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Building an Information Management System for Emergency Preparedness and Response to Promote Assurance: A Case Study of the Fulton County Department of Health and Wellness

Judith A. Robinson
Georgia State University

**BUILDING AN INFORMATION MANAGEMENT
SYSTEM FOR EMERGENCY PREPAREDNESS
AND RESPONSE TO PROMOTE ASSURANCE:
A CASE STUDY OF THE FULTON COUNTY
DEPARTMENT OF HEALTH AND WELLNESS**
by

JUDITH A. ROBINSON, JD, MIS, MPH Candidate

**A capstone submitted in partial fulfillment of the
requirements for the degree of
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Approved by _____Dr. Sheryl Strasser_____

Chairperson of Supervisory Committee

_____Mr. Charles Reneau_____

Committee Member

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ABSTRACT

By Judith A. Robinson

The Strategic National Stockpile (SNS) is a program that provides medical countermeasures during a public health emergency. A public health emergency can be a natural or man-made disaster, an act of terrorism, or a pandemic. The Cities Readiness Initiative (CRI) was created to help the nation's largest metropolitan regions develop the ability to provide SNS life-saving medications in the event of a large-scale bioterrorist attack or naturally occurring disease outbreak. To address the risks associated with a public health emergency the Center for Disease Control and Prevention (CDC) requires a comprehensive emergency response plan for distributing SNS/CRI materials quickly and efficiently. The Fulton County Department of Health and Wellness (FCDHW) is tasked with responsibility for distributing and dispensing of SNS/CRI medical assets delivered during a public health emergency. FCDHW is also tasked with the development of a comprehensive response plan. Past TAR scores revealed that passing SNS/CRI audits has been a challenge for FCDHW. A case study was conducted to note if the development of an information management system could facilitate successful future SNS/CRI audits.

A needs assessment revealed that an information management system for emergency preparedness and response compliance was needed. Microsoft SharePoint 2007 was used to

develop the information management system.   SharePoint contains a secure document repository that linked the work products of all relevant internal and external stakeholders and revealed compliance deficiencies early enough to allow for corrective actions. The result was a passing TAR score that was a 59 point increase from the last published score.

Keywords: Strategic National Stockpile, Cities Readiness Initiative Program, Emergency Preparedness and Response, Disaster Management, Information Management System, SharePoint 2007, Countermeasures, Assurance, Technical Assistance Review (TAR), Public Health Emergency

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INTRODUCUTION

Since September 11, 2001, there has been an increased emphasis on improving the ability of communities to prepare for and respond to large-scale public health emergencies (Stergachis et al, 2007) "Whether caused by natural, accidental, or intentional means public health threats are always present (CDC, 2010c). Incidents such as the 2009 H1N1 Influenza pandemic and 2005 Hurricane Katrina are just two examples of public health emergencies that required deployment of SNS/CRI medical assets as a countermeasure to a particular public health emergency (Bueheler & Berkelman, 2006; CDC, 2010f). Regardless of the type of public health emergency, response begins at the local level (Prior, 2004). The Fulton County Department of Health and Wellness (FCDHW) is the local agency tasked with responding to public health emergencies in Fulton County, Georgia. Fulton County, Georgia is a Strategic National Stockpile/Cities Readiness Initiative (SNS/CRI) Program location. FCDHW is responsible for the development and implementation of the SNS/CRI emergency response plan for Fulton County, Georgia (FCDHW, 2010).

The Centers for Disease Control and Prevention (CDC) conducts an annual audit of SNS/CRI emergency response plans to denote the acceptability of an agency's SNS/CRI plan by issuing an assessment score. The Technical Assistance Review (TAR) is the CDC's assessment tool for the SNS/CRI program. The TAR's scores range from 0 to 100. The minimum passing score of 69/100 was increased to 79/100 for the 2010 assessment (CDC, 2010). FCDHW has historically been challenged to receive a passing score (CDC 2008c; CDC 2010c). The project goal was to facilitate a passing score on the 2010 SNS/CRI audit. The use of an information

management system developed to mirror the elements of the SNS/CRI emergency preparedness and response plan was one means to accomplish this goal.

BACKGROUND

In 1999, the United States Congress tasked the Department of Health and Human Services (HHS) and the Centers for Disease Control and Prevention (CDC) with establishing a National Pharmaceutical Stockpile (NPS) that could resupply large quantities of essential medical materiel to states and communities within 12 hours of a Federal decision to deploy during a public health emergency (CDC 2010d;Malatino, 2008; Pesik, 2002). Note the term "materiels" refers to the pharmaceutical and medical supplies and equipment necessary to serve as a medical countermeasure to a particular public health emergency (Merriam-Webster, 2010). The specific mission described under the congressional mandate required that the CDC utilize the NPS to address: "An act of terrorism [or a large scale natural disaster] targeting the U.S. civilian population [that] will require rapid access to large quantities of pharmaceuticals and medical supplies." Congress believed that effective medical countermeasures, provided by the NPS, were required to significantly decrease the impact of a bioterrorist attack (Prior, 2004). The CDC responded to Congress by developing both a stockpile of medical materiels and a means of rapid deployment that could meet the stated requirements (Malatino, 2008).

In 2003, the National Pharmaceutical Stockpile became the Strategic National Stockpile (SNS) and was jointly managed by the Departments of Homeland Security (DHS) and Health and Human Services (Malatino, 2008). The BioShield Act of 2004 transferred the sole responsibility

of the SNS back HHS (BioShield, 2004; Malatino, 2008; Pesik, 2002). HHS tasked the CDC's Coordinating Office for Terrorism Preparedness and Response with oversight of the SNS.

The two events that tested the newly reconfigured SNS program were hurricane Katrina in 2005 and the threat of an H1N1 influenza pandemic in 2009.   Hurricane Katrina was one of the strongest hurricanes to impact the Atlantic Coast of the United States in over 100 years and caused immense devastation to both human life and city operation and infrastructure (NOAA, 2010).   In response to the vast medical needs that arose from this devastation the first SNS materiels were deployed.   The 2009 threat of an H1N1 influenza pandemic also resulted in the deployment of the SNS program assets (CDC 2010f). While H1N1 did not result in an influenza pandemic, development of a comprehensive all hazards plan including a medical countermeasure plan, necessary to facilitate the receiving, distributing, and dispensing of H1N1 vaccine was essential .

STRATEGIC NATIONAL STOCKPILE

Public health emergencies require medical countermeasures, such as vaccines, antibiotics, or antidotes to be delivered rapidly to the general public. The federal government, through the CDC, maintains a cache of pharmaceutical drugs and other medical materiels known as the SNS (CDC, 2010e; Esbitt, 2003; Malatino, 2008; Priester, 2008). The SNS is not designed as a first-response asset, but as a back-up or resupply resource for state and local medical materiel in limited supply or depleted by a large-scale emergency (CDC, 2010e; Malatino, 2008; Priester, 2008). . The SNS is managed by the Health and Human Services (HHS) and is coordinated through the CDC, one of the major operating components of HHS.

The SNS is comprised of 12 separate "push packages," each capable of reaching its designated destination within 12 hours of DHS's authorization. Each push package includes caches of pharmaceuticals, antidotes, and medical supplies designed to provide a broad spectrum of assets in the early hours of an event (CDC 2010e; Esbitt, 2003). The push packages are positioned in strategically located, secure warehouses and delivered by commercial, express carriers. Additional specially tailored supplies known as vendor managed inventory (VMI) follow within 24 to 36 hours of an event. (CDC,2010e; Esbitt, 2003; Malatino, 2008; Priester, 2008). HHS transfers authority for the SNS materiel to the state and local authorities once it arrives at the designated receiving and storage site. State and local authorities then begin the breakdown of the 12-hour Push Package for distribution. SNS Stockpile Service Advance Group (SSAG) remain on site to assist state and local officials so that SNS assts can be efficiently received and distributed upon arrival at the site (CDC 2010e; Esbitt, 2003; Malatino,2008; Priester 2008).

CITIES READINESS INITIATIVE

While the objective of the SNS program is to provide medical assets during a public health emergency; the objective of the CRI program is to improve the ability of the nation's largest metropolitan regions to provide life-saving medications, received from the SNS, in the event of a large-scale bioterrorist attack or naturally occurring disease outbreak within 48 hours to 100 percent of the population within the MSA's jurisdiction (CDC 2008a; CDC 2010d, Fong, 2004; Willis et al. 2009). The 48 hours deadline is a goal based on an outdoor aerosolized anthrax bioterrorism attack scenario, which is considered a worst case scenario and prepares the MSAs to

address lesser emergencies (CDC 2008a; Lee, 2009; Prior, 2004).. There are seventy-two cities in the Cities Readiness Initiative Program (CRI), sometimes referred to as the SNS plus program which represents more than 50% of the U.S. population (CDC, 2008a; CDC 2010c; Fong, 2004; Prior 2004). CRI locations are known as Metropolitan Statistical Areas (MSAs) (CDC 2008a; Willis et al, 2009). A MSA may consist of one or more counties or cross state lines but each state contains at least one MSA (CDC,2008a). CRI recipients receive enhanced funding, technical assistance and are subject to assessment and accountability requirements that go beyond those outlined in other portions of the CDC's Cooperative Agreement on Public Health Emergency Preparedness (PHEP) (Prior 2004). Because response efforts can be logistically demanding in a public health emergency, SNS/CRI cities are required to develop comprehensive emergency response plans (CDC, 2010 a; CDC 2010b; CDC, 2010g). The emergency response plans must include drills and training developed from an all hazards approach and are compliant with Presidential Directive 5 which promotes a centralized approach to disaster management via use of a National Incident Management System (NIMS) (FEMA n.d.).

The twelve critical capacities and essential functions required of SNS/CRI awardees and assessed on the CDC's TAR (2010g) are listed below:

1. Develop a SNS plan with the rationale being the better the plan, the better the MSA is prepared for receiving, distributing, and dispensing of the SNS assets

2. Manage SNS operations as part of the emergency response efforts

3. Request SNS assets once a declaration of emergency has occurred

4. Assure tactical communication in an effort to remain informed and to coordinate response efforts

5. Disseminate public information and communications to keep the public informed and reduce impact of misinformation and rumors

6. Assure security support since emergencies can be chaotic in nature and security can aid the promotion of order and crowd control

7. Regional/Local receiving, staging, and storing SNS assets as required by the SNS program

8. Control SNS inventory before, during and after the emergency

9. Distribution of SNS Assets

10. Dispense oral medications as per compliance plan

11. Coordinate treatment centers to facilitate successful dispensing of medications

12. Train, exercise, and evaluate responders in order to improve response efforts

AN ALL HAZARDS APPROACH

Pursuant to Presidential Directive 5, all SNS/CRI compliance documents are required to be developed from an all hazards approach (DHS, 2009). An "all hazards" approach does not imply that one plan adequately addresses all of the requisite response efforts necessary to prevent, mitigate, respond, or recover from any public health emergency. An all hazards approach notes there are functions common to all public health emergencies and addresses the implementation of these common functions in a base plan while addressing the specific differences associated with a specific hazard in the appendices of the plan. Plans need to be adaptable, innovative, and when

necessary, improvisational to specific circumstances. (Waugh, 2004) The theory is that "all-hazards" plans can provide a basic framework for responding to a wide variety of disasters making it cost effective in terms of time and money. An all-hazards approach to planning encourages a broader perspective on dealing with risk and a broader foundation on which to build effective programs to manage hazards and disasters (DHS, 2009; FEMA, 2008)

Effective [disaster] management should not be event driven. Instead a new paradigm must be approached through increased awareness, preventive measures, and robust preparedness (Waugh, 2004). Preventing a disaster from ever occurring reaps far more benefits than simply reducing the costs of post-incident response and recovery (Waugh, 2004; FEMA 2008). To make the response and recovery aspects of our nation's readiness system as efficient and effective as possible, a cooperative national effort is essential, one with a unified approach to incident management and with the ultimate goal of a significant reduction in our nation's vulnerability over time (DHS, 2009; FEMA, 2008.). All SNS/CRI documents developed for FCDHW were National Response Framework (NRF) and National Incident Management System compliant.

The National Response Framework (NRF) presents the guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies – from the smallest incident to the largest catastrophe (FEMA,2008). The NRF defines the key principles, roles, and structures that organize the way we respond as a Nation. It describes how communities, tribes, States, the Federal Government, private-sector and nongovernmental partners apply these principles for a coordinated and effective national response.

FEMA (2008) notes that the NRF is always in effect, and its elements can be implemented at any

level and at any time. The Framework addresses the following:

1. Key Players: Organizations and entities that may either need assistance or
provide assistance

2. Federal Assistance: Descriptions of the processes for requesting and obtaining
Federal assistance in support of States, tribes, local jurisdictions, and other federal
partners

3. Emergency Support Function Annexes: Summaries of the 15 ESF Annexes,
which group federal resources and capabilities into functional areas to serve as the
primary mechanisms for providing assistance at the operational level

4. Support Annexes: Summaries of the 8 support annexes, which describe
essential supporting aspects that are common to all incidents

The Framework also includes incident annexes that address specific categories of
contingencies or hazard situations requiring specialized application of framework
mechanisms.

Development of the 2010 SNS/CRI compliance documents were developed using an all

hazard approach which was also National Incident Management System (NIMS) compliant which

establishes procedures for efficient collaboration among both internal and external stakeholders

during a domestic disaster (FEMA, n.d). Following the guidance of the National Response

Framework assures a higher TAR audit score as the aforementioned approach also addressed the

obligatory CRI critical capacities and SNS essential functions.

IMPLEMENTATION OF THE SNS/CRI PROGRAM IN FULTON COUNTY

The Fulton County Department of Health and Wellness (FCDHW) is responsible for the development and implementation of the SNS/CRI program on behalf of the residents of incorporated and unincorporated Fulton County, the largest metropolitan statistical area in Georgia. (Appendix B)(Georgia Info, 2003). The CDC's Division of Strategic National Stockpile (DSNS) is responsible for the annual SNS/CRI audit utilizing the Technical Assistance Review (TAR) measurement tool (2010g). The TAR is a CDC-administered assessment that focuses on jurisdictions' capabilities in 12 core functional areas associated with countermeasure distribution and dispensing (CDC, 2010g). A review of past published TAR scores revealed that consistent procurement of a passing score on the TAR has historically been a challenge for FCDHW (CDC, 2008c; CDC 2010c). This problem was further complicated by the CDC raising the minimum passing score from 69/100 to 79/100, a ten point increase, for the 2010 annual audit (CDC, 2010c).

PROBLEM INDENTIFICATION

Research has shown that the audit scores of SNS/CRI MSAs improve the longer they are in the program (Prior 2004: Willis, 2009). However, for some MSAs including the FCDHW the challenge continues (CDC, 2008c). FCDHW has been a SNS/CRI MSA since 2004, but had yet to receive a passing TAR score (CDC 2008c, CDC 2010c). In order to determine what was needed to facilitate a passing score on the TAR, a crosswalk of the CDC's TAR and past FCDHW compliance plans was conducted. A review of previous audits revealed that missing or incomplete documentation contributed to a pattern of failed audit reviews for FCDHW. One

problem noted was that past compliance documents that were stored on a Fulton County shared drive could not be located when needed. Based on the aforementioned, it was also determined that a secure document repository was needed.

MICROSOFT SHAREPOINT 2007 AS AN IMS FOR SNS/CRI COMPLIANCE

Microsoft Office SharePoint 2007 was used to design and develop an information management portal that mirrored the 12 critical capabilities and essential functions of the SNS/CRI program requirements as assessed by the TAR assessment tool. Microsoft SharePoint was selected because of the plethora of tools it contains (Maxima, n.d.; Microsoft, 2010). Those tools include, but are not limited to a calendar/announcement time management tools with video capabilities; a tool that surveys and permits voting; a tool to allow for committee organization ; a tool which allows the administrator to customize the level of clearance given to internal or external project stakeholders; a collaboration tool with also provides for blogs, discussions, and wikis; a project management tool that allow for detailed and current task and project progress ;and a tool to build websites for intranet or extranet capabilities (See Figure 2) Maxima, n.d.; Microsoft, 2010).

CAPSTONE GOALS

The goal of the2010 SNS/CRI capstone project was to facilitate a successful audit score of at least a 79/100. An IMS was developed based on the required components of the TAR assessment tool and to serve as a secure repository for all compliance materials not only for this audit, but future review as well.

METHODOLOGY

A needs assessment was conducted to identify the deficiencies of past FCDHW SNS/CRI plans.   Georgia is divided into 159 state districts.   Fulton County is Georgia District 3-2 (FCDHW,2010). A cross reference of the District 3-2 (Fulton County Department of Health and Wellness) SNS/CRI POD Manual and District Emergency Operations Plan (DEOP) and   the CDC's TAR identified which compliance documents were satisfactory, required modification, or were missing. All SNS/CRI documents were then either created or modified using an all hazards approach.

A recommendation was then made to align all SNS/CRI compliance materials to the TAR format and design and develop IMS that also mirrored the TAR.   One advantage of developing a secure IMS was it would no longer be necessary to recreate all SNS/CRI compliance materials for future audits. Preparation for future audits would merely require the modification of the previous year's plan to address any program changes or requirements. To ensure compliance with the federal standardization of emergency preparedness and response efforts to domestic incidents, all SNS/CRI compliance documents adhered to the requirements of the National Response Framework.

Use of a secure IMS to facilitate a successful SNS/CRI audit required the design and development of a secure virtual IMS that also served as a secure document repository. The virtual IMS would allow for intranet and extranet access; collaboration among both internal and external project stakeholders; tasks and project tracking; use of surveys; the ability to control the amount of clearance and authorization afforded to internal and external SNS/CRI stakeholders; and calendar,

event, and announcement sharing and notification capabilities. The security component of the IMS assures against documents being lost, deleted, or corrupted, all possibilities for users of the Fulton County government shared drive. The use of SharePoint allowed all audit stakeholders to upload their audit documentation once and then checkout the document to make necessary modifications for subsequent audits. SharePoint has a feature which can track various versions of a modified document. This feature is invaluable with regards to preparation for future audits in that it will no longer be necessary to recreate the SNS/CRI audit documents, but merely to modify them to reflect program changes. The use of the secure document repository restricted access to compliance documents to designated project members. Documents identified as incomplete or missing were modified or created pursuant to the requirements noted in the TAR. This is significant in that the removal of the geographical and time access barriers previously caused by use of the Fulton County Government shared drive resulted in increased collaboration.

In order to promote efficient use of SharePoint, training was provided for the FCDHW staff and interns, the staff of the Georgia Tech Research Institute (an external partner), and Fulton County emergency response.

A work plan was established to ensure time to create and upload all necessary compliance documents. Once all of the requisite SNS/CRI documents were either created or edited, the documents were uploaded to the IMS for pre-assessment at the state level. Once the state auditor's recommendations and comments were received, a 45 day work plan was established to incorporate the state's recommendations in time to update the SNS/ CRI documents for the CDC's audit in late July 2010.

PROJECT RESPONSIBILITIES

Once a decision was reached to develop an IMS, my responsibilities were to design and develop an IMS to function as a virtual compliance tool organized to satisfy the requirements of the TAR. I conducted periodic audits of the SharePoint portal were conducted to ensure that the IMS was user friendly, and functioned properly. Periodic audits of compliance documents were also conducted for completeness, accuracy, and program compliance. As the lead intern and project manager, production support of audit materials was required in addition to my SharePoint duties.

THE THREE CORE FUNCTIONS OF PUBLIC HEALTH

There are three core functions of public health. The first core function of public health is Assessment. The second core function of public health is Policy Development. The third core function of public health is Assurance. Listed below is an explanation of how three core functions aligned with the ten essential services of public health and the impact on FCDHW's SNS/CRI program.

The Assessment function refers to the obligation of every public health agency to monitor the health status and needs of its community regularly. This function incorporates the essential services of monitoring health status and diagnosis and investigation of health problems and hazards. FCDHW via the SNS/CRI program monitors for hazardous agents and their threats to the community as well as their impact on individual and community health.

The Policy Development function refers to the responsibility of every health agency to develop comprehensive policies that are based on available knowledge and responsive to communities health needs. This function incorporates informing, educating, and empowering

people; mobilizing community partnerships and action; and developing policies and plans that support individual and community health efforts. FCDHW via SNS/CRI inform, educate, and empower emergency responders to address public health emergencies, mobilize community response partners, and develops comprehensive SNS/CRI plans to support individual and community health efforts.

Assurance is the guarantee of governments that agreed upon, high priority personal and community health services will be provided to every member of the community by qualified personnel and organizations as well as enforcement of laws and regulations that protect health and ensure safety. This function guarantees the use of a competent healthcare workforce, evaluation of personnel and program effectiveness, accessibility of services, and quality personal and population based services; and research based insights and innovative solutions to health problems. FCDHW via SNS/CRI links the population of the Fulton County MSA to the necessary medical assets during a public health emergency, and assures competent public and personal health care workforce via training, exercises and drills, and evaluates SNS/CRI plans using the TAR to determine the readiness of a MSA to address a public health emergency as well as adhering to all laws that protect and ensure the safety of the residents of Fulton County, Georgia.

CHALLENGES

A means of tracking necessary SNS/CRI program improvements was not in existence prior to the beginning of this project; therefore, it was difficult for the FCDHW to track the requisite plan improvements. Continued auditing of the compliance process was needed, but was extremely difficult due to its reliance on external partners for compliance documents. This is especially

relevant when one considers that FCDHW did not have any authority to compel the production of necessary compliance document from external partners. The use of SharePoint reduces the amount of work FCDHW will need to do for future audits because rather than recreate every document in the IMS, it will now be necessary to only make the requisite modifications not recreate the all SNS/CRI compliance documents in the secure repository. It is unlikely that all of the materials uploaded to SharePoint will require modifications to meet the requirement of the 2011 TAR. However, it is also advisable to conduct a needs assessment prior to beginning the SNS/CRI audit process.

RESULTS

The use of SharePoint as an IMS, to enhance emergency preparedness and response assurance along with systematic monitoring and evaluation during the compliance process, was vital to the success of the TAR review. Geographical and time related constraints were no longer an issue due to the fact that SharePoint could be accessed over a secure internet connection from any place at anytime. The use of SharePoint as a secure document repository rather than the FCDHW shared drive that could only be accessed from a Fulton County government location during business hours resulted in increased collaboration and contribution of internal and external audit stakeholders. The project's goal was to facilitate a TAR audit score of at least 79/100. The project goal was met as FCDHW received a 2010 TAR audit score of 86/ 100. FCDHW also received a certificate of achievement from the state of Georgia for the "most improved" score for the 2010 TAR annual review.

FUTURE DIRECTIONS

The SNS/CRI program offers a continued opportunity for Georgia State University's (GSU) public health students with an interest in emergency preparedness and response to contribute to emergency preparedness and response efforts. The opportunity exists for realistic on-the-job training and insights into local health department operations, structures, and challenges and all within walking distance of campus.

RECOMMENDATIONS

While the success of the 2010 audit was the result of the efforts of more than 20 SNS/CRI team members, this is not an option future audits. One advantage of designing and developing an IMS to promote the assurance of a successful audit is that maintenance requires only a fraction of the staff that was needed during the development of the IMS. This is due to the fact that all compliance documents needed are available for requisite modifications instantaneously.

It is advisable to continue to incorporate comments and recommendations from the states' pre-assessment review into the SNS/CRI documents in preparation for the CDC's annual TAR review. The CDC's TAR comments and recommendations should then be incorporated into the upcoming years plan to improve the compliance product for the next year's state pre-assessment. Continued use of the each auditor's comments in the preparation for the next pre-assessment or CDC review will allow for a continual improvement in the development and implementation of future SNS/CRI compliance efforts. To sustain the facilitation of a future successful SNS/CRI

audit, periodic program evaluations must occur. These suggestions should result in a better compliance product.

It is also advisable to expand the needs assessment prior to beginning each audit period note any program changes needed not only to improve the compliance product, but the compliance process.. For example, if it historically takes a certain amount of time to procure all memorandums of understanding and the past timeline allotted less, modify the timeline to reflect the actual time needed not the theoretical time allotted.

While the SNS/CRI compliance efforts can present challenges with regards to supporting repeated success on annual pre-assessments and TAR reviews, adherence to the aforementioned recommendations for continued quality improvement is required if assurance is to be sustained.

APPENDIX A: ACRONYMS

CDC   Centers for Disease Control and Prevention

CRI   Cities Readiness Initiative

DSLR   Division of State and Local Readiness

DSNS   Division of Strategic National Stockpile

FCDHW   Fulton County Department of Health and Wellness

GIS   Geographic Information System

HHS   U.S. Department of Health and Human Services

HSEEP   Homeland Security Exercise and Evaluation Program

ICS   Incident Command System

MOU   Memorandum of Understanding

MSA   Metropolitan Statistical Area

NIMS   National Incident Management System

NRF   National Response Framework

POD   Point of Dispensing

SNS   Strategic National Stockpile

TAR   Technical Assistance Review

FIGURE 1: GEORGIA SNS/CRI METROPOLITAN STATISTICAL AREAS

FIGURE 2: SHAREPOINT TOOLS

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