. Subgroups, also co-chaired by CDC and grantees, are responsible for carrying out specific activities that require focused ongoing discussion and interaction. Teams are formed as necessary, often led by grantees, with significant contractor support. Teams are intended to quickly focus attention and make recommendations on specific issues to the subgroup or workgroup to which they report and then to disband. New teams are formed as new issues are identified.

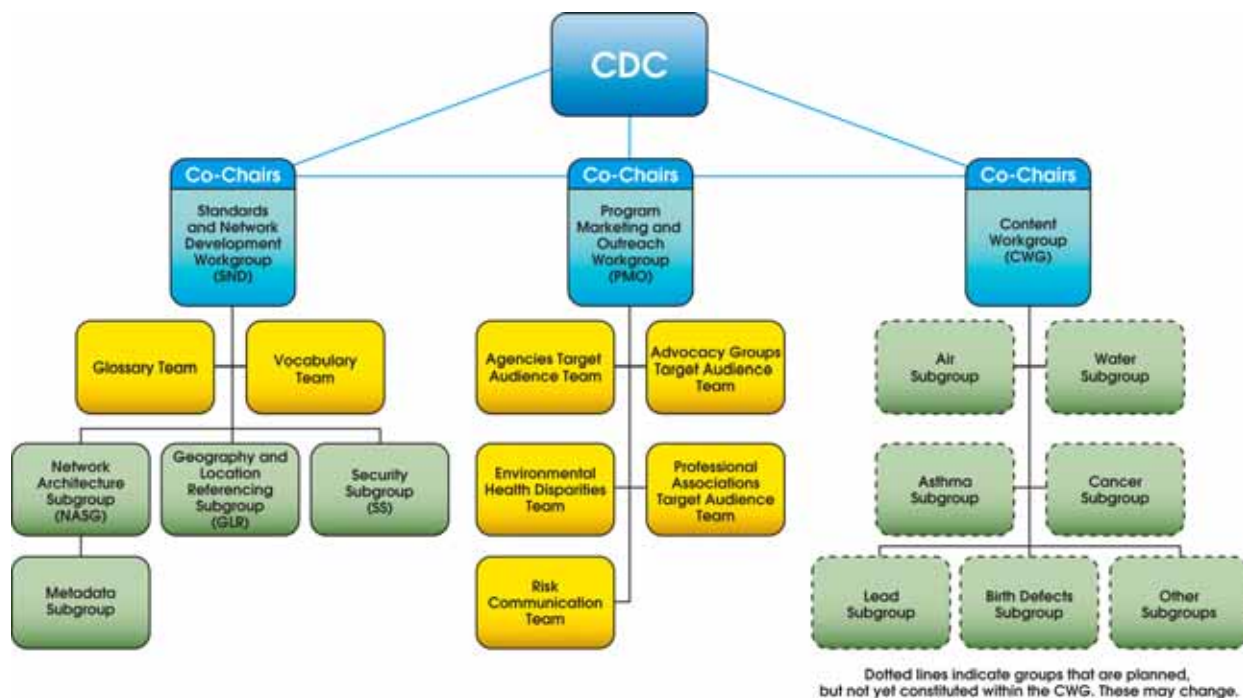


Exhibit 2-1: Workgroups Responsible for Tracking Network Implementation

The co-chairs of the workgroups are working to establish effective ways to coordinate the various workgroups' activities to support implementation and evolution of the Tracking Network. The co-chairs are responsible for sharing workgroup products and recommendations with CDC. CDC then adopts the recommendations as appropriate (they must fit into Tracking Program goals and priorities). The NNIP outlines the various actions and steps that form the basis for the work plans of the workgroups.

The mission of each workgroup is described in Exhibit 2-2. Over the last three years, the SND Workgroup has had specific responsibilities to identify needed and existing standards that will assist in Tracking Network development. Examples of this work include a draft template for data sharing agreements and standards for metadata to describe elements that must be captured about a data set to enhance the ability to search for data and determine data usability. The SND Workgroup looks to the activities being conducted under the Public Health Information Network (PHIN) and the Environmental Protection Agency Exchange Network for guidance in standards development. Where standards play a role in the workgroup efforts, using existing standards and guidelines is the preferred approach. Only where appropriate standards are not available will new standards be considered for development. The PMO Workgroup focuses on promoting interest and engagement in the Tracking Network by developing communication and outreach materials. As of the writing of this NNIP, the CWG is just being formed. Examples of the types of work that the CWG will be engaged in are included in the discussion in Chapter 6. Subgroups and teams have not yet been formed for the CWG.

Exhibit 2-2: Mission and Functions of the Tracking Workgroups

	Standards and Network Development (SND)	Program Marketing and Outreach (PMO)	Content (CWG)
Mission	Facilitate and promote collaboration among CDC and other partners in development of the Tracking Network as it relates to network functions, requirements, and data and information technology specifications and standards.	Assist CDC and grantees in the development and implementation of a program outreach and marketing plan.	Facilitate and promote collaboration among CDC and other partners about content for the Tracking Network and methodologies for collecting and organizing that content.
Major Activities or Functions	<p>Identify needed standards and other mechanisms that will support the ability to exchange, integrate, and use environmental and health data.</p> <p>Examine the availability and applicability of existing data standards or collaboratively define and develop new standards.</p> <p>Identify approaches for implementing and encouraging use of standards and best practices that will facilitate data exchange and use.</p> <p>Ensure compatibility to the extent feasible with existing and developing standards of other efforts such as the Public Health Information Network (PHIN) and EPA's National Environmental Information Exchange Network (Exchange Network).</p>	<p>Develop appropriate education and outreach materials that emphasize and support the goals, objectives, and timely promotion of the national tracking effort.</p> <p>Develop targeted communications strategies and documents for Tracking.</p> <p>Identify and promote effective risk communication strategies.</p> <p>Engage health and environmental programs interested and involved in Tracking.</p> <p>Work collaboratively between CDC and the grantees to carry out Tracking marketing and outreach activities.</p> <p>Address confidentiality issues related to state and federal policies, laws and regulations.</p>	<p>Recommend nationally consistent measures and data to be included in the Tracking Network.</p> <p>Develop guidelines or standards for data definitions, vocabularies, and common procedures for analysis, reporting, and presentation of data to be used in the Tracking Network.</p> <p>Contribute to development and standardization of metadata (under development by SND).</p>

2.4 Implementation Activities for Tracking Network Coordination

Exhibit 2-3 outlines the major activities needed to promote coordination in the implementation of the Tracking Network. Similar exhibits are included in subsequent chapters that identify the details of implementing each of the components of the Network. Chapter 7 compiles information from each chapter to present a 5-year plan of implementation activities. The major activities discussed below include the process of continued planning and implementation, gaining agreement on a process to finalize, adopt, and implement recommendations; disseminating information; and promoting participation in the Tracking Network.

Exhibit 2-3: Coordination Activities for Overall Tracking Network Implementation

Activity	Responsible Entity
2006	
Finish the National Network Implementation Plan (NNIP).	CDC, Grantees
Fund state/local entities to develop their networks and contribute to the development of the Tracking Network.	CDC
Develop, review, and adopt a process to promote implementation of standards and guidelines recommended by SND (and other Workgroups).	SND, CDC
Begin development of the Technical Network Implementation Plan (TNIP) to build the components of the Tracking Network.	CDC
Begin to identify potential partners for involvement in the Tracking Network	PMO
Provide opportunities (e.g., annual conferences/workshops) to discuss the vision, process, lessons learned, and implementation of the Tracking Network.	CDC
Collate and disseminate via an annual report information on lessons learned in tracking.	CDC
2007	
Develop drafts, review, and finalize the Technical Network Implementation Plan (TNIP).	CDC, Grantees, SND
Provide opportunities (e.g., annual conferences and workshops) to discuss the process and implementation activities of the Tracking Network.	CDC
Collate and disseminate via an annual report information on lessons learned in tracking.	CDC
Promote the availability of the Tracking Network and guidelines for participation.	PMO
2008	
Provide opportunities (e.g., annual conferences and workshops) to discuss the process and implementation activities of the Tracking Network.	CDC
Collate and disseminate via an annual report information on lessons learned in tracking.	CDC
Evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).	CDC, SND
Explore and recommend to CDC new technologies to enhance the Tracking Network.	SND, CDC
Use lessons learned from Tracking Network implementation to inform creation of 2010-2015 Tracking Strategic Plan.	CDC
Promote use of the Tracking Network and guidelines for participation.	PMO

Activity	Responsible Entity
2009	
Provide opportunities (e.g., annual conferences and workshops) to discuss the process and implementation activities of the Tracking Network.	CDC
Collate and disseminate via an annual report information on lessons learned in tracking.	CDC
Continue to evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).	CDC, SND
Continue to explore and recommend to CDC new technologies to enhance the Tracking Network.	SND
Continue to promote use of the Tracking Network.	PMO
2010	
Provide opportunities to discuss the process and implementation activities of the Tracking Network (e.g., annual conferences/workshops).	CDC
Collate and disseminate via an annual report information on lessons learned in tracking.	CDC
Continue to explore and recommend to CDC new technologies to enhance the Tracking Network.	SND, CDC
Continue to evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).	CDC, SND
Continue to promote use of the Tracking Network.	PMO

3. What Are the Components of the Tracking Network?

A complex endeavor such as the Tracking Network must be broken into manageable parts. For the Tracking Network, these manageable parts are referred to as “components.” The critical components to develop the Tracking Network are outlined below, with more detailed descriptions in following chapters.

Components are highly inter-related, and represent a productive way to identify needed capabilities to partition the work of implementation. Components in many cases represent work that has been initiated by CDC and the Tracking Program Standards and Network Development (SND) Workgroup. Development of various components will also be informed by the Tracking Program Content Workgroup (CWG). Although highly inter-related, the components are specifically identified to assist in the technical implementation of the Tracking Network. Each component has multiple implementation activities and schedules. To a large extent, once the high level design and requirements are validated, implementation of components can proceed along parallel paths and be incrementally incorporated into the overall Tracking Network.

3.1 Tracking Network National Portal

CDC will establish a national portal for the Tracking Network. The Tracking Network’s national portal will serve as a Web-based interface for stakeholders, the public, and other users to interact with the Tracking Network. A portal is essentially a Web site designed to support a user’s interactions with the variety of applications, services, and information that will be available on the Tracking Network.

3.2 Tracking Network National Gateway

CDC will establish a national gateway for the Tracking Network. In some ways, a gateway (whether at the national, state, or local level) acts as “traffic control officer” for information as it moves around the Tracking Network. Invisible to the user, gateways will consist of a set of software and hardware that will be operated under standards and protocols for data exchange and access. Working in conjunction with the Tracking Network national portal, the national gateway will support network security services to ensure confidentiality of data and availability of data and tools. The difference between the portal and the gateway for the user is that the portal is what the user will see on their computer screen as they access the Tracking Network and the gateway is the behind the scenes activity that is not visible to the user. The national gateway will allow access to grantee tracking networks and partner resources.

3.3 Grantee Tracking Network Interfaces

Tracking Program grantees will develop Tracking Network interfaces, primarily in the form of a gateway, to interact with other parts of the Tracking Network, other grantee gateways, and other

partners in an automated manner. Additionally, grantees are expected to develop Web-based tracking network portals that can support specific grantee requirements for interactions with other partners that may not be met by the Tracking Network's national portal. Recommendations for the specifications of these interfaces will be developed by the SND Workgroup. CDC will work with grantees to support testing, piloting, and deployment.

3.4 Stakeholder Tracking Network Interfaces

Stakeholder interfaces are the electronic mechanisms by which academic and federal partners and other stakeholders will interact with the Tracking Network to support the exchange of data and services. Stakeholders may establish gateways according to Tracking Network specifications (currently under development in the SND Workgroup), but may also maintain other interfaces, such as the EPA Exchange Network nodes. Work is proceeding on pilot activities to examine interoperability between the Tracking and Exchange Networks.

3.5 Nationally Consistent Data and Measures

“Nationally consistent data and measures” are electronic records and statistics that are collected and/or organized based on standards that have been recommended by the CWG and adopted by CDC for the Tracking Network. Many of the data sets that will be made accessible through the Tracking Network will be collected by programs not established for tracking purposes. The process of developing consistent approaches for compiling and integrating data will require time and interaction among grantees, partners, and other stakeholders. Data will have standardized schema and metadata, and will represent various geographies within the jurisdictions of the grantees. The geographic resolution of these data will be a function of use restrictions, the need for data to meet environmental public health purposes, and data availability. The data and associated measures will primarily reside at grantee sites, but will be available through the Tracking Network national portal and gateway to those with appropriate access rights. Privacy constraints and access rights will determine the type and level of aggregation of data made available through the Tracking Network and state or local networks. The Tracking Network will provide the means to access core measures, summary (aggregated) data; and more detailed data as available from grantee sites.

3.6 Stakeholder Data and Assets

The Tracking Network also may provide secure access to or otherwise interact with multiple other data sources and services provided by stakeholders. These represent data, software tools, and services (e.g., geocoding services) that support Tracking requirements, but are not the same across all stakeholders.

3.7 Portfolio of Services

A set of services and data will be managed by the Tracking Network to support the needs of CDC and Tracking Network stakeholders. Efforts to plan and develop of the Tracking Network

are coordinated with other efforts at CDC focused on infrastructure for dataflow, data management, and data use. As a component of CDC's PHIN, the Tracking Network portfolio of services will expand on those already available through PHIN. Services available to network users will be dependent on users' defined network roles and may include the following:

- Metadata management;
- Data management, analysis and visualization tools and services;
- Standards, protocols, agreements; and
- Data search, exchange and access services: including messaging services for gateway interactions as well as secured grantee-to-grantee exchanges.

3.8 Tracking Network National Repositories

The services just discussed will be offered through the Tracking Network's repositories. The Tracking Network is designed to be distributed, i.e., most data will be managed by grantees, partners, or other stakeholders. Some data and metadata repositories, however, will be managed centrally by CDC through the Tracking Network's national portal. National repositories, or stores, may include core measures, aggregated data or other "summary information" as well as the data required for supporting services such as search tools and grantee information. The national repositories may also house metadata that are centrally managed on the Tracking Network. National repositories may be used for storage of other data as requested, by grantees or partners.

3.9 How Components Fit Together

Collectively, the components will work together to support the functions of the Tracking Network outlined in Chapter 2. Exhibit 3-1 depicts the technical aspects of this interaction. These are discussed in more detail in the three following chapters, addressing Network access, services, and content. The CDC Unified Process will be used to help identify specific requirements for implementation to determine more details on the workings of these components and their interactions with each other.

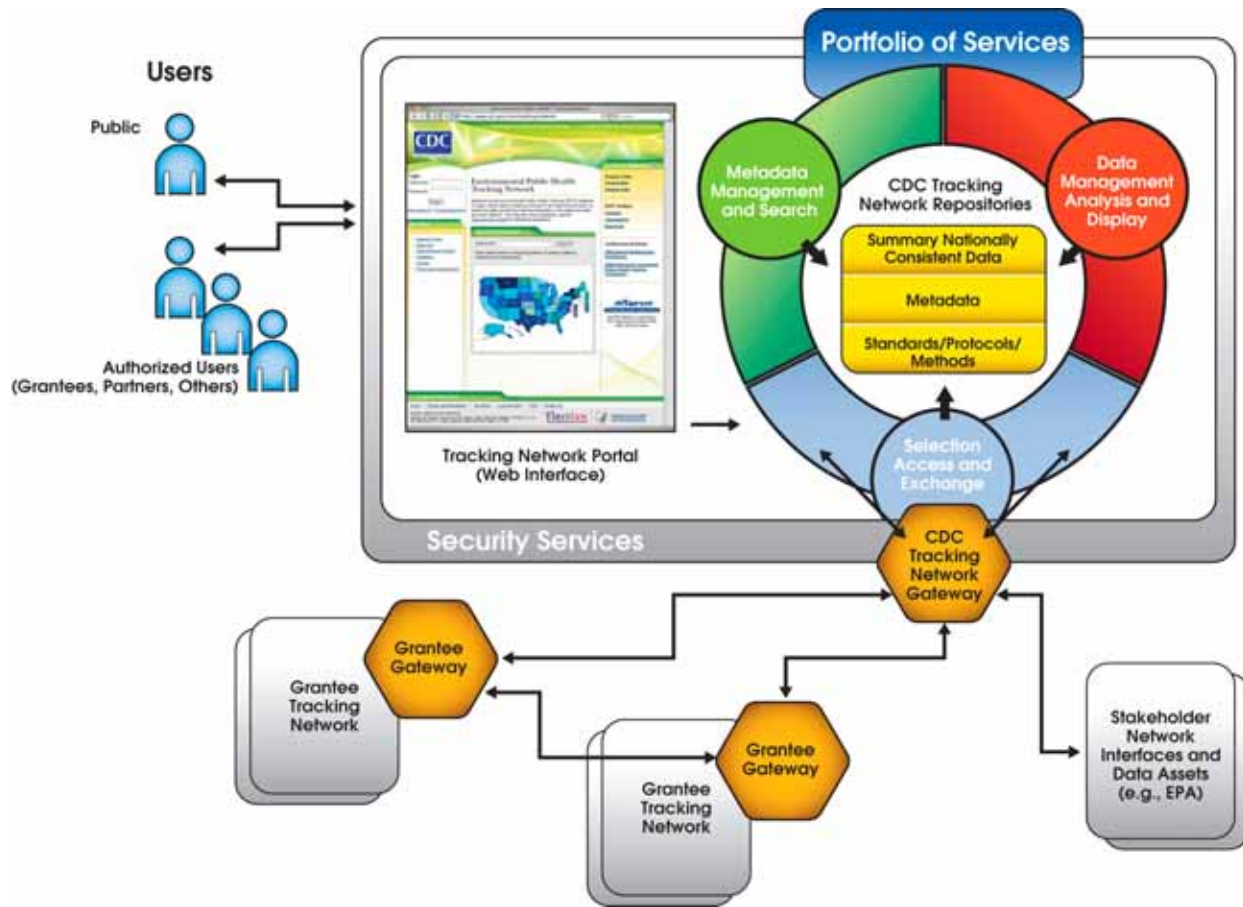


Exhibit 3-1: Interaction of the Tracking Network Components

4. How Is the Tracking Network Accessed?

Portals and gateways serve as the primary points of access to the data and services on the Tracking Network. A gateway on the Tracking Network is defined as the access and control point for secure and automated transmission of information between grantees and CDC. Gateways will consist of software and hardware that will be operated under standards and protocols for data exchange and access. A portal, on the other hand, is essentially a Web site designed to support a variety of applications and services, including management of secure access. A gateway supports machine-to-machine interactions, while a portal supports human-to-machine interactions.

This chapter covers Tracking Network interfaces that will be used to access the portfolio of services and data. There are many ways that CDC, grantees and partners might interact using the Tracking Network. Seven basic scenarios are displayed in Figure 4-1 and are described immediately following. Details about components described in these scenarios are included in the remainder of this chapter. Additionally, this chapter addresses the security services needed to ensure data privacy and confidentiality on the Tracking Network.

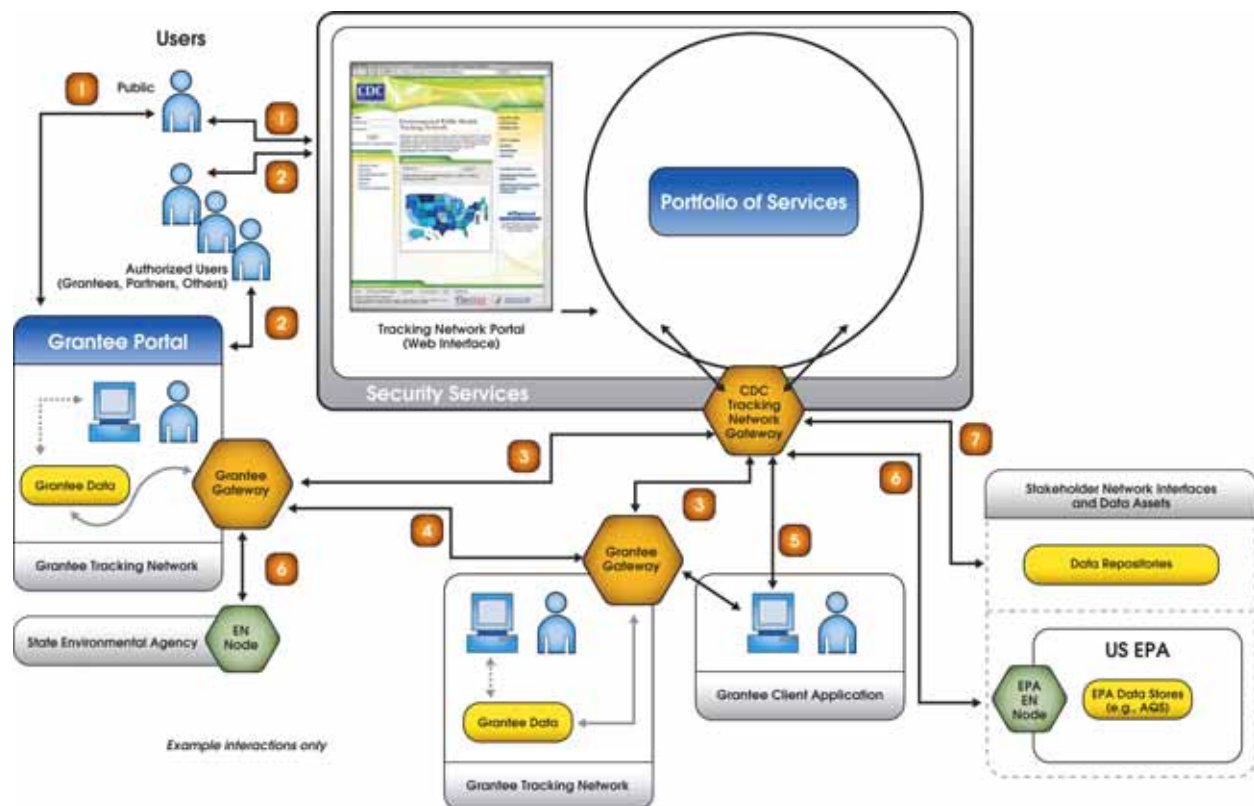


Exhibit 4-1: Tracking Network Interactions

Scenario #1: Public interaction with the Tracking Network portals

The public will be able to access information on the Tracking Network portals using a standard Web browser. They will have access to a limited set of data and services. For example, a public user may access the national portal to conduct a state-level comparison of childhood asthma rates. From the national portal the user may be linked to other CDC asthma data or to state data sets through the Tracking Network national gateway and state gateways.

Scenario #2: Authorized user interaction with the Tracking Network portals

Grantees and other authorized users such as academic partners will use a standard Web browser through a secure interface on the Tracking Network portals to contribute and access data and services for which they have authorization. For example, a grantee may log into the national portal to upload core measures to the CDC Data Repository.

Scenario #3: Grantee gateway interaction with the Tracking Network's national gateway

This interaction represents "machine-to-machine" transfers of information. Grantee gateways will send and receive data from the Tracking Network's national gateway using a secure interface. To facilitate this electronic interaction between the gateways, grantees will implement a standardized transport and message routing protocol specified by CDC. For example, a grantee may use their gateway to automatically update their metadata. This interaction is not intended to replicate data pathways that exist between grantees and other national partners, but to provide new ways to compile and examine existing data.

Scenario #4: Grantee gateway interactions

Grantees will use their gateways to interact with other gateways on the Tracking Network using secure interfaces to exchange information directly with other grantee networks. For example, grantees may use gateways to automatically refresh new case records with a joint Tracking grantee in an adjacent state.

Scenario # 5: Other grantee interactions with Tracking Network's national gateway

Some grantee interactions will not merit use of a full grantee gateway to move data. In these cases, grantees can send or receive data from the Tracking Network's national gateway using a compatible, secure application. For example, a grantee may use an automated application to periodically download CDC provided standard specifications for environmental health measures.

Scenario #6: Partner interface interaction with the CDC Tracking Network gateway

Tracking Network partners (e.g., EPA) who use their own exchange protocols will be able to interact with the national gateway using secure, interoperable (currently under development) messaging protocols. For example, an EPA node may periodically update air monitoring data to the CDC Data Repository.

Scenario #7: Partner and other stakeholder data repository interaction with Tracking Network national gateway

Other Tracking Network partners (e.g., Census Bureau; academic partners) or other stakeholders (e.g., researchers, non-grantee states) have data repositories and tools

which could be useful to CDC. Periodic exchanges of data with these partners and other stakeholders may be conducted using the Tracking Network national gateway, in a secure manner. For example, users on the portal may access the census data products, which are hosted by the U.S. Census Bureau. Data requests from the portal to the census data products may be routed through the national gateway.

The scenarios outlined above show many possible interactions between portals, gateways and other interfaces. In the initial phases, the Tracking Network may support only limited interactions. Additional interactions will be added as the network and user capabilities mature. The sections below provide details about the operations of the components and the role that they will play in facilitating interactions with the Tracking Network. The technical details for the components are currently being developed by the subgroups and teams of the SND Workgroup.

4.1 Tracking Network National Portal

The Tracking Network national portal will be hosted by CDC and serve as the primary point of human interaction with the Tracking Network. The Tracking Network national portal will be accessible on the Internet through a standard Web browser. As some of the data on the Tracking Network will be confidential, the Tracking Network national portal will have an interface for public access to summary statistics and non-confidential data and a secure interface to access secure data to authorized users.

4.1.1 Public Interface

The public interface to the Tracking Network national portal will enable stakeholders to access some data, services, and tools offered by the Tracking Network. This includes access to summary statistics and the ability to display the data on maps, tables, and charts where applicable. The interface will be designed to be accessible using a standard Web-browser. Public stakeholders will not be required to be authenticated or authorized to use these services though some registration may be required to facilitate customization of data and services to help support their needs. The administrator of the public interface will work closely with the data owners / stewards to identify data appropriate for public access.

4.1.2 Secure Interface

The secure interface to the Tracking Network national portal will enable stakeholders to access data and resources and utilize authorized services. To utilize the features offered by the secure interface, stakeholders will have to be authenticated and authorized by the Network Security Services. Interactions with the secure portal will also take place through a standard browser. Authorized stakeholders may be required to download and install additional plug-ins for their browser to enable advanced security features that ensure the confidentiality of the interactions.

4.2 Tracking Network National Gateway

The Tracking Network national gateway will serve as the primary point of machine to machine interaction with the Tracking Network. The Tracking Network national gateway will be

implemented by CDC and facilitate interaction with other systems which are either a part of the Tracking Network or have partnered with the Tracking Network. Gateways are not designed for human interactions but to automatically accept and send messages to other systems. To facilitate inter-system communication, gateways on the Tracking Network must use a common messaging protocol. This will ensure that data sets attached to messages sent on the Tracking Network are properly routed to intended recipient systems and are processed accordingly.

The Public Health Information Network Messaging System (PHIN MS) is being evaluated as one option for a messaging protocol for gateways on the Tracking Network. Messages to gateways will be constructed using a common protocol and gateways will be designed to route messages using the information specified in the messages. Common protocols may support the following actions:

- Message Construction;
- Message Routing;
- Secure Message Transport; and
- System Authentication.

4.3 Security

Access to Tracking Network data and services will be managed to ensure that only authorized users and systems will be able to access restricted data and services on the Tracking Network. Security will exist at both portals and gateways to ensure the secure transport of data and resources. Tracking Network security will focus on three primary areas:

- Access control (authentication and authorization);
- Preservation of confidentiality; and
- Data usage policies.

These are described in more detail below.

4.3.1 Access Control

Access control is implemented through two primary processes, authentication and authorization.

4.3.1.1 Authentication

Authentication is the process of verifying that a subject, either a user or a machine, is who he, she, or it claims to be (i.e., certifying or proving that someone or something is genuine.) The authentication process requires that the subject present evidence, or a credential. The credential is then checked or verified against an authority. The Tracking Network will support authentication of users, machines, and/or messaging services.

4.3.1.2 Authorization

Different users on the Tracking Network will have different levels of access to network contents. Authorization establishes a user's rights to access particular data or services. Policies related to authorization will be enforced by the Security Services which will be used

to authorize access to the Secure Interface of the Tracking Network portal and the Tracking gateway. The Security Services will maintain an identity store that will contain security credentials and access rights for authorized users.

4.3.2 Protection of Confidentiality

Information on the Tracking Network will be exchanged using the Internet. Due to the confidential nature of some information, the Tracking Network must adopt mechanisms and protocols to ensure that information being exchanged is only accessible to authorized users. Robust encryption systems will help to ensure this. Confidential information exchanged with the Tracking portal and the gateway will be encrypted using industry standards to safeguard the data during transport across the Internet.

4.3.3 Data Usage Policies

The Tracking Network can use technology to enforce security while data are on the network. Once the data have been downloaded, however, from the Tracking Network, users will have the responsibility to maintain security. The Tracking Network will ensure that mechanisms are in place to ensure that users have established rights of access and have agreed to appropriate levels of security required for the data, including how they are used, maintained, and stored. The metadata that accompany the data contain fields for usage restrictions which can be filled in by the data owner / steward. The Tracking Network national portal can inform users of any usage restrictions before data are downloaded and ask users to accept a confidentiality agreement before download is permitted.

4.4 Grantee Tracking Network Interfaces

Given the unique nature of each local and state network environment, grantees will develop their own interfaces to facilitate interaction with the Tracking Network. These interfaces, however, will be based on templates and examples to be provided by CDC, based on recommendations from SND, and will depend on common standards and protocols to facilitate interoperability.

4.4.1 Grantee Gateways

To interact with the Tracking Network national gateway and other grantee gateways, grantees will implement interoperable gateways that use a standard messaging protocol. Grantee gateways will use the security services for authentication and authorization for interactions with the Tracking Network national gateway but may choose to use their own internal security mechanism for exchanges with other grantee gateways, as long as CDC security requirements are maintained.

4.4.2 Grantee Portals

Grantees will develop their own portals which will provide information important to their constituents. These portals will be linked to the Tracking Network's national gateway to enable access to services or functionality provided solely by the national gateway. The level of

sophistication and the services offered by the grantee portals will depend on grantee investments and needs. These investments and needs are addressed in grantee network implementation plans. The SND Workgroup will develop recommendations for standard portal attributes that grantees may adopt.

4.4.3 Grantee Client Applications

Some grantees may not initially install gateways, but may run other applications that allow access to a gateway. These applications will allow the grantees to have the ability to perform basic interactions with the Tracking Network national gateway or other grantee gateways, but will not have all of the functionality of a gateway. The applications will allow the grantee to use the security services for authentication and authorization, but may have limitations.

4.5 Stakeholder Tracking Network Interfaces

In addition to grantee gateways which will use common protocols and standards to exchange data, the Tracking Network national gateway will also interact with federal and academic partners and other stakeholder organizations that may not use the same protocols for data exchange.

4.5.1 EPA Exchange Network Nodes

The EPA's Exchange Network is designed to facilitate information sharing between state environmental agencies and the EPA Central Data Exchange (CDX). EPA and CDC are currently testing mechanisms to exchange data between their respective networks. Once a mechanism is finalized, it is expected that EPA Exchange Network Nodes will be able to interact with the Tracking Network gateways. Exhibit 4-2 depicts multiple pathways among Exchange Network nodes and Tracking Network gateways. These are described below.

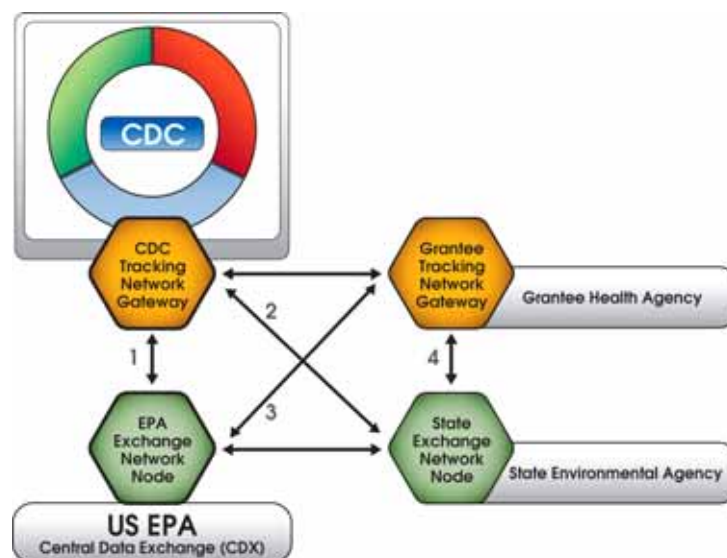


Exhibit 4-2: Possible Partner Interactions on the Tracking Network

Interaction between CDC Tracking Network gateway and EPA CDX Node

1. Interaction between state environmental agency node and CDC Tracking Network gateway
2. Interaction between grantee gateway and EPA CDX Node
3. Interaction between grantee gateway and state environmental agency node.

All or some of these pathways may be utilized depending on the nature of the data being exchanged. A potential option is for grantees to use the CDC Tracking Network gateway as a proxy to access data on the EPA Exchange Network Node. The exact nature of these interactions will depend on which agency decides to host a translator that will interpret messages coming from the other network. The security and exchange protocols for these interactions are in development.

4.5.2 Other Applications

To facilitate access to data and services by other stakeholders without having to create an interoperable infrastructure, the Tracking Network will provide an application that enables these stakeholders to interact with Tracking Network services. These applications may be used to manage data sets from agencies, such as NASA and the U.S. Census Bureau, in to Tracking Network gateway. This application will be similar to a gateway client but will allow users to customize certain aspects to work with their own protocols and systems.

4.6 Implementation Activities for Tracking Network Access

Exhibit 4-3 lists the implementation steps that should be conducted to deploy the CDC Tracking Network portal and gateway as well as the grantee and partner interfaces.

Exhibit 4-3: Implementation Activities for Portals, Gateways, and Interfaces for the Tracking Network

Activity	Responsible Entity
2006	
Explore approaches for data exchanges based on different transport mechanisms (e.g., PHIN MS).	SND Network Architecture Subgroup, CDC
Continue exploration of options for interoperability with the EPA Exchange Network.	CDC, SND Network Architecture Subgroup, Tracking Network Partners, Grantees
Examine options for network security protocols.	SND Security Subgroup, CDC
Begin Tracking Network national portal and gateway development, including security, metadata, analytical tools, transport, and services.	CDC
2007	
Test options for network security protocols for the Tracking Network.	SND Security Subgroup, CDC, Grantees
Make recommendations to CDC on security protocols for the Tracking Network	SND
Review, revise as necessary, and adopt security protocol recommendations made by SND	CDC
Conduct training on Tracking Network security infrastructure for grantees to begin integration with state/local networks.	CDC

Activity	Responsible Entity
Begin implementation of Tracking Network national portal and gateway security infrastructure.	CDC, Grantees
Conduct pilot exchanges with EPA Exchange Network nodes and the Tracking Network national gateway.	Grantees, CDC, Tracking Network Partners
Examine options and share approaches for grantee gateway and portal implementations.	SND, Grantees
Provide training, planning assistance, and tools for grantees to implement portals and gateways (including messaging protocols).	CDC
Test grantee gateways and local installations of messaging protocols	Grantees
Begin exploration of the development of 'data brokers' to exchange data among partner organizations	Grantees, Tracking Network Partners, SND, CDC
2008	
Deploy Tracking Network national portal with data tools (secure interface) using security infrastructure.	CDC
Deploy Tracking Network national portal with data tools (public interface) for public access.	CDC
Deploy grantee gateways to support secure data exchanges with the Tracking Network national gateway, other grantee gateways, and partner interfaces.	Grantees
Conduct pilot exchanges using grantee gateways with other partner organizations.	CDC, Grantees, Tracking Network Partners
Establish full interoperability between Tracking Network gateways and the EPA Exchange Network.	Grantees, CDC, Tracking Network Partners
2009	
Continue to refine functionality of grantee gateways and portals	Grantees
Establish interoperability with additional Tracking Network partners.	Grantees, CDC, Tracking Network Partners
Continue to evaluate and make recommendations regarding Tracking Network security infrastructure.	SND Security Subgroup

5. What Services Does the Tracking Network Provide?

The technical components described in Chapter 4, are designed to provide an infrastructure for a specific set of Tracking Network services. These services are intended to directly support environmental public health practitioners and provide the public and other stakeholders access to improved Tracking information. The Tracking Network exists, in large part to support these services, and in-turn their users. Like users of the Internet, Tracking Network stakeholders will expect the operation of the infrastructure components to be easy to use. They will use the Tracking Network to search for and select data, access those data, and analyze them with tools; many without interest in the underlying mechanisms making it all possible.

This chapter provides an overview of the Tracking Network's portfolio of services (Exhibit 5-1). In sections below are a rationale for considering Tracking Network services as a portfolio, criteria for selection of services, and technical approaches to the deployment of tools and services. The chapter then specifically addresses the types of services that will be available, including the following:

- Tracking Network repositories;
- metadata management and search;
- data selection, access, and exchange; and
- tools for data management, analysis, and visualization.

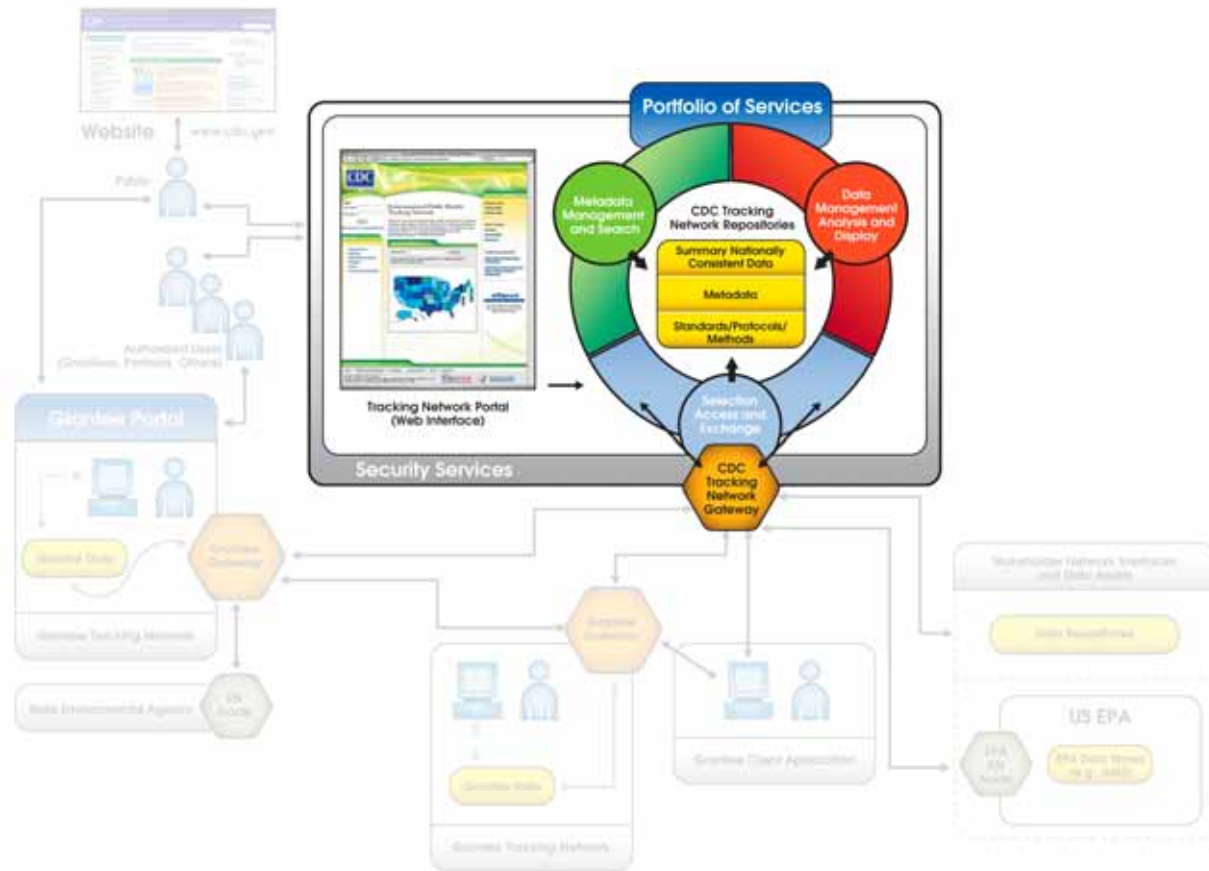


Exhibit 5-1: Portfolio of Services

5.1 Rationale for a Portfolio of Tracking Network Services

The Tracking Network is envisioned both as a data communications infrastructure and a secured access point for relevant, managed, environmental public health informatics data and services. In its first generation, significant investment will be needed in the infrastructure for these services (as described in Chapter 4). Initially the Portfolio of Services will be limited in scope, but will grow with the Tracking Network. This NNIP outlines the development of an ongoing process by which these services are evaluated, refined and expanded.

The analogy of “portfolio” for these services, tools and data is used for the following reasons:

- The capabilities are the collective “assets” of the Tracking Network. They are what make the Tracking Network useful, and used;
- The assets and their inter-relationships are better managed as a whole to leverage the network synergies they offer;
- The assets are expected to be dynamic, in response to the requirements of CDC, grantees, and partners and to evolve, individually, at different paces. Some services may be added to test possible utility to stakeholders, and some may be removed if they are not being used.

Ultimately, this portfolio is managed to leverage the common investment and make available to all authorized users, functionality that few could afford to develop individually. Tracking Network tools, if properly identified and hosted can provide significant value (both individually and collectively) to Tracking Network users. This value will likely justify the significant investment required to achieve this functionality.

5.2 Criteria for Selecting Tracking Network Tools and Services

Tools selected for the Tracking Network should, above all, be well designed and easily available. Based on the interviews and site visits conducted in the preparation of this NNIP, four additional criteria should be used to select Tracking Network tools:

- Tools must be relevant to the specific tracking objectives of users;
- Tools must “embed” significant environmental public health knowledge, algorithms and methods;
- Tools must leverage connectivity provided by the Tracking Network to known methods and integrate multiple data sources (and ultimately other applications);
- Tools must be aligned with other tools provided by CDC.

Achieving these criteria will require significant interaction with tool developers, users and those responsible for mounting the tools on the Tracking Network. As identified in the implementation task table below, CDC, in coordination with grantees, academic partners, and other stakeholders, will oversee this process, and the overall process of tool identification, prioritization, investment and hosting.

5.3 Deploying Tools on the Tracking Network

Tracking Network tools will be deployed through two mechanisms: tools for download from the Tracking Network that will run on local desktops and “online” tools, which will be accessed and operated through the Tracking Network national portal. The first approach, which brings the tool to the data, is supported by Network users downloading tools to their desktops and manipulating local data. The second approach depends upon the architecture of the portal and gateway (either national or state) to bring the data to the tool. Over time, as grantees and partners develop full interfaces to the Tracking Network, online tools will directly access stakeholder data via these interfaces. Online tools initially deployed will use one of two approaches (depending on the nature of the tool itself). These are:

- Temporary Virtual Private Workspaces: Portal users will temporarily transfer and store data in a super-secured “vault” accessible only to that user and the selected tool for a defined period of time. Data in the vault will be inaccessible to all other users, including administrators of the portal such as CDC. Such applications are commonly deployed commercially to support hosted applications that deal with sensitive data.
- User installed special purpose interface: Under this approach users will install a special purpose adapter to “bridge” their local data stores with the tool. These adaptors are designed largely for “point-to-point” connections. For example, SAS is a widely deployed

application suite for analysis. SAS provides such adaptors, specialized to connect disparate SAS (and some other) data assets into a single virtual dataset. Data are required to move from the local store to the application, but only as needed, and are typically erased as soon as the application session is ended.

While most (but not all) Tracking Network users can download and install simple desktop applications, such local implementation may be impractical as security procedures become more restrictive and applications grow in complexity (for example requiring statistical and database engines). For this reason online provision of tools is likely to be of growing importance on the Tracking Network. Deployment of “online” tools, however, presents significant technical challenges. Foremost among these is how the application, which will be hosted centrally, can be connected to secure data located on remote systems (e.g., at grantee sites). The sensitivity of the data and the complexity of the interactions raise challenges for the Tracking Network. Over time, however, it is likely that the Tracking Network will acquire, develop and integrate a significant portfolio of online applications, tailored to the priorities of users, which, via the Network national, state, and local gateways, could draw on a rich set of data sources.

5.4 Tracking Network National Repositories

In addition to the infrastructure of the national portal and gateway, CDC will establish Tracking Network national repositories. Although, by design, the Tracking Network will be a highly distributed architecture, initially some information will be centrally stored for use by the portfolio to provide services. National repositories will include the following:

- National metadata repository: stores directory and description data in support of the metadata management and search services, this will include metadata about grantee and partner assets;
- National standards, procedures, methods repository: to provide a basic “library” function where users can access a growing collection of the Tracking Network underlying content, technology security and other standards;
- National core measures and summary data repository: to store, for user and public access, core measures and summary forms of nationally consistent data;
- National repository of other relevant Tracking resources – e.g., national directory used to support role-based access.

These national repositories will expand as needed to support priority services; however, they are not intended to act as a general purpose data warehouse for CDC, grantees or other stakeholders.

5.5 Metadata Management and Search

Supporting the ability of users to find and assess relevant data is a core function of the Tracking Network. Users will be able to search all Tracking Network assets via the national portal and gateway. The national portal will provide access to the Portfolio of Services and the functionality to search metadata to assess and select data for analysis and / or download. Search services provided across the grantee and national gateways will allow authorized

applications to execute searches on the Tracking Network and return results to the user. The Tracking Network search system will be composed of the following parts:

- Tracking Network metadata standard: standardized content and format for the information used to locate and describe data assets;
- National metadata repository: a central repository where Tracking Network metadata are stored, searched and managed;
- Metadata management tools: national portal based, (and possibly a stand alone application) used by contributors to create and manage metadata for their assets;
- Search engine: standardized mechanism to search metadata and other assets (such as documentation, reports or other metadata); and
- Portal search application: application mounted on the national portal that will provide access to the search engine and metadata management tools.

5.5.1 Tracking Network Metadata Standard

The SND Workgroup has recommended to CDC the use of a subset of the Federal Geographic Data Committee (FGDC) Metadata Standard, which will form the core metadata for environmental public health tracking. The workgroup coordinated with the FGDC to determine this approach. The current standards form the minimum core metadata that will be required for resources on the Tracking Network. The current standards were adopted primarily with data sets in mind but may be adaptable to other Tracking Network assets. The metadata standard is discussed in more detail in Chapter 6.

5.5.2 National Metadata Repository and Management Tools

In the early stages, the Tracking Network will implement a national metadata registry with centrally stored and managed metadata. As the Tracking Network develops and more data and core measures are added, it is expected that grantees and partners will develop metadata registries locally. Eventually the Tracking Network will support the ability to search across all of these. First generation metadata management tools will provide the capability to create, edit, import and upload metadata. This functionality will be provided over the portal, and (optionally) as a stand alone application.

5.5.3 Metadata Search Engine Tool

The Tracking Network search engine will initially be hosted centrally within the national portal. It will provide the capability to search within and across Tracking Network metadata. Initial deployment will provide a basic search function (with parameters based on the metadata standard) and a full text search function. Users will be able to switch easily between searching and browsing, using their own terminology for a search while learning the organization and vocabulary of the data. Metadata search tools will provide a simple, easy to use interface.

5.5.4 National Portal Search Application

The national portal application will allow context sensitive search functions, as well as allow users to move from the discovery of a given data asset to inspection and access. An example mock up of the application interface is shown in Exhibit 5-2.

Exhibit 5-2: Example Tracking Network Search Interface

5.6 Data Selection, Access, and Exchange Services and Tools

Other service components of the Portfolio include data selection, data access, and data exchange. These are described below.

5.6.1 Data Selection and Access

Once users have discovered or identified a data asset of interest, they must select and access those data, before they can be available for data management, analysis, and display. Data access will be role-based. Depending on the user's role, authorization may require procedures such as a data sharing agreements.

Many applications and related data sharing portals provide the capability to designate and “bundle” desired data sets such that they can be integrated or otherwise processed together. By analogy this selection process can be envisioned as a “data shopping cart.” This functionality will be provided over the Tracking Network portal. It will likely be combined with basic viewing and descriptive statistics functionality. Because data selection is an inherently manual process, this service is not as applicable for provisioning over the gateway.

Once data have been selected they must be accessed. Stakeholders will access Tracking Network data using the following approaches:

- Browsing the data via portal applications;
- Downloading data via the portal for local processing;
- Using another interface application (grantee or partner) to request the data from the Tracking Network gateway (or the gateway of the grantee or partner hosting that data).

5.6.2 Data Exchange

In many cases (especially early in the Tracking Network's deployment), users may discover, via metadata on the national portal or other mechanisms, data sets which are not "on" (published via a gateway or portal) the Tracking Network. In these cases, after negotiating the required access privileges (and documenting them in a data sharing agreement, if required) users will need a mechanism to securely transfer the data from one or more sites. CDC and the grantees will also need these kinds of transfers for aggregation of nationally consistent data and development of core measures. These types of transfers are termed "exchanges." For exchanges between grantees and CDC, various options may exist such as:

- Use of a portal's secured upload and download functions;
- Use of a CDC provided (or other) gateway to send/receive data directly from the national gateway using a common messaging protocol;
- Use of other networks such as the CDC Secure Data Network or EPA Exchange Network.

One way for exchanges to occur between individual grantees and/or authorized stakeholders with gateways is the use of a gateway interface application to send/receive data using the standard messaging protocol. Such applications could be provided in the form of a desktop application or Web-browser plug-in that emulates secured email using the Tracking Network standards messaging protocol.

5.7 Tools for Data Management, Analysis, and Visualization

Both the CWG and the SND Workgroup will consider candidate tools for management, analysis and visualization of environment and health data. Recommendations from these workgroups will be reviewed by CDC and adopted as appropriate. In addition, CDC is identifying tools for the Tracking Network, such as the Rapid Inquiry Facility (RIF) that combines basic data management, analysis (statistical and spatial), and mapping functionality.

5.7.1 Data Management Tools

Data management is the process of redefining and re-formatting data based on a set of predefined rules or algorithms. Basic data management functionality is widespread in many applications. In most cases, it is the specification of the pre-defined rules and algorithms that make the data management tools especially useful, for example converting data from one standard format or measure to another.

Special-purpose tools are often developed for specific data functions used in a given field, such as biostatistics. The Tracking Network data management tools will focus on rule sets that have been developed or adapted specifically for environmental public health and that are based on standards, methods, or procedures evaluated and implemented by participants. Exhibit 5-3 identifies the data management activities that have been discussed with SND and other grantees.

Exhibit 5-3: Examples of Needed Data Management Services

Data Development Activity	Description
De-identification of data	Removal of identifying characteristics from data records to provide a specified level of confidentiality with a minimum loss of the data's tracking and analysis value. (Data contributors will de-identify data as appropriate based on data sharing agreements.)
Locational Referencing and Analysis	Actions that convert, improve, and / or infer locational references in a data set. These actions include those based on conversion and referencing of address, census tract, or case event data. Locational referencing is an important dimension for data integration and exposure/hazard estimation (see next item) and is often referred to as geocoding.
Tailoring of Environmental Monitoring Data for Public Health Use	Actions to convert or transform environmental monitoring data with which public health practitioners may not be familiar, to make it compatible with public health data and uses
Integration and Access of other Priority Tracking Network Data Sources	Actions designed to support integration of other priority data sources to support development of nationally consistent data and measures.
Estimation via Model	Many relevant data sources require significant modeling to derive useful estimates for key parameters (e.g., exposure). These models can be thought of as data management services taking in raw data and providing out (changing them to) parameter estimates.

5.7.2 Tools for Analysis and Display

Once data have been selected, referenced, and refined, the Tracking Network, and Reporting (AVR) Toolkit. Grantees, partners and CDC have identified, developed and adapted numerous public health and environmental public health tools. These tools will be early candidates to transition to the Tracking Network. The following analysis and display tool requirements have been identified by grantees in various discussions.

5.7.2.1 Spatial Analysis

One of the primary purposes of locationally referencing or geocoding environmental and health data is to be able to spatially analyze and display data. The ability to conduct environmental public health tracking is, in many ways, dependent on the ability to establish associations between hazards in the environment, exposures to these hazards, and health conditions. These associations are frequently established on the basis of common time frames and common locations (e.g., individuals with specific health conditions have been in proximity to certain environmental hazards within a specific time frame). The results of these types of analyses may be displayed in a variety of forms. A surface or map that shows risk of "exposure" could be generated, or "hot spots" might be depicted. The RIF mentioned earlier is an example of a tool that provides mapping capability.

5.7.2.2 Advanced Statistical Analysis

Public health practitioners may use a variety of methods and software to conduct statistical analysis and display of data. The Tracking Network will provide a mechanism for users to easily access analytic tools that will facilitate standardization of analyses. Many grantees already have access to the common tools such as SAS, SUDAAN, and ArcView. Many

statistical software packages include features to produce attractive reports that could be made available for users of the network.

5.8 Implementation Activities for a Portfolio of Services

Exhibit 5-4 below outlines the major activities that are required to implement a portfolio of services on the Tracking Network.

Exhibit 5-4: Implementation Activities for a Portfolio of Services

Activity	Responsible Entity
2006	
Examine options for geocoding tools to be used on the Tracking Network.	SND Geography and Locational Referencing Subgroup
Develop metadata template and begin to examine options for metadata tools and registries to organize and manage metadata on the Tracking Network.	SND Metadata Subgroup
Refine metadata template to address data quality for describing nationally consistent data and measures.	CWG, SND Metadata Subgroup
Begin examination of tools for data analysis, visualization, and display.	CDC
2007	
Recommend tools for geocoding as appropriate to CDC for use on the Tracking Network.	SND
Recommend templates, tools, and registries for metadata creation and management to CDC for use on the Tracking Network.	SND
Review, revise as needed, and adopt SND recommendations on standards and guidelines for metadata, addressing, geocoding, and georeferencing.	CDC
Conduct training for grantees on metadata creation and management.	CDC, SND Metadata Subgroup
Examine options for and make recommendations to CDC on metadata for Tracking Network content other than nationally consistent data.	SND Metadata Subgroup, CWG, SND
Create, make accessible, and test repositories of sample data and metadata.	CDC, Grantees
Test, assess, and make recommendations to CDC for tools for data analysis, visualization, and display.	Grantees, CWG, SND, CDC
Test, assess and make recommendations to CDC on tools for search, selection, access, and exchange of tracking data across organizations.	Grantees, SND, CDC
Review, revise as needed, and adopt SND and CWG recommendations on tools for search, selection, access, exchange, analysis, visualization, display, and asset metadata for use on the Tracking Network.	CDC
Begin to develop metadata for grantee/partner data and assets.	Grantees
2008	
Deploy Tracking Network national portal with data tools (secure interface) using security infrastructure.	CDC
2009	
Continue to identify needs for tools and services on the Tracking Network	CWG, SND, Grantees, CDC
Continue to examine, test, and integrate advanced tools and services on the Tracking Network.	SND, CDC, Grantees, Tracking Network Partners
2010	
Continue to explore, develop, and integrate advanced tools and services on the Tracking Network.	SND, CDC, Grantees, Tracking Network Partners, CWG

6. What Content Is on the Tracking Network?

The Tracking Network will include a core set of nationally consistent data and measures about health, exposures and hazards. Health data in the Tracking Network will focus on non-infectious health conditions, such as poisoning by carbon monoxide or lead, asthma and other respiratory disease, cancers, and birth defects. With further development, the Network will also begin to address emerging issues such neurodegenerative and autoimmune diseases. Exposure data include observations of the presence of an environmental agent or its metabolite in individuals, such as lead or cotinine in blood and arsenic in urine. Hazard data may include chemical agents (e.g., pesticides), physical agents (e.g., dust particles), and biologic toxins (e.g., harmful algal blooms) that may be found in air, water, soil, food, or other environmental media. Hazard data may be obtained by direct measurement or by use of models. Examples of hazards are arsenic in drinking water and ambient ozone levels. Examples of Tracking Network content are provided in Exhibit 6-1.

The vision for the National Network is to facilitate access to environmental health information. This may be accomplished several ways: (1) CDC and grantees will develop nationally consistent data and core measures that will be accessible via the Network; (2) CDC will work with Federal partners who have existing national data repositories (e.g., CDC's WONDER (<http://wonder.cdc.gov/>) and the Census Bureau's Data Ferrett (<http://dataferrett.census.gov/>) to integrate and leverage these existing resources and avoid duplication of effort. The CWG will play a major role in identifying existing resources and making recommendations to CDC on how they can be used for environmental health tracking.

This chapter describes two major categories of content that will be available on the Tracking Network: "measures and data" and metadata. "Measures and data" include a core set of nationally consistent data and measures described in Chapter 2, as well as other data grantees, partners, or other stakeholders may make available on the Tracking Network. Metadata will be made available for all data on the Tracking Network. Two aspects of metadata are described: structure / standards and types of information. Tools are also a category of content, but were described in detail in the previous chapter, so are not discussed herein.

Exhibit 6-1: Examples of Tracking Network Content

Tracking Network Content Types		Examples
Nationally consistent data and measures	Data and measures compiled using Tracking Network guidelines or standards for format, compilation, and analysis.	<ul style="list-style-type: none"> Numbers and rates of low birth weight by county or lowest geographic level that can ensure protection of confidentiality. Definitions of low birth weight and analysis used will be the same across all jurisdictions.
Other Data	Data collected by Tracking Network stakeholders that do not necessarily conform to specific standards	<ul style="list-style-type: none"> A linked data set containing geocoded childhood blood lead levels and housing stock data for a particular metropolitan area A multi-state model of ozone concentrations based on 2001 monitoring data from the EPA.
Metadata	Data about the data, measures, and other Tracking Network assets	<ul style="list-style-type: none"> A searchable database providing information about the items above. Metadata can include contact information for the data owner, data attributes, access and use restrictions, and other data.
Tools	Methodologies	<ul style="list-style-type: none"> Guidelines for ensuring data quality and linking data. Air modeling protocols Data collection methodology or best practices
	Models for practice	<ul style="list-style-type: none"> Model laws Data sharing agreement templates
	Software or shareware	<ul style="list-style-type: none"> Metadata input tools Mapping tools Software to conduct spatial or statistical analyses for Tracking

The sections below address the two major categories of content in more detail, including the meaning of terms, and processes by which core measures are selected, standards will be identified and implemented, and data will be made available to the Tracking Network. Data protection and confidentiality are also discussed. These are critical issues that require ongoing discussion with data owners/stewards to balance concerns of risk to individual privacy against the need for information that can protect the health of the public. Activities needed to address content on the Tracking Network are described in the final section.

6.1 Nationally Consistent Data and Measures

Standards for data and core measures will be developed for use in the Tracking Network. With funding from CDC in 2006 for Tracking Network implementation, states and localities will assist CDC in developing and adopting standards for nationally consistent data; defining appropriate core tracking measures; and ensure the availability and accessibility of data for development of these nationally consistent core measures. The CWG provides the mechanism for grantees, academic and federal partners and other stakeholders, including data owners/stewards, to identify and recommend standards and core measures to CDC for use in the Tracking Network. Recommendations may include, but are not limited to, case definitions; desired geographic and temporal referencing; adopting of existing data vocabularies or formats; or data transformation or analysis methods. The CWG will make recommendations about other types of information that are important to consider and collect, such as demographic or community characteristics that are predictors of health or environmental exposures. Grantees, in close collaboration with data stewards, will make available on the Tracking Network information and data that adhere to

guidelines and standards adopted by CDC for the National Tracking Network. The detailed data to support development of core measures will be maintained on state or local networks and may be accessed through the national portal or grantee portals. Some “summary data” will be provided by grantees and maintained by CDC in a data repository (see Section 5.4). An example of summary data may be the annual number of hospitalizations for carbon monoxide poisoning by county, state, or nationally. CDC will utilize these data in compiling regional and national statistics on the state of environmental public health in the United States

6.1.1 Common Case Definitions

National surveillance case definitions exist for some environmental diseases or conditions, such as carbon monoxide poisoning, asthma, and elevated blood lead levels. These national surveillance case definitions were jointly defined and approved by CDC and the Council for State and Territorial Epidemiologists (CSTE). Existence of a national case definition, however, does not ensure its uniform use. For example, to monitor childhood lead poisoning, CDC recommends tracking the number of children tested for lead and the number of confirmed elevated blood lead levels. While a case definition for a confirmed elevated blood lead level exists, not all states analyze their blood lead data using the recommended case definition. Ideally, to achieve national consistency, all blood lead level data on the Tracking Network would be analyzed using the case definition for confirmed elevated blood lead level developed jointly between CDC and CSTE. New case definitions may need to be developed for some conditions.

6.1.2 Geographic and Temporal Referencing

All data on the Tracking Network should be spatially and temporally referenced. The use of coordinates (geographic referencing) or other geographic locators is critically important to the use of environmental public health tracking data. Understanding the proximity of people with specific health conditions to the location of environmental hazards can often generate hypotheses about possible associations. When using location to estimate possible exposure to an environmental hazard, it is important to consider how much time is spent at place of residence and school, or work. Exposures may vary by time of day and season.

Location can be identified in various ways, including street address, latitude/longitude, ZIP codes, census tract, city, and county. Both zip codes and census tracts are commonly used but can change over time. The more accurately something is geographically referenced, the more accurately it can be integrated with other geographic data sets. The geo-referencing that is conducted will be performed in such a way as to protect identities as necessary. Geographically referenced data may be derived by digitizing or scanning maps, processing address lists to develop coordinates, or using GPS devices to develop coordinates during field sampling.

Understanding the temporal aspect of data (e.g., the frequency of data collection; the duration of the exposure to an environmental hazard, the time of day; and the day, month and year of sample collection or diagnosis) is also important because it can offer clues about whether some environmental hazards could be related to specific health effects. For example, timing of exposure is critical for many types of birth defects; during fetal development, there are specific stages of organ development when exposure to contaminants is likely to result in specific birth defects. When assessing whether a specific birth defect could have resulted from a contaminant in the community, it is important to consider whether the mothers of the children with the birth defect had lived in that community during their pregnancy.

6.2 Metadata

Metadata, defined as data about data, are needed for all data on the Tracking Network. Development and use of metadata must consider what about a data set will be described and how those descriptions will be captured, stored, and managed. Metadata can describe available sources of data such as cancer, birth defects and vital statistics registries, as well as environmental data sources useful to environmental public health. The types of information provided by metadata should include descriptions of data quality, accessibility and limitations. Information in metadata allows stakeholders to determine which data are most appropriate for their intended uses. Metadata standards will ensure that consistent information is included in the metadata to promote searching and identifying data of interest. The SND Workgroup recommended an initial set of standards based on a subset of the Federal Geographic Data Committee (FGDC) metadata standard that includes the following elements:

- Identification and Description
- Citation (originator, publication date, title URL)
- Description (intended use, limitations, supplemental information)
- Time period (currency of information, duration of event information)
- Status (progress and maintenance information)
- Spatial domain (north, south, east, west bounding coordinates)
- Keywords (to be defined)
- Entity and attributes
- Detailed summary of the information contained
- Metadata reference
- Metadata creation date and contact
- Metadata standard used
- Access and use restrictions
- Beginning and end dates
- Contact information
- Organization
- Address, email, and phone number

Several challenges related to implementing metadata have been identified. First, the current version of the Tracking Network metadata template does not explicitly include elements that describe characteristics of data quality (e.g., accuracy, completeness, comparability). These can be captured under the detailed summary of entity and attributes, but a more structured format would facilitate use. Second, metadata templates do not exist for describing other tracking assets such as tools. Third, metadata are most valuable when updated regularly. This requires procedures to ensure regular maintenance as well as time and resources on the part of data creators / owners / stewards. The SND Metadata Subgroup will work with the CWG to address these challenges.

Metadata repositories and registries will manage metadata. These were described in Section 5.4.

6.3 Selection and Standardization of Data and Measures

Unfortunately, many environmental public health conditions are not reportable at the state or federal level, meaning that few environmental health conditions are currently tracked. As guidance to states and localities funded for tracking network implementation in 2006, CDC defined an initial set of data and measures that would be targeted for use in the Network. The selection of these initial measures and data to support them was based on a review of priorities and lessons learned from local, state and national Tracking Program activities and planning efforts conducted from 2002 to 2006. It is the aim of the Tracking Program to increase the number of core measures and nationally consistent data that are tracked each year by all grantees. The CWG will recommend additional core health, exposure, and hazard measures for the Tracking Network and nationally consistent data to support the development of these measures. Partner data, such as from EPA's air quality system or CDC health registries and national surveys, will be accessible through the Tracking Network as interoperability is established (see also Chapter 4).

6.3.1 CDC-Selected Data and Measures

CDC has defined the initial set of data and core measures to be made available by 2008 as: hospitalizations for asthma and myocardial infarction, ambient levels of particulate matter and ozone, data/information on key drinking water contaminants (to be defined through the CWG), and data/information from at least two of the following data sources or tracking systems: birth defects, cancer, child blood lead levels, or vital statistics. By September 2010, all of the above will be tracked and made accessible via the Tracking Network. The CWG will refine this initial set of data and measures provided by CDC to better define the measures being used, the methods used to develop each measure, and the standards that the underlying data must meet to be considered "nationally consistent." In the future, CDC may identify national-level data needs that drive the development of new nationally consistent data and measures for the Tracking Network.

6.3.2 CWG-Selected Data and Measures

The CWG will assess and prioritize determinants of health in selecting additional core measures and data to recommend for inclusion in the National Network. Data selection criteria, such as those used by CSTE and CDC in developing environmental public health indicators, may be used to establish priorities. The criteria may include science, public health importance, public concern, feasibility, public health capacity/resource needs, and the degree to which exposures can be avoided.² Periodically, nationally consistent measures and data will be evaluated to assure their continued utility and accuracy.

Initial priorities are likely to be given to environmental public health concerns with well established etiology. Approaches for organizing data around "emerging environmental public health issues" on the Tracking Network will be addressed in the future. For example, an emerging health concern is carbon monoxide poisoning. A workgroup has been developing

² CSTE 2006 Environmental Public Health Indicators: A guide for monitoring the occurrence of environmentally-related exposures and diseases. Available at: <http://www.cste.org/pdffiles/Environmentalpublichealthindicators.pdf> (Accessed February 2006)

approaches for surveillance of carbon monoxide poisoning and is developing a surveillance case definition. Another area of importance is availability of biomonitoring data. Biomonitoring provides the only actual measurement of human exposure to a chemical. Several Tracking grantees have piloted different ways to improve biomonitoring capacity. These different approaches will be evaluated by the CWG to consider their application for the Tracking Network.

The CWG will begin its efforts by identifying existing measures and data; determining how they have been used in the past for environmental public health; how the tracking network can enhance their use; and what new data or measures need to be developed. One goal of this effort is to ensure that the Tracking network does not duplicate existing health tracking or environmental monitoring activities but enhances them. Because initial pilot projects for environmental public health tracking focused on linkage of health and environmental data, there is a misconception that core measures and data developed for use in the Tracking Network will *only* include “linked” data / measures. The CWG’s goal is to identify and recommend nationally consistent data and measures that can and should be used to characterize the state of environmental public health in communities, states, and the nation. In some situations, meeting this goal may require linking health and environmental data.

6.3.3 Grantee-Specific Data and Measures

In addition to the core set of nationally consistent data and measures to be tracked by all grantees, some grantees or partners may choose to track other hazards, exposures or health effects that are priorities for their state or local area. Many of these data may only be accessible to users who have previously or will establish agreements for access (e.g., data sharing agreements). If more than one grantee identifies the same area of interest, CDC will ensure coordination among these grantees to establish methods to present data consistently.

6.3.4 Standardization of Data and Measures

The key to the success of the National Network will be adoption and implementation of data standards by grantees. While grantee data may be useful for state or local tracking and interventions, development of standards for data and measures will allow these to be compared and exchanged across jurisdictions and will allow data to be combined for analyses.. Data that are highly relevant to tracking are owned and maintained by a variety of organizational entities that collect the data for purposes other than tracking. Examples include pesticide illness reporting systems, fish contamination survey systems, vital statistics, cancer, birth defects, health and nutrition survey data, and behavioral risk factor survey data. Even when existing surveillance systems are working on improving the consistency of the data there are differences in data quality and comparability. For example, there are efforts to improve the consistency of birth defects surveillance data; however, there are differences in how the data are collected. Consequently, while different birth defects registries may report data for the same outcomes, understanding the differences in surveillance approaches suggest that the data may not be entirely comparable. The details of how data will be standardized will be further examined.

The Content Workgroup is tasked with identifying, recommending and promoting the use of standards to facilitate data collection, organization, linkage, and use for Tracking. Standards to improve data quality and comparability may cover a range of activities, including definitions; cleaning and linking data (e.g., cancer registries link their registry database with death records for case-finding and quality control); approaches for removing duplicate records; and data

analysis, presentation, and interpretation techniques. Collaboration with data owner / stewards is essential to ensure that data are appropriately used and interpreted. An illustration of aspects of data that might be standardized to facilitate consistency in analysis is provided in Exhibit 6-2.

Exhibit 6-2: Example of Aspects of Data to Standardize

Measure	Unit of Measure	Geographic Resolution	Time Period
Asthma	Annual asthma hospitalization rate	Residential zip code	Calendar year
Ozone	Parts per million (ppm)	12 x 12 km grid	Calendar year

Existing standards for health and environmental data will be used where applicable. For example, the International Classification of Diseases, Clinical Modification (ICD-10-CM) will be used as the coding and classification standard for morbidity data from inpatient and outpatient records, physician offices, and many National Center for Health Statistics (NCHS) surveys. The International Classification of Diseases (ICD) will be used to code and classify mortality data from death certificates. The International Classification of Diseases for Oncology (ICD-O) will be used to classify cancer data. Standardized vocabularies identified by the SND Workgroup and others may be used in the Tracking Network to clarify and standardize terminology and establish hierarchical relations of terms. Vocabularies developed for other purposes within PHIN and standards developed by other CDC programs (e.g., National Program of Cancer Registries), professional organizations (e.g., National Birth Defects Prevention Network North American Association of Central Cancer Registries) or within states also may be relevant to reference and incorporate.

6.4 Data Protection and Confidentiality

The Tracking Network will provide various levels of access to users depending on their role and purpose. A user of the Tracking Network will by default be granted access to public use information. Access to more sensitive information will be granted by the data owner/steward, with different rights of access possible. Access to data will be granted to the maximum extent possible, considering confidentiality, legality, and technical feasibility. Data Sharing Agreements may be necessary to specify details of access. Data owners/stewards will have the ability to restrict the release of data based on reliability or privacy concerns.

Public health practitioners and researchers interested in assessing relationships of adverse health effects and exposures and environmental hazards require data that provide location and time references at fine resolutions. This level of detail in the data could be used to identify individuals and raises issues of confidentiality. The Tracking Network workgroups will identify and recommend mechanisms and policies to ensure that the confidentiality of the data is protected. Without these mechanisms, potential data contributors will not be willing to make information available on the Tracking Network.

The Tracking Network will provide data at different levels of resolution for access by users with varying rights of access. These rights will be based on who the users are (e.g., general public, public health practitioner, CDC) and established agreements between users and data providers.

Role-based access is one way that the Tracking Network will preserve privacy and confidentiality of information. With the exception of the “summary data” (which are expected to be accessible to anyone) data providers and contributors will determine appropriate access levels for each dataset provided through the Tracking Network. Access will be determined according to the data sharing requirements of each owner/steward. Data-sharing or trading-partner agreements (signed documents that help establish the circumstances, conditions, and protocols for transferring or sharing data) are useful for negotiating data access. The SND Workgroup has developed a trading-partner agreement template for the Tracking Program. The template was designed to serve as a model that grantees/partners can use to document and formalize the processes for managing the data, but it is not mandatory. Data sharing agreements will provide a mechanism for users to gain the right to access linkable data through the Tracking Network.

There are several methods used to protect privacy and confidentiality of public use information which may be used in the Tracking Network, including the following:

- Aggregating data helps to protect privacy and confidentiality. Grantees will use standardized methods to collect, format, analyze, and display data such that they can be aggregated and descriptively compared (i.e., counts by zip code or county, national average, highest rates, trend in rates, etc.).
- Statistical algorithms can be used to mask individually identifiable data to preserve privacy.
- If specific health and environmental associations are well known, individual case data may not be required for public health action. For example, many studies have demonstrated a clear increased risk of asbestosis with exposure to asbestos. Therefore, if asbestos is found, appropriate remediation should be initiated. No further studies are warranted to initiate preventive interventions.

6.5 Implementation Activities for Nationally Consistent Data and Measures, Grantee / Partner Data and Assets

A variety of activities are needed to develop and implement nationally consistent data and measures; grantee data, measures and assets; and metadata. These are outlined in the exhibit below.

Exhibit 6-3: Implementation Activities for Nationally Consistent Data and Measures, Grantee / Partner Data and Assets

Activity	Responsible Entity
2006	
Examine address standards and their potential use on the Tracking Network.	SND Geography and Locational Referencing Subgroup
Identify, organize, and work on grantee/partner data and assets.	Grantees, Tracking Network Partners
Identify initial nationally consistent data and measures (e.g., asthma, birth defects, lead poisoning, air pollution, etc.) to be examined.	CDC

Activity	Responsible Entity
Examine options for optimizing the ability to share data on the Tracking Network among grantees - including use of Trading Partner Agreements, work with IRBs, data sharing agreements, etc.	CWG, SND Security Subgroup, CDC
Begin development of standards/guidelines for creating and summarizing nationally consistent data and measures, including consistent vocabularies.	CWG, SND
2007	
Examine need for and recommend to CDC if necessary geospatial guidelines to support tracking needs (e.g., locational accuracy).	SND Geography and Locational Referencing Subgroup, CWG, SND, CDC
Recommend address standards as appropriate to CDC for use on the Tracking Network.	SND
Continue examination of and make recommendations for data standards/guidelines (e.g., elements, vocabularies) for nationally consistent data and measures.	CWG, SND
Begin development of metadata for nationally consistent data and measures and populate metadata registries.	Grantees
Review, revise as necessary, and adopt standards/guidelines recommended by CWG for nationally consistent data and measures.	CDC
Create, make accessible, and test repositories of sample data and metadata.	CDC, Grantees
Begin to develop metadata for grantee/partner data and assets.	Grantees
Establish data sharing agreements (using EPHT templates as appropriate) where needed to allow compilation and use of nationally consistent data and measures.	CDC, Grantees
Organize the initial elements of nationally consistent data and measures using the agreed upon standards and guidelines.	Grantees
Promote data sharing options among new partners that will be contributing to the Tracking Network - including use of Trading Partner Agreements, work with IRBs, data sharing agreements, etc.	PMO
Examine options and make recommendations for public access to nationally consistent data and measures.	PMO, CWG, SND
Continue to identify new data for nationally consistent data and measures.	CWG, Grantees, CDC
Continue to compile nationally consistent data and measures.	Grantees, CDC
2008	
Examine and assess available national measures and grantee/partner data and assets and continue to populate the Tracking Network.	CWG, Grantees, CDC, Tracking Network Partners
Begin discussions about additional grantee/partner data (other than nationally consistent data and measures) to include on the Tracking Network.	CWG
2009	
Continue to identify and add national measures and other relevant grantee/partner data and assets (and metadata) to the Tracking Network.	CDC, CWG, Grantees, Tracking Network partners
2010	
Continue adding grantee and partner data and assets (including metadata) to the Tracking Network.	Grantees, Tracking Network Partners

7. Implementation Activities

7.1 Overview

The steps outlined in this Chapter summarize by fiscal year the implementation activities for the components described in the preceding Chapters. The NNIP has attempted to describe a set of functions based on input from CDC and grantees and outline the components that must be developed to address those functions. Ongoing examination and adjustment of this NNIP will be important to ensure that implementation is proceeding as expected. The steps below that support aspects of the Tracking Network development that relate to planning and overall coordination are labeled as “Network Coordination” in the Component column in the tables. The Exhibit following each of the tables below depicts the components of the Tracking Network as they are likely to exist at the end of the fiscal year described. Appendix A summarizes activities by responsible entity.

Many of the steps are also specifically identified in CDC’s *FY 2005-2010 Strategy for the National Environmental Public Health Tracking Program*. The milestones from the strategy document are shown associated with each fiscal year in the following sections.

7.2 Fiscal Year 2006 (October 1, 2005 – September 30, 2006)

The milestones related to Tracking Network efforts, identified by CDC in its Tracking Program Strategy for FY 2006, include the following:

- Establish recommendations for initial set of methods and tools for Tracking Network (update annually).
- Begin construction of CDC gateway for Tracking Network.
- Collate and disseminate information about lessons learned from completed state/local/national projects.
- Identify Tracking Network standards and specifications (update annually).

Exhibit 7-1: Implementation Steps for FY 2006

Responsible Entity	Activity
CDC, Grantees	Finish the National Network Implementation Plan (NNIP).
SND, CDC	Develop, review, and adopt a process to promote implementation of standards and guidelines recommended by SND (and other Workgroups).
SND Network Architecture Subgroup, CDC	Explore approaches for data exchanges based on different transport mechanisms (e.g., PHIN MS).
SND Geography and Locational Referencing Subgroup	Examine address standards and their potential use on the Tracking Network.
SND Geography and Locational Referencing Subgroup	Examine options for geocoding tools to be used on the Tracking Network.
SND Metadata Subgroup	Develop metadata template and begin to examine options for metadata tools and registries to organize and manage metadata on the Tracking Network.

Grantees, Tracking Network Partners	Identify, organize, and work on grantee/partner data and assets.
CDC, SND Network Architecture Subgroup, Tracking Network Partners, Grantees	Continue exploration of options for interoperability with the EPA Exchange Network.
CDC	Identify initial nationally consistent data and measures (e.g., asthma, birth defects, lead poisoning, air pollution, etc.) to be examined.
SND Security Subgroup, CDC	Examine options for network security protocols.
CWG, SND Security Subgroup, CDC	Examine options for optimizing the ability to share data on the Tracking Network among grantees - including use of Trading Partner Agreements, work with IRBs, data sharing agreements, etc.
CWG, SND Metadata Subgroup	Refine metadata template to address data quality for describing nationally consistent data and measures.
CWG, SND	Begin development of standards/guidelines for creating and summarizing nationally consistent data and measures, including consistent vocabularies.
CDC	Begin development of the Technical Network Implementation Plan (TNIP) to build the components of the Tracking Network.
CDC	Begin Tracking Network national portal and gateway development, including security, metadata, analytical tools, transport, and services.
PMO	Begin to identify potential partners for involvement in the Tracking Network
CDC	Begin examination of tools for data analysis, visualization, and display.
CDC	Provide opportunities (e.g., annual conferences/workshops) to discuss the vision, process, lessons learned, and implementation of the Tracking Network.
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.

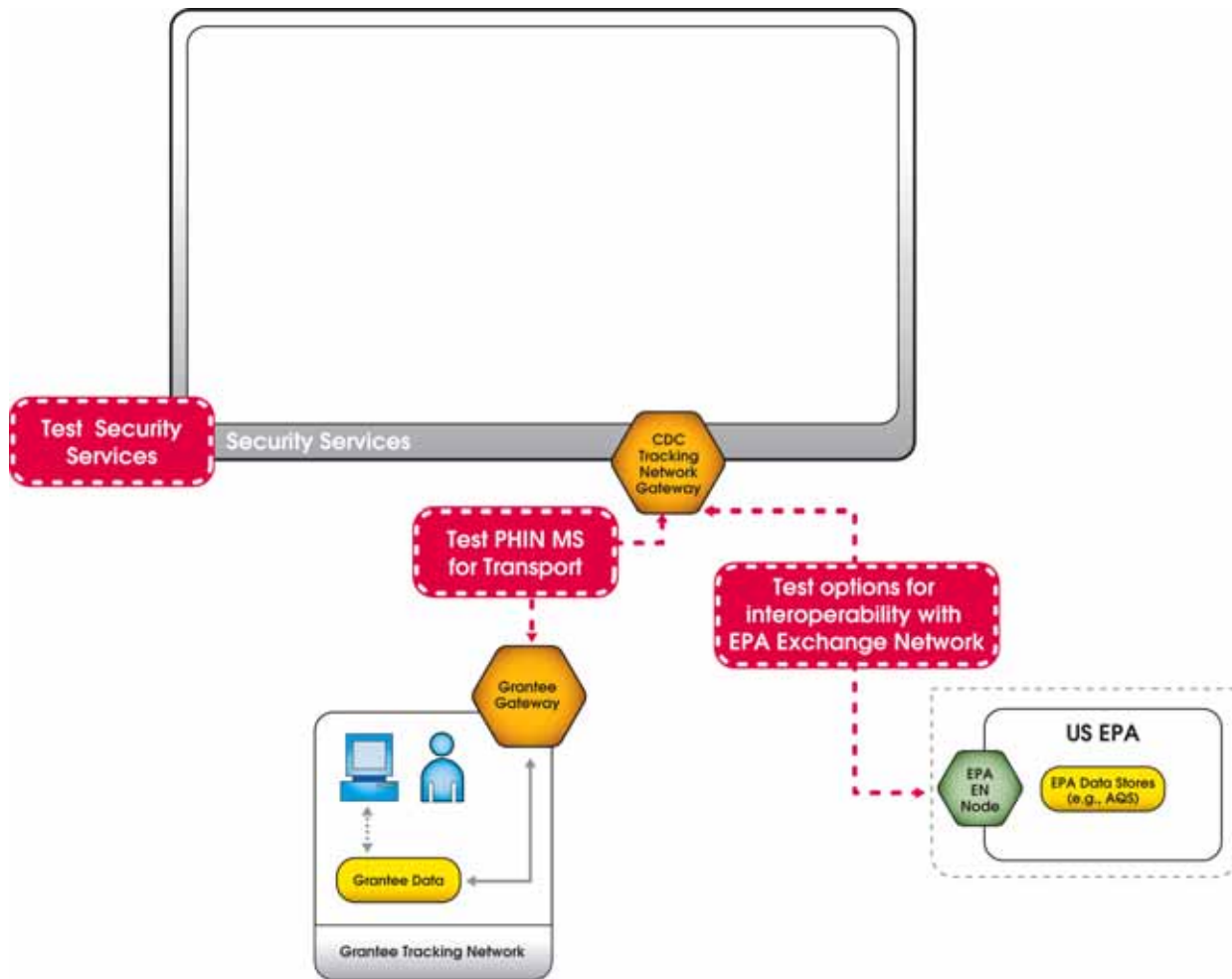


Exhibit 7-2: Tracking Network Architecture at End of FY 2006 (Sept 2006)

7.3 Fiscal Year 2007 (October 1, 2006 – September 30, 2007)

The CDC milestones during this fiscal year include the following:

- Expand the number of state/local health departments funded to construct local / state networks.
- Establish data sharing agreements between CDC and state / local / federal partners (update annually).
- Establish recommendations for initial set of methods and tools for Tracking Network (update annually).
- Identify Tracking Network standards and specifications (update annually).

Exhibit 7-3: Implementation Steps for FY 2007

Responsible Entity	Activity
SND Geography and Locational Referencing Subgroup, CWG, SND, CDC	Examine need for and recommend to CDC if necessary geospatial guidelines to support tracking needs (e.g., locational accuracy).
SND	Recommend address standards as appropriate to CDC for use on the Tracking Network.
SND	Recommend tools for geocoding as appropriate to CDC for use on the Tracking Network.
SND	Recommend templates, tools, and registries for metadata creation and management to CDC for use on the Tracking Network.
CDC	Review, revise as needed, and adopt SND recommendations on standards and guidelines for metadata, addressing, geocoding, and georeferencing.
CDC, SND Metadata Subgroup	Conduct training for grantees on metadata creation and management.
SND Metadata Subgroup, CWG, SND	Examine options for and make recommendations to CDC on metadata for Tracking Network content other than nationally consistent data.
CDC, Grantees, SND	Develop drafts, review, and finalize the Technical Network Implementation Plan (TNIP).
CWG, SND	Continue examination of and make recommendations for data standards/guidelines (e.g., elements, vocabularies) for nationally consistent data and measures.
Grantees	Begin development of metadata for nationally consistent data and measures and populate metadata registries.
CDC	Review, revise as necessary, and adopt standards/guidelines recommended by CWG for nationally consistent data and measures.
CDC, Grantees	Create, make accessible, and test repositories of sample data and metadata.
Grantees, CWG, SND, CDC	Test, assess, and make recommendations to CDC for tools for data analysis, visualization, and display.
Grantees, SND, CDC	Test, assess and make recommendations to CDC on tools for search, selection, access, and exchange of tracking data across organizations.
CDC	Review, revise as needed, and adopt SND and CWG recommendations on tools for search, selection, access, exchange, analysis, visualization, display, and asset metadata for use on the Tracking Network.
SND Security Subgroup, CDC, Grantees	Test options for network security protocols for the Tracking Network.
SND	Make recommendations to CDC on security protocols for the Tracking Network
CDC	Review, revise as necessary, and adopt security protocol recommendations made by SND
CDC	Conduct training on Tracking Network security infrastructure for grantees to begin integration with state/local networks.
CDC, Grantees	Begin implementation of Tracking Network national portal and gateway security infrastructure.
Grantees, CDC, Tracking Network Partners	Conduct pilot exchanges with EPA Exchange Network nodes and the Tracking Network national gateway.
Grantees	Begin to develop metadata for grantee/partner data and assets.
SND, Grantees	Examine options and share approaches for grantee gateway and portal implementations.
CDC	Provide training, planning assistance, and tools for grantees to implement portals and gateways (including messaging protocols).
CDC, Grantees	Establish data sharing agreements (using EPHT templates as appropriate) where needed to allow compilation and use of nationally consistent data and measures.

Grantees	Organize the initial elements of nationally consistent data and measures using the agreed upon standards and guidelines.
Grantees	Test grantee gateways and local installations of messaging protocols
PMO	Promote data sharing options among new partners that will be contributing to the Tracking Network - including use of Trading Partner Agreements, work with IRBs, data sharing agreements, etc.
PMO, CWG, SND	Examine options and make recommendations for public access to nationally consistent data and measures.
Grantees, Tracking Network Partners, SND, CDC	Begin exploration of the development of 'data brokers' to exchange data among partner organizations
CDC	Provide opportunities (e.g., annual conferences and workshops) to discuss the process and implementation activities of the Tracking Network.
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.
PMO	Promote the availability of the Tracking Network and guidelines for participation.
CWG, Grantees, CDC	Continue to identify new data for nationally consistent data and measures.
Grantees, CDC	Continue to compile nationally consistent data and measures.

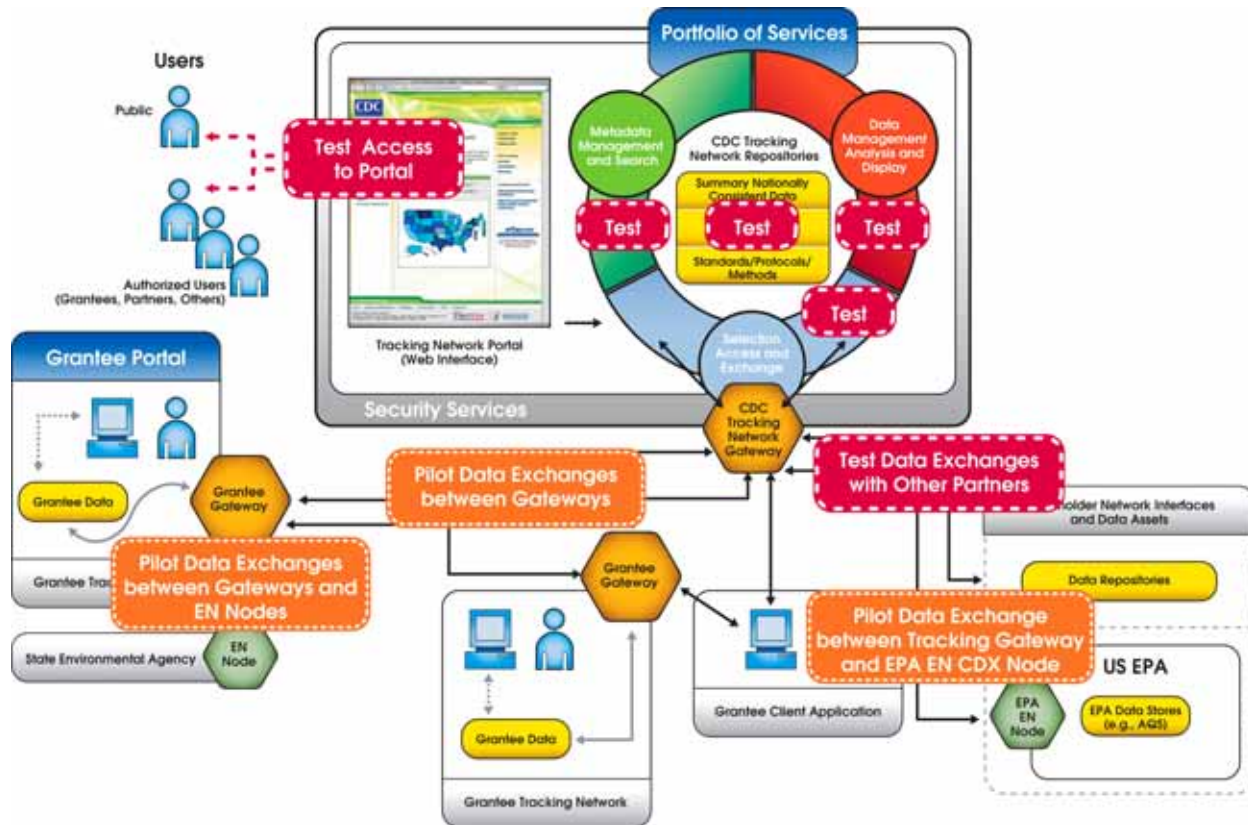


Exhibit 7-4: Tracking Network Architecture at the End of FY07 (Sept 2007)

7.4 Fiscal Year 2008 (October 1, 2007 – September 30, 2008)

The CDC Milestones during this fiscal year include the following:

- Facilitate deployment of state/local networks.
- Launch awareness campaign to promote use of Tracking Network.
- Deploy Tracking Network.

Exhibit 7-5: Implementation Steps for FY 2008

Responsible Entity	Activity
CDC	Deploy Tracking Network national portal with data tools (secure interface) using security infrastructure.
CDC	Deploy Tracking Network national portal with data tools (public interface) for public access.
Grantees	Deploy grantee gateways to support secure data exchanges with the Tracking Network national gateway, other grantee gateways, and partner interfaces.
CDC, Grantees, Tracking Network Partners	Conduct pilot exchanges using grantee gateways with other partner organizations.
Grantees, CDC, Tracking Network Partners	Establish full interoperability between Tracking Network gateways and the EPA Exchange Network.
CWG, Grantees, CDC, Tracking Network Partners	Examine and assess available national measures and grantee/partner data and assets and continue to populate the Tracking Network.
CWG	Begin discussions about additional grantee/partner data (other than nationally consistent data and measures) to include on the Tracking Network.
CDC	Provide opportunities (e.g., annual conferences and workshops) to discuss the process and implementation activities of the Tracking Network.
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.
CDC, SND	Evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).
SND, CDC	Explore and recommend to CDC new technologies to enhance the Tracking Network.
CDC	Use lessons learned from Tracking Network implementation to inform creation of 2010-2015 Tracking Strategic Plan.
PMO	Promote use of the Tracking Network and guidelines for participation.

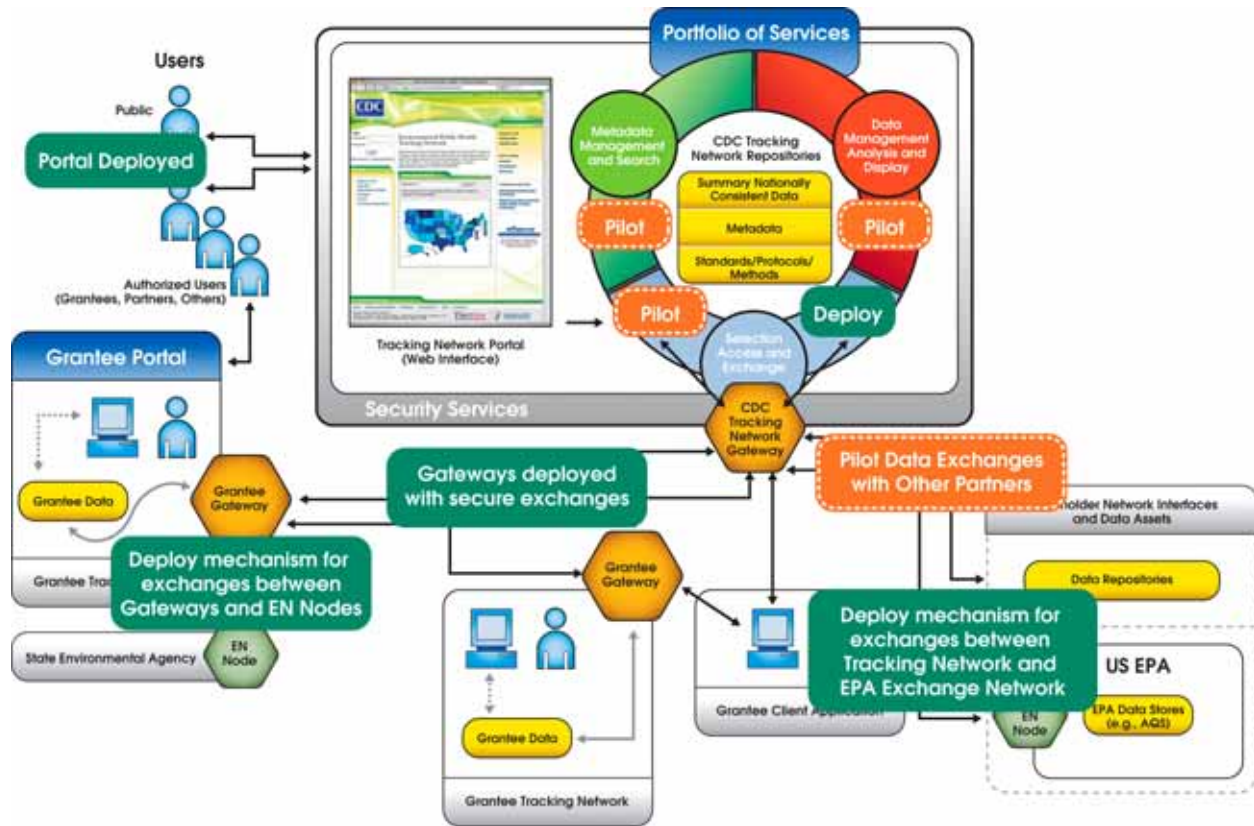


Exhibit 7-6: Tracking Network Architecture at the End of FY 2008 (September 2008)

7.5 Fiscal Year 2009 (October 1, 2008 – September 30, 2009)

The CDC Milestone during this fiscal year is to evaluate Tracking Network design, functionality, and content.

Exhibit 7-7: Implementation Steps for FY 2009

Responsible Entity	Activity
Grantees	Continue to refine functionality of grantee gateways and portals
CWG, SND, Grantees, CDC	Continue to identify needs for tools and services on the Tracking Network
SND, CDC, Grantees, Tracking Network Partners	Continue to examine, test, and integrate advanced tools and services on the Tracking Network.
Grantees, CDC, Tracking Network Partners	Establish interoperability with additional Tracking Network partners.
SND Security Subgroup	Continue to evaluate and make recommendations regarding Tracking Network security infrastructure.
CDC, CWG, Grantees, Tracking Network partners	Continue to identify and add national measures and other relevant grantee/partner data and assets (and metadata) to the Tracking Network.
CDC	Provide opportunities (e.g., annual conferences and workshops) to discuss the process and implementation activities of the Tracking Network.
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.

CDC, SND	Continue to evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).
SND	Continue to explore and recommend to CDC new technologies to enhance the Tracking Network.
PMO	Continue to promote use of the Tracking Network.

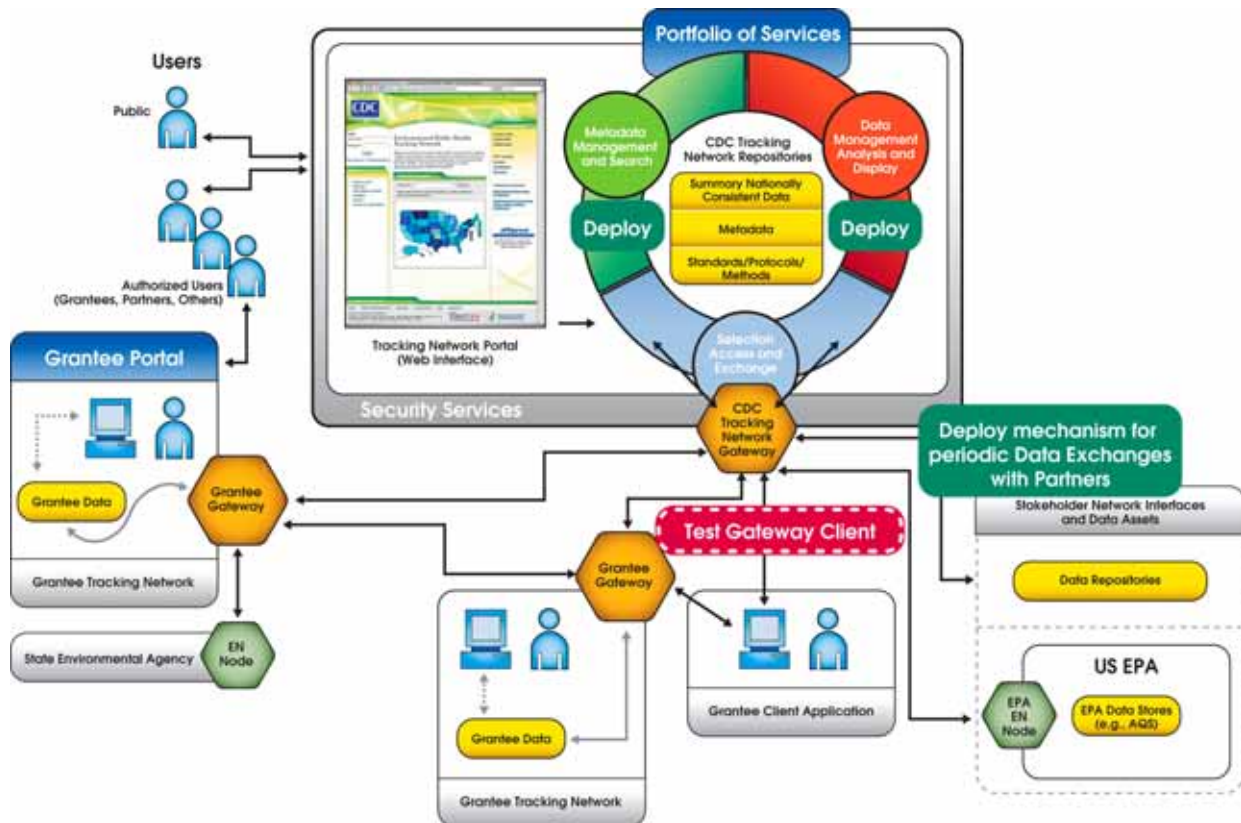


Exhibit 7-8: Tracking Network Architecture at the End of FY 2009 (September 2009)

7.6 Fiscal Year 2010 (October 1, 2009 – September 30, 2010)

The CDC milestone is to disseminate the Tracking Network Enhancement Plan.

Exhibit 7-9: Implementation Steps for FY 2010

Responsible Entity	Activity
CDC	Provide opportunities to discuss the process and implementation activities of the Tracking Network (e.g., annual conferences/workshops).
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.
SND, CDC	Continue to explore and recommend to CDC new technologies to enhance the Tracking Network.
Grantees, Tracking Network Partners	Continue adding grantee and partner data and assets (including metadata) to the Tracking Network.
CDC, SND	Continue to evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).
SND, CDC, Grantees, Tracking Network Partners, CWG	Continue to explore, develop, and integrate advanced tools and services on the Tracking Network.
PMO	Continue to promote use of the Tracking Network.

Appendix A: Summary of Activities by Responsible Entities for Tracking Network Development

CDC

Responsible Entity	Activity
2006	
CDC, Grantees	Finish the National Network Implementation Plan (NNIP).
CDC	Fund state/local entities to develop their networks and contribute to the development of the Tracking Network.
SND, CDC	Develop, review, and adopt a process to promote implementation of standards and guidelines recommended by SND (and other Workgroups).
SND Network Architecture Subgroup, CDC	Explore approaches for data exchanges based on different transport mechanisms (e.g., PHIN MS).
CDC, SND Network Architecture Subgroup, Tracking Network Partners, Grantees	Continue exploration of options for interoperability with the EPA Exchange Network.
CDC	Identify initial nationally consistent data and measures (e.g., asthma, birth defects, lead poisoning, air pollution, etc.) to be examined.
SND Security Subgroup, CDC	Examine options for network security protocols.
CWG, SND Security Subgroup, CDC	Examine options for optimizing the ability to share data on the Tracking Network among grantees - including use of Trading Partner Agreements, work with IRBs, data sharing agreements, etc.
CDC	Begin development of the Technical Network Implementation Plan (TNIP) to build the components of the Tracking Network.
CDC	Begin Tracking Network national portal and gateway development, including security, metadata, analytical tools, transport, and services.
CDC	Begin examination of tools for data analysis, visualization, and display.
CDC	Provide opportunities (e.g., annual conferences/workshops) to discuss the vision, process, lessons learned, and implementation of the Tracking Network.
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.
2007	
SND Geography and Locational Referencing Subgroup, CWG, SND, CDC	Examine need for and recommend to CDC if necessary geospatial guidelines to support tracking needs (e.g., locational accuracy).
CDC	Review, revise as needed, and adopt SND recommendations on standards and guidelines for metadata, addressing, geocoding, and georeferencing.
CDC, SND Metadata Subgroup	Conduct training for grantees on metadata creation and management.
CDC, Grantees, SND	Develop drafts, review, and finalize the Technical Network Implementation Plan (TNIP).
CDC	Review, revise as necessary, and adopt standards/guidelines recommended by CWG for nationally consistent data and measures.
CDC, Grantees	Create, make accessible, and test repositories of sample data and metadata.
Grantees, CWG, SND, CDC	Test, assess, and make recommendations to CDC for tools for data analysis, visualization, and display.

Responsible Entity	Activity
Grantees, SND, CDC	Test, assess and make recommendations to CDC on tools for search, selection, access, and exchange of tracking data across organizations.
CDC	Review, revise as needed, and adopt SND and CWG recommendations on tools for search, selection, access, exchange, analysis, visualization, display, and asset metadata for use on the Tracking Network.
SND Security Subgroup, CDC, Grantees	Test options for network security protocols for the Tracking Network.
CDC	Review, revise as necessary, and adopt security protocol recommendations made by SND
CDC	Conduct training on Tracking Network security infrastructure for grantees to begin integration with state/local networks.
CDC, Grantees	Begin implementation of Tracking Network national portal and gateway security infrastructure.
Grantees, CDC, Tracking Network Partners	Conduct pilot exchanges with EPA Exchange Network nodes and the Tracking Network national gateway.
CDC	Provide training, planning assistance, and tools for grantees to implement portals and gateways (including messaging protocols).
CDC, Grantees	Establish data sharing agreements (using EPHT templates as appropriate) where needed to allow compilation and use of nationally consistent data and measures.
Grantees, Tracking Network Partners, SND, CDC	Begin exploration of the development of 'data brokers' to exchange data among partner organizations
CDC	Provide opportunities (e.g., annual conferences and workshops) to discuss the process and implementation activities of the Tracking Network.
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.
CWG, Grantees, CDC	Continue to identify new data for nationally consistent data and measures.
Grantees, CDC	Continue to compile nationally consistent data and measures.
2008	
CDC	Deploy Tracking Network national portal with data tools (secure interface) using security infrastructure.
CDC	Deploy Tracking Network national portal with data tools (public interface) for public access.
CDC, Grantees, Tracking Network Partners	Conduct pilot exchanges using grantee gateways with other partner organizations.
Grantees, CDC, Tracking Network Partners	Establish full interoperability between Tracking Network gateways and the EPA Exchange Network.
CWG, Grantees, CDC, Tracking Network Partners	Examine and assess available national measures and grantee/partner data and assets and continue to populate the Tracking Network.
CDC	Provide opportunities (e.g., annual conferences and workshops) to discuss the process and implementation activities of the Tracking Network.
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.
CDC, SND	Evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).
SND, CDC	Explore and recommend to CDC new technologies to enhance the Tracking Network.
CDC	Use lessons learned from Tracking Network implementation to inform creation of 2010-2015 Tracking Strategic Plan.
2009	
CWG, SND, Grantees, CDC	Continue to identify needs for tools and services on the Tracking Network

Responsible Entity	Activity
SND, CDC, Grantees, Tracking Network Partners	Continue to examine, test, and integrate advanced tools and services on the Tracking Network.
Grantees, CDC, Tracking Network Partners	Establish interoperability with additional Tracking Network partners.
CDC, CWG, Grantees, Tracking Network partners	Continue to identify and add national measures and other relevant grantee/partner data and assets (and metadata) to the Tracking Network.
CDC	Provide opportunities (e.g., annual conferences and workshops) to discuss the process and implementation activities of the Tracking Network.
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.
CDC, SND	Continue to evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).
2010	
CDC	Provide opportunities to discuss the process and implementation activities of the Tracking Network (e.g., annual conferences/workshops).
CDC	Collate and disseminate via an annual report information on lessons learned in tracking.
SND, CDC	Continue to explore and recommend to CDC new technologies to enhance the Tracking Network.
CDC, SND	Continue to evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).
SND, CDC, Grantees, Tracking Network Partners, CWG	Continue to explore, develop, and integrate advanced tools and services on the Tracking Network.

Grantees

Responsible Entity	Activity
2006	
CDC, Grantees	Finish the National Network Implementation Plan (NNIP).
Grantees, Tracking Network Partners	Identify, organize, and work on grantee/partner data and assets.
CDC, SND Network Architecture Subgroup, Tracking Network Partners, Grantees	Continue exploration of options for interoperability with the EPA Exchange Network.
2007	
CDC, Grantees, SND	Develop drafts, review, and finalize the Technical Network Implementation Plan (TNIP).
Grantees	Begin development of metadata for nationally consistent data and measures and populate metadata registries.
CDC, Grantees	Create, make accessible, and test repositories of sample data and metadata.
Grantees, CWG, SND, CDC	Test, assess, and make recommendations to CDC for tools for data analysis, visualization, and display.
Grantees, SND, CDC	Test, assess and make recommendations to CDC on tools for search, selection, access, and exchange of tracking data across organizations.
SND Security Subgroup, CDC, Grantees	Test options for network security protocols for the Tracking Network.
CDC, Grantees	Begin implementation of Tracking Network national portal and gateway security infrastructure.

Responsible Entity	Activity
Grantees, CDC, Tracking Network Partners	Conduct pilot exchanges with EPA Exchange Network nodes and the Tracking Network national gateway.
Grantees	Begin to develop metadata for grantee/partner data and assets.
SND, Grantees	Examine options and share approaches for grantee gateway and portal implementations.
CDC, Grantees	Establish data sharing agreements (using EPHT templates as appropriate) where needed to allow compilation and use of nationally consistent data and measures.
Grantees	Organize the initial elements of nationally consistent data and measures using the agreed upon standards and guidelines.
Grantees	Test grantee gateways and local installations of messaging protocols
Grantees, Tracking Network Partners, SND, CDC	Begin exploration of the development of 'data brokers' to exchange data among partner organizations
CWG, Grantees, CDC	Continue to identify new data for nationally consistent data and measures.
Grantees, CDC	Continue to compile nationally consistent data and measures.
2008	
Grantees	Deploy grantee gateways to support secure data exchanges with the Tracking Network national gateway, other grantee gateways, and partner interfaces.
CDC, Grantees, Tracking Network Partners	Conduct pilot exchanges using grantee gateways with other partner organizations.
Grantees, CDC, Tracking Network Partners	Establish full interoperability between Tracking Network gateways and the EPA Exchange Network.
CWG, Grantees, CDC, Tracking Network Partners	Examine and assess available national measures and grantee/partner data and assets and continue to populate the Tracking Network.
2009	
Grantees	Continue to refine functionality of grantee gateways and portals
CWG, SND, Grantees, CDC	Continue to identify needs for tools and services on the Tracking Network
SND, CDC, Grantees, Tracking Network Partners	Continue to examine, test, and integrate advanced tools and services on the Tracking Network.
Grantees, CDC, Tracking Network Partners	Establish interoperability with additional Tracking Network partners.
CDC, CWG, Grantees, Tracking Network partners	Continue to identify and add national measures and other relevant grantee/partner data and assets (and metadata) to the Tracking Network.
2010	
Grantees, Tracking Network Partners	Continue adding grantee and partner data and assets (including metadata) to the Tracking Network.
SND, CDC, Grantees, Tracking Network Partners, CWG	Continue to explore, develop, and integrate advanced tools and services on the Tracking Network.

Standards and Network Development Workgroup, Subgroups, and Teams

Responsible Entity	Activity
2006	
SND, CDC	Develop, review, and adopt a process to promote implementation of standards and guidelines recommended by SND (and other Workgroups).
SND Network Architecture Subgroup, CDC	Explore approaches for data exchanges based on different transport mechanisms (e.g., PHIN MS).

Responsible Entity	Activity
SND Geography and Locational Referencing Subgroup	Examine address standards and their potential use on the Tracking Network.
SND Geography and Locational Referencing Subgroup	Examine options for geocoding tools to be used on the Tracking Network.
SND Metadata Subgroup	Develop metadata template and begin to examine options for metadata tools and registries to organize and manage metadata on the Tracking Network.
CDC, SND Network Architecture Subgroup, Tracking Network Partners, Grantees	Continue exploration of options for interoperability with the EPA Exchange Network.
SND Security Subgroup, CDC	Examine options for network security protocols.
CWG, SND Security Subgroup, CDC	Examine options for optimizing the ability to share data on the Tracking Network among grantees - including use of Trading Partner Agreements, work with IRBs, data sharing agreements, etc.
CWG, SND Metadata Subgroup	Refine metadata template to address data quality for describing nationally consistent data and measures.
CWG, SND	Begin development of standards/guidelines for creating and summarizing nationally consistent data and measures, including consistent vocabularies.
2007	
SND Geography and Locational Referencing Subgroup, CWG, SND, CDC	Examine need for and recommend to CDC if necessary geospatial guidelines to support tracking needs (e.g., locational accuracy).
SND	Recommend address standards as appropriate to CDC for use on the Tracking Network.
SND	Recommend tools for geocoding as appropriate to CDC for use on the Tracking Network.
SND	Recommend templates, tools, and registries for metadata creation and management to CDC for use on the Tracking Network.
CDC, SND Metadata Subgroup	Conduct training for grantees on metadata creation and management.
SND Metadata Subgroup, CWG, SND	Examine options for and make recommendations to CDC on metadata for Tracking Network content other than nationally consistent data.
CDC, Grantees, SND	Develop drafts, review, and finalize the Technical Network Implementation Plan (TNIP).
CWG, SND	Continue examination of and make recommendations for data standards/guidelines (e.g., elements, vocabularies) for nationally consistent data and measures.
Grantees, CWG, SND, CDC	Test, assess, and make recommendations to CDC for tools for data analysis, visualization, and display.
Grantees, SND, CDC	Test, assess and make recommendations to CDC on tools for search, selection, access, and exchange of tracking data across organizations.
SND Security Subgroup, CDC, Grantees	Test options for network security protocols for the Tracking Network.
SND	Make recommendations to CDC on security protocols for the Tracking Network
SND, Grantees	Examine options and share approaches for grantee gateway and portal implementations.
PMO, CWG, SND	Examine options and make recommendations for public access to nationally consistent data and measures.
Grantees, Tracking Network Partners, SND, CDC	Begin exploration of the development of 'data brokers' to exchange data among partner organizations
2008	
CDC, SND	Evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).

Responsible Entity	Activity
SND, CDC	Explore and recommend to CDC new technologies to enhance the Tracking Network.
2009	
CWG, SND, Grantees, CDC	Continue to identify needs for tools and services on the Tracking Network
SND, CDC, Grantees, Tracking Network Partners	Continue to examine, test, and integrate advanced tools and services on the Tracking Network.
SND Security Subgroup	Continue to evaluate and make recommendations regarding Tracking Network security infrastructure.
CDC, SND	Continue to evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).
SND	Continue to explore and recommend to CDC new technologies to enhance the Tracking Network.
2010	
SND, CDC	Continue to explore and recommend to CDC new technologies to enhance the Tracking Network.
CDC, SND	Continue to evaluate Tracking Network usage (e.g., terms searched, content downloaded, design, and function).
SND, CDC, Grantees, Tracking Network Partners, CWG	Continue to explore, develop, and integrate advanced tools and services on the Tracking Network.

Content Workgroup and Teams

Responsible Entity	Activity
2006	
CWG, SND Security Subgroup, CDC	Examine options for optimizing the ability to share data on the Tracking Network among grantees - including use of Trading Partner Agreements, work with IRBs, data sharing agreements, etc.
CWG, SND Metadata Subgroup	Refine metadata template to address data quality for describing nationally consistent data and measures.
CWG, SND	Begin development of standards/guidelines for creating and summarizing nationally consistent data and measures, including consistent vocabularies.
2007	
SND Geography and Locational Referencing Subgroup, CWG, SND, CDC	Examine need for and recommend to CDC if necessary geospatial guidelines to support tracking needs (e.g., locational accuracy).
SND Metadata Subgroup, CWG, SND	Examine options for and make recommendations to CDC on metadata for Tracking Network content other than nationally consistent data.
CWG, SND	Continue examination of and make recommendations for data standards/guidelines (e.g., elements, vocabularies) for nationally consistent data and measures.
Grantees, CWG, SND, CDC	Test, assess, and make recommendations to CDC for tools for data analysis, visualization, and display.
PMO, CWG, SND	Examine options and make recommendations for public access to nationally consistent data and measures.
CWG, Grantees, CDC	Continue to identify new data for nationally consistent data and measures.
2008	
CWG, Grantees, CDC, Tracking Network Partners	Examine and assess available national measures and grantee/partner data and assets and continue to populate the Tracking Network.

Responsible Entity	Activity
CWG	Begin discussions about additional grantee/partner data (other than nationally consistent data and measures) to include on the Tracking Network.
2009	
CWG, SND, Grantees, CDC	Continue to identify needs for tools and services on the Tracking Network
CDC, CWG, Grantees, Tracking Network partners	Continue to identify and add national measures and other relevant grantee/partner data and assets (and metadata) to the Tracking Network.
2010	
SND, CDC, Grantees, Tracking Network Partners, CWG	Continue to explore, develop, and integrate advanced tools and services on the Tracking Network.

Program Marketing and Outreach Workgroup and Teams

Responsible Entity	Activity
2006	
PMO	Begin to identify potential partners for involvement in the Tracking Network
2007	
PMO	Promote data sharing options among new partners that will be contributing to the Tracking Network - including use of Trading Partner Agreements, work with IRBs, data sharing agreements, etc.
PMO, CWG, SND	Examine options and make recommendations for public access to nationally consistent data and measures.
PMO	Promote the availability of the Tracking Network and guidelines for participation.
2008	
PMO	Promote use of the Tracking Network and guidelines for participation.
2009	
PMO	Continue to promote use of the Tracking Network.
2010	
PMO	Continue to promote use of the Tracking Network.

Tracking Network Partners

Responsible Entity	Activity
2006	
Grantees, Tracking Network Partners	Identify, organize, and work on grantee/partner data and assets.
CDC, SND Network Architecture Subgroup, Tracking Network Partners, Grantees	Continue exploration of options for interoperability with the EPA Exchange Network.
2007	
Grantees, CDC, Tracking Network Partners	Conduct pilot exchanges with EPA Exchange Network nodes and the Tracking Network national gateway.
Grantees, Tracking Network Partners, SND, CDC	Begin exploration of the development of 'data brokers' to exchange data among partner organizations
2008	

Responsible Entity	Activity
CDC, Grantees, Tracking Network Partners	Conduct pilot exchanges using grantee gateways with other partner organizations.
Grantees, CDC, Tracking Network Partners	Establish full interoperability between Tracking Network gateways and the EPA Exchange Network.
CWG, Grantees, CDC, Tracking Network Partners	Examine and assess available national measures and grantee/partner data and assets and continue to populate the Tracking Network.
2009	
SND, CDC, Grantees, Tracking Network Partners	Continue to examine, test, and integrate advanced tools and services on the Tracking Network.
Grantees, CDC, Tracking Network Partners	Establish interoperability with additional Tracking Network partners.
CDC, CWG, Grantees, Tracking Network partners	Continue to identify and add national measures and other relevant grantee/partner data and assets (and metadata) to the Tracking Network.
2010	
Grantees, Tracking Network Partners	Continue adding grantee and partner data and assets (including metadata) to the Tracking Network.
SND, CDC, Grantees, Tracking Network Partners, CWG	Continue to explore, develop, and integrate advanced tools and services on the Tracking Network.

Appendix B: Overview of NNIP Development

Development of the NNIP involved interaction among CDC and Tracking Program grantees and partners. A contractor (Ross & Associates) worked closely with CDC Tracking Program staff and a variety of other entities to identify, document and refine the Tracking Network scope, context, objectives and high level functional requirements. A number of drafts were produced, reviewed and revised.

The Standards and Network Development Workgroup (SND) and its Network Architecture Subgroup (NASG), established by CDC at the outset of the Tracking Program, have provided guidance and insight throughout the development of the NNIP. This effort drew heavily from existing Tracking Network documentation, including CDC's *Strategy for the National Environmental Public Health Tracking Program, Fiscal Years 2005-2010*, SND's *Implementation Plan Guidelines*, and CDC's *2006 Competing Continuation Request for Applications (CDC-RFA-EH06-601)*. Additional sources of information include requirements gathering activities conducted in 2004 and 2005. Additionally, site visits and conference call interviews (using WebEx collaborative meeting software) were conducted with CDC staff and nearly all grantees. The full range of grantee staff members, including environmental public health practitioners and experts in environmental and health data systems and related technologies, were encouraged to participate in the interviews.

Those contacted were asked to describe and discuss their answers to five key questions:

1. What is the Tracking Network for?
2. What are differences between the grantee networks and the national network?
3. Who are the users?
4. How does the network assist Tracking in new ways?
5. What are the major Tracking assets that you have created thus far in the effort that might be of interest to other grantees?

The grantee interactions and interviews also provided a means to gather information on their capabilities and experiences to better address how the Tracking Network might best proceed and where specific investments may be needed.

NNIP Versions

Several versions of the NNIP have been generated. The Alpha NNIP, outlining initial implementation approaches was developed and shared with grantees and partners in November, 2005. Comments were solicited and submitted by grantees and other partners.

A Beta version of the NNIP was developed based on the comments and additional discussion and review with CDC, the SND Workgroup and its Network Architecture Subgroup (NASG). Released in March 2006, the Beta version was a significant re-write of the "Alpha" NNIP and was organized by specific network components rather than implementation arenas identified in the Alpha NNIP. The Beta NNIP was extensively reviewed by CDC staff, grantees, partners, and contractors.

This August 2006 version of the NNIP reflects the comments received on earlier drafts. These comments focused on the need to identify audience and clarify language. Some details of technical implementation have been removed from this final public version of the document and will be included in a Technical Implementation Plan for the Tracking Network. Otherwise, the structure of the document has not changed significantly from the Beta NNIP.

Appendix C: Acronyms and Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
AVR	Analysis, Visualization, and Reporting
CDC	Centers for Disease Control and Prevention
CDC UP	Centers for Disease Control Unified Process
CDX	U.S. EPA Central Data Exchange
CSTE	Council of State and Territorial Epidemiologists
CWG	Content Workgroup
EPA	U.S. Environmental Protection Agency
Exchange Network	U.S. EPA National Environmental Information Exchange Network
FGDC	Federal Geographic Data Committee
FY	Fiscal Year (Federal)
GIS	Geographic Information System
HHS	U.S. Department of Health and Human Services
ICD	International Classification of Diseases
IRB	Institutional review board
NASA	National Aeronautics and Space Administration
NASG	Network Architecture Subgroup
NCEH	National Center for Environmental Health
NCHS	National Center for Health Statistics
NEDSS	National Electronic Disease Surveillance System
NGO	non-governmental organization
NNIP	National Network Implementation Plan
OMB	Office of Management and Budget
PHIN	Public Health Information Network
PHIN MS	Public Health Information Network Message System
PMO	Program Marketing and Outreach Workgroup
RIF	Rapid Inquiry Facility
SND	Standards and Network Development Workgroup
TPA	trading partner agreement
Tracking Network	CDC Environmental Public Health Tracking Network
Tracking Program	CDC Environmental Public Health Tracking Program
URL	Uniform Resource Locator