

Job Aid: Incident Management Technology

Guidance on Technology Standards,
Interoperability, and Acquisition

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Table of Contents

I. OVERVIEW	4
II. RECOMMENDED STANDARDS	5
III. USE CASE SCENARIO.....	6
SET-UP.....	6
AVAILABLE DATA.....	6
MISSING/FUTURE DATA	7
INCIDENT FIELD DATA.....	7
MUTUAL AID REQUESTS	7
CONTEXT DIAGRAM	7
IV. IMPLEMENTING THE STANDARDS TO INCIDENT MANAGEMENT TECHNOLOGY	9
STEP 1 – DETERMINE YOUR AGENCY’S NEED FOR INFORMATION SHARING	11
STEP 2 – DETERMINE HOW THE SYSTEM(S) NEED TO COMMUNICATE TO SHARE INFORMATION	11
STEP 3 – IDENTIFY WHAT INTEROPERABILITY ELEMENTS ARE MOST IMPORTANT	12
STEP 4 – INCORPORATE RESULTS FROM STEPS 1-3 INTO YOUR SYSTEM REQUIREMENTS SPECIFICATION DOCUMENT	12
V. STANDARDS WORKFLOWS.....	13
SITUATIONAL AWARENESS STANDARDS.....	15
RESOURCE MANAGEMENT STANDARDS	16

Table of Figures

Figure 1 Suite of Standards in Job Aid	5
Figure 2 Context Diagram for Use Case Scenario	8
Figure 3 Technology Decision and Implementation Processes	9
Figure 4 Four Steps to Assess Information Sharing Needs & Requirements.....	11
Figure 5 Standards Selection Workflow and Decision Map.....	14
Figure 6 Situational Awareness Workflow and Standards	15
Figure 7 Situational Awareness Workflow Considerations	16
Figure 8 Resource Management Workflow and Standards.....	17
Figure 9 Resource Management Workflow Considerations.....	18

I. Overview

A variety of technologies and products are available for use by the public safety community in supporting incident management and mutual aid. These tools, systems, and products – hereinafter referred to as incident management technology – can support any one or more of the following functions:

- Resource or Asset Inventorying
- Personnel Qualifications and Credentialing
- Deployment Management
- Incident or Crisis Management
- Mutual Aid Operations
- Situational Awareness and Decision Support

The public safety community continues to experience challenges carrying out the functions identified above, not because of a lack of technology, but due to the insufficient use of interoperability and information exchange standards between systems. This issue is often a principal reason why technology often fails to meet the needs of the public safety community. Information that can be shared directly between systems improves reliability, accountability, speed, and accuracy. Phone calls, radio calls, email, and other methods of communication that involve human intervention can slow the flow of information and introduce human errors, including mistranscription, misinterpretation, and delay. During an incident, speed is life. The speed by which accurate information is available to Leaders and Managers directly influences the outcomes of events.

Information shared between systems using common data standards are less prone to these errors and can speed up the flow of information, since modern technology enables near real-time information sharing. Accurate, reliable, and timely information is critical to the public safety community.

The goal of this Job Aid is to equip Leaders and Managers with the requisite knowledge to aid in the acquisition and selection of incident management technologies that apply information sharing requirements and standards.

II. Recommended Standards

The Standards Review and Assessment involved a comprehensive research activity on relevant standards for incident management and mutual aid requirements and was carried out by the National Alliance for Public Safety GIS (NAPSG) Foundation. This review identified a variety of standards from the Organization for the Advancement of Structured Information Standards (OASIS) Emergency Data Exchange Language (EDXL) suite of standards that are directly applicable to the core functions listed in section 1.0. These include:

Standard	Authoritative Information
Common Alerting Protocol (CAP) - OASIS	https://docs.oasis-open.org/emergency/cap/v1.2/CAP-v1.2.html
Hospital Availability Exchange (HAVE v2) - OASIS and HL7 ^R	https://docs.oasis-open.org/emergency/edxl-have/v2.0/edxl-have-v2.0.html
Distribution Element (DE) - OASIS	https://docs.oasis-open.org/emergency/edxl-de/v2.0/edxl-de-v2.0.html
Resource Messaging (RM) - OASIS	https://docs.oasis-open.org/emergency/edxl-rm/v1.0/EDXL-RM-SPEC-V1.0.html
Situation Report (SitRep) - OASIS	https://docs.oasis-open.org/emergency/edxl-sitrep/v1.0/edxl-sitrep-v1.0.html
Tracking Emergency Patients (TEP) - OASIS	https://docs.oasis-open.org/emergency/edxl-tep/v1.1/edxl-tep-v1.1.html
Emergency Management Loose Coupler-National Information Exchange Model (NIEM)	NIEM EM - https://www.niem.gov/communities/emergency-management NIEM Releases - https://niem.github.io/niem-releases/

Figure 1 Suite of Standards in Job Aid

The standards listed above are focused on information exchange for different types of emergency management systems that support incident management and mutual aid functions. It is recommended that most technology tools or products for this mission would need to implement multiple standards to cover the breadth of information to be shared.

This Job Aid serves as a simple guide to choosing the appropriate information sharing standard for a given need. The primary audience is public safety Leaders and Managers to help them determine the best options for their needs and properly communicate those requirements to

technology vendors. The secondary audience is technologists and vendors, to help guide implementation and provide technical guidance.

Adoption and use of the standards listed above is typically on a voluntary basis, and most used when prompted or required by the customer – the public safety community. This is where a paradigm shift needs to occur by the technology providers and vendors, where they design solutions based on the inherent interoperability and information sharing needs of the public safety community first and foremost.

III. Use Case Scenario

This Job Aid has walked through various recommended standards. The next step is to progress through a “real life” emergency scenario to show how these implementations could improve and enhance the way data is shared in the field. The premise of this scenario is a large-scale traffic accident involving multiple injuries, fatalities, vehicle fires, hazardous material leakage, and multi-jurisdiction response. This scenario highlights how each of the identified standards could be used to improve situational awareness and response.

Set-Up

A large winter storm is impacting a small Midwest town with blizzard conditions and reported power outages. A regional Emergency Operations Center (EOC) has been activated to monitor and respond to the changing weather conditions. Emergency operations plans are in place to deal with the situation. Reports of a multi-vehicle pileup on the interstate are starting to trickle in. Response to the incident will be coordinated through the EOC.

Available Data

The EOC situational awareness system is already receiving Hospital AVailability Exchange Reports (HAVE reports) from the regions’ hospitals. This information includes bed status, emergency services status, and EMS services status. Additionally, the EOC is receiving real-time local agency Computer-Assisted Dispatch (CAD) information about active incidents, unit status, and unit locations via the National Information Exchange Module Emergency Management Loose Coupler (NIEM EMLC) reports. Blizzard warnings and alerts (EDXL CAP) are being received from the Federal Emergency Management Agency (FEMA) Integrated Public Alert and Warning System (IPAWS) as the National Weather Service updates them.

Missing/Future Data

In this situation, and in addition to the HAVE reports, a new type of report dealing with the electric grid would be useful. This information would include facility ID, overall capacity, status, and expected issue correction estimates.

A new type of report dealing with Department of Transportation (DOT) road information would also be useful in the situation. This information should include things like road ID, road status, and expected future status.

Incident Field Data

During the incident, field reports, like Emergency Data Exchange Language Situation Reports (EDXL SitRep), can be generated from boots on the ground to indicate any immediate needs and initial observations from the scene. This information could also be generated by personnel in the EOC or dispatch centers from radio reports in the field.

Converting this information to Situation Reports (SitRep) allows the information to be shared more easily across systems.

Mutual Aid Requests

As the incident escalates, both automatic and longer-term mutual aid requests can be made to nearby jurisdictions using EDXL Resource Management (RM). The automatic request would include unit availability, unit capabilities, unit type, and estimated departure/arrival information. The long-term aid would most likely include costing information as well as the previously identified fields.

Context Diagram

Figure 2 illustrates what data could be provided by what system and in what format. It is intended to highlight what could be possible when the right standards are used. It illustrates how the various standards apply to different types and levels of incident management technology and workflows. These range from field-based applications to Emergency Communication Centers, mass notification systems, and EOCs.

The communication methods Hypertext Transfer Protocol (HTTP) or Message Queuing Telemetry Transport (MQTT) will be system dependent and are not displayed. Additional details about communication methods are provided in the accompanying Technical Guide.

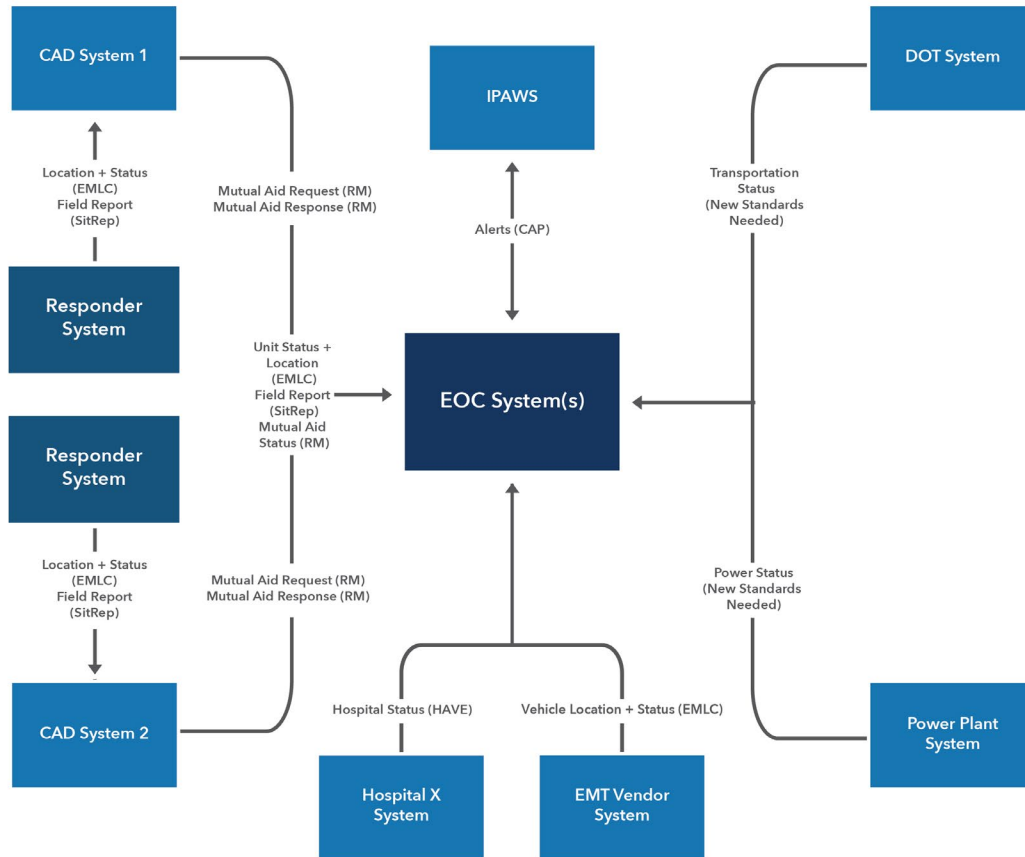


Figure 2 Context Diagram for Use Case Scenario

IV. Implementing the Standards to Incident Management Technology

The standards described in this Job Aid will help public safety Leaders and Managers understand the basic information within relevant standards and how they can help in the product selection and adoption process. Figure 3 illustrates the sequence of decision and implementation processes.

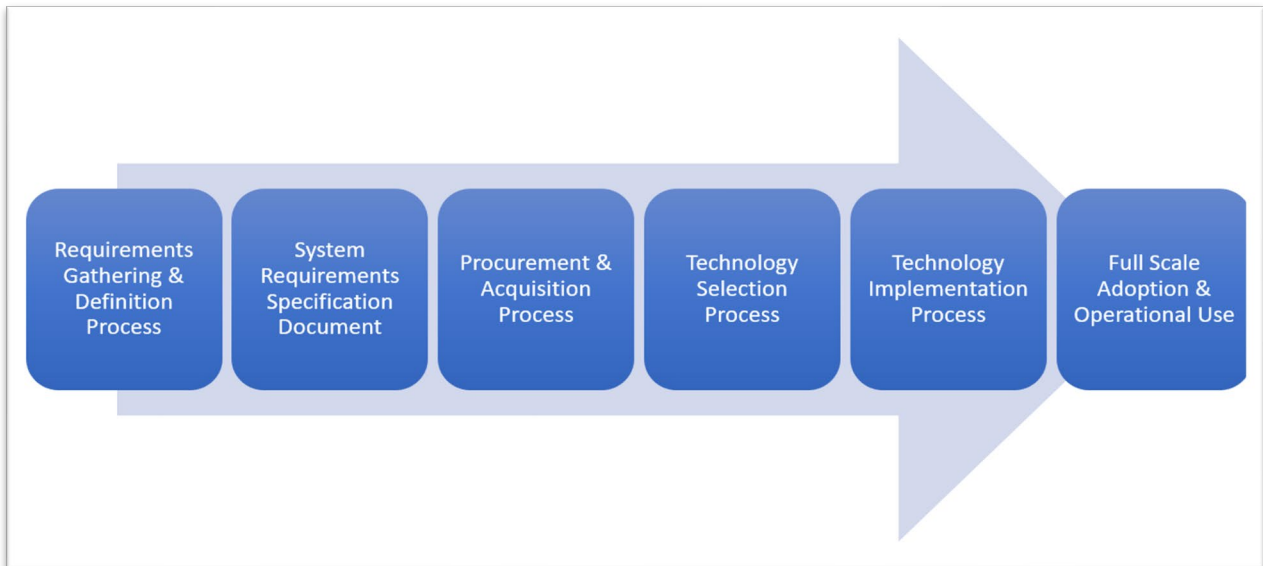


Figure 3 Technology Decision and Implementation Processes

To improve interoperability and information sharing across agencies and organizations for incident management, public safety Leaders and Managers need to require that their technology vendors and providers implement appropriate information sharing standards.

An appendix is provided in the accompanying Technical Guide with technical details and samples of what application programming interfaces (APIs) and architectures might look like to provide additional technical insight. Leaders and Managers can share this document, and the detailed appendices, with their Information Technology (IT) staff and technology vendors and providers.

Why Are Information Sharing Standards Important?

When looking to implement a new software for emergency management use, it is important for agencies to focus on the high-level requirement areas for a system so that the software purchased is of greater value for a longer period. For instance, the agency needs to ensure that the software, application, or product they are purchasing is built to the appropriate interoperability standard. Leaders and Managers cannot assume that interoperability is inherent in the products being promoted by technology providers and vendors.

Ensuring interoperability increases the longevity of the technology investment and overall sustainability. Since standards do not change frequently, upgraded software and technology does not need to be purchased as often. While user interface and functionality requirements are important, the underlying data, how it is managed and shared, provide the true longevity of any system. Achieving effective incident management and mutual aid relies on the following:

- Use of standards within the technology system or product,
- Technical communication between systems, and
- Consistent use of the system and decision support products by the community.

Standards provide an agreed upon data format that knowledgeable groups have vetted through a series of community-involved reviews and can allow systems to speak easily to one another. By reducing the need for extensive customization, typically offered as an expensive add-on, the overall costs should be reduced, and interoperability should improve.

Further, it is important to consider the use of open standards that are widely available at no cost to the community. Open standards for technology and data exchange are more readily accessible and are therefore easier for the technology/vendor community to adopt. The standards referenced in this Job Aid are all open standards that are publicly available at no cost.

Illustrated below in Figure 4 are the four steps in assessing information sharing needs and requirements, which are critical in implementing incident management technology that is scalable, flexible, and interoperable.

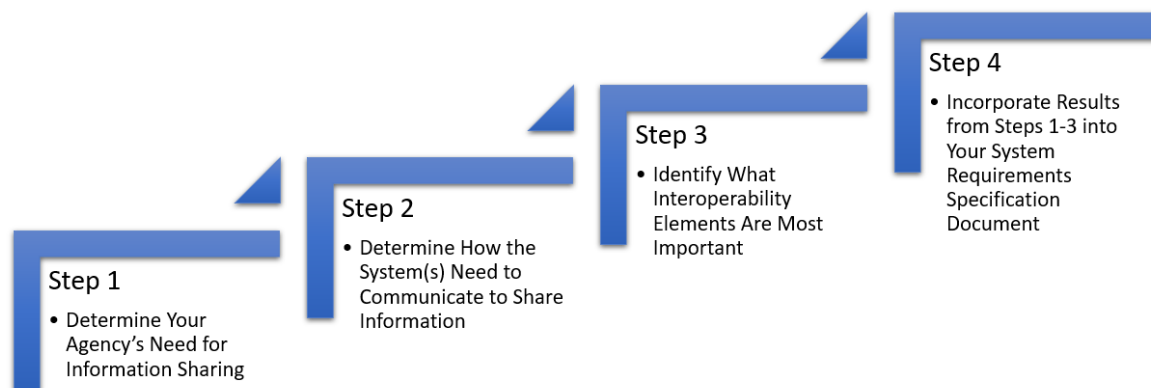


Figure 4 Four Steps to Assess Information Sharing Needs & Requirements

Step 1 – Determine Your Agency's Need for Information Sharing

The decision maker should ask questions about their system needs, such as:

- What are we trying to share and why?
- With whom are we trying to share data?
- What are the major elements of the data that we need to share (e.g., incident info, resource info, patient info, etc.)?

Once these answers are identified, the decision maker can then run through the workflow provided in Figure 6 of this guide to identify the best standards to cover their needs. As noted, there is no one-stop-shop standard, so multiple standards likely apply. Leaders and Managers should also ensure they share information in compliance with their respective policies and legal parameters.

Example: Our agency is trying to share field observations and field reports with neighboring jurisdictions providing mutual aid to ensure situational awareness and prevent duplication of effort in response. Major data elements include incident information, resource information, incident stabilization efforts, and damage assessment reports.

Step 2 – Determine How the System(s) Need to Communicate to Share Information

Once standards are identified, the decision maker can then turn their attention to the aspect of communication for their system. As noted above, communication, when identified as the way systems “speak” to one another, can also limit the amount of customization or cost associated

with procuring a system. If the decision maker identifies a specific communication system that neighboring jurisdictions use, and that system utilizes Open Data Standards, it may be in their best interest to shop for that same style of communication to ensure interoperability. The decision maker can also work with their technical staff to use the communications workflow included in the accompanying Technical Guide to determine the best communication choice for their software.

Step 3 – Identify What Interoperability Elements Are Most Important

After running through these activities, the decision maker should be able to identify the types of interoperable elements most important to their system and can request that of technology providers and vendors. If the proper system or tool does not currently exist, the demand by decision makers – as the purchasers - should eventually create a market for vendors to meet the demand. Gone will be the days where systems are stove piped by proprietary development and expensive support; a national (and global) ecosystem of strong software choices that increase interoperability will be created. Example interoperability elements include:

- Location format (latitude/longitude, USNG, etc.)
- File format or type
- Unique identifiers

Step 4 – Incorporate Results from Steps 1-3 into Your System Requirements Specification Document

The findings and results from the requirements gathering and definition process will establish a strong foundation for the procurement and acquisition. Sound technology procurement and acquisition practices rely upon clear and comprehensive requirements and specifications that are developed and provided by the decision maker as the purchaser. This ensures that the decision maker clearly conveys to technology providers and vendors what their explicit needs are. By incorporating the inputs from Steps 1-3 in an agency's technology specifications or system requirements specification (SRS) document, the decision maker ensures that technology providers and vendors know up front what standards they must implement and comply with to ensure scalability, flexibility, and ultimately interoperability.

V. Standards Workflows

The following section describes the decision workflow for choosing the appropriate standard based on need. The intent is to aid in the selection of which standards should be used based on what information needs to be shared.

The workflow in Figure 5 is split into two branches based on the type of information needed to be shared.

- Situational Awareness
- Resource Management

The alignment of standards for each is based on the results from the standards review and assessment process that NAPSG Foundation carried out as part of the development of this Job Aid. The Situational Awareness branch of the workflow aligns itself to the Situational Awareness Requirements, while the Resource Management branch aligns itself to the Resource Management Requirements.

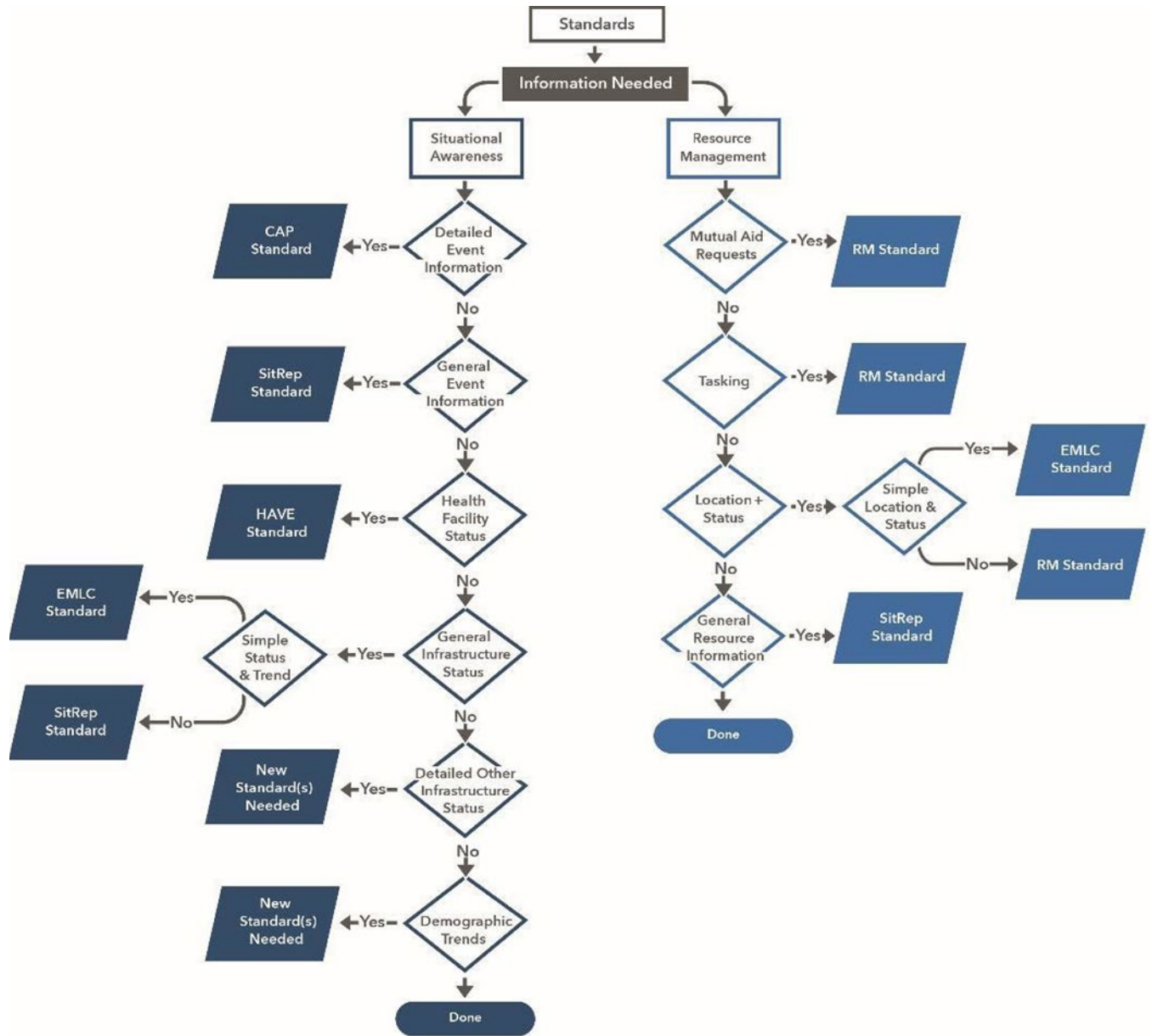


Figure 5 Standards Selection Workflow and Decision Map

Situational Awareness Standards

The Situational Awareness workflow branch asks a series of questions about the kind of information needing to be shared. These are loosely based on the Situational Awareness requirements defined by public safety stakeholders over several years through coordination by NAPSG Foundation, and is documented in the [Summary Report: Mutual Aid Information Requirements](#).

A “Yes” to the question points in the direction of a recommended standard, while a “No” simply moves you to the next question. The table in Figure 7 explains the intent of each workflow question.

Situational Awareness Workflow and Standards

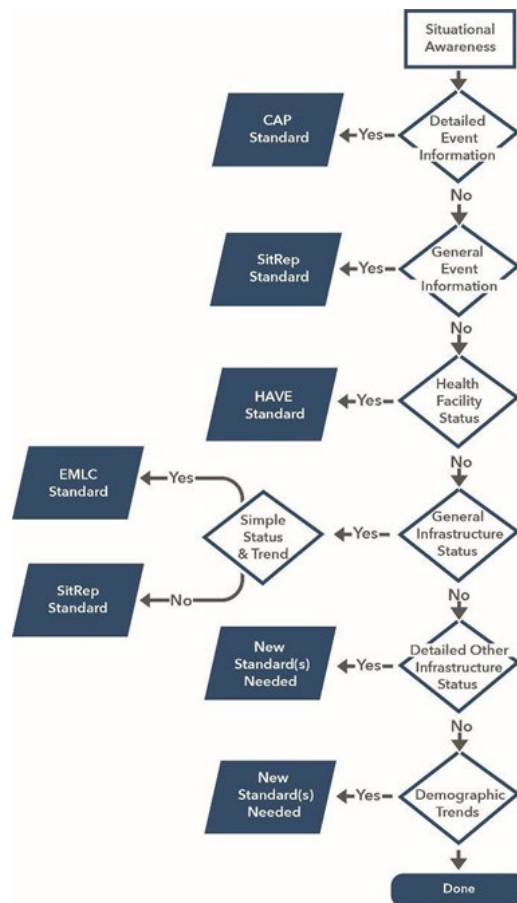


Figure 6 Situational Awareness Workflow and Standards

The intent of the workflow is to match high-level information sharing needs to a recommended standard as simply as possible. In a few cases, there are no existing standards that meet an information need from the Situational Awareness requirements.

The standards that align with the Situational Awareness workflow include the following:

- CAP - <https://docs.oasis-open.org/emergency/cap/v1.2/CAP-v1.2.html>
- EDXL SitRep - <https://docs.oasis-open.org/emergency/edxl-sitrep/v1.0/edxl-sitrep-v1.0.html>
- HAVE - <https://docs.oasis-open.org/emergency/edxl-have/v2.0/edxl-have-v2.0.html>
- NIEM EMLC - <https://niem.github.io/niem-releases/>

Workflow Considerations	Explanation
Detailed Event Information	Is detailed information needed about a specific event, including status and location, future predictions, impact area, and how to respond to a specific event?
General Event Information	Is more summary-level, current information needed about an event?
Health Facility Status	Is detailed information needed about a specific health care facility, including bed status, Emergency Room (ER) capacity, Emergency Medical Services (EMS) response availability, etc.?
General Infrastructure Status	Is a general status needed for a specific infrastructure facility, such as Power Plant X, or for a general infrastructure category, such as communication?
Detailed Other Infrastructure Status	Is detailed information, like the type of information in health facility status, needed for a specific, non-health infrastructure facility?
Social Vulnerability and Demographic Trends	Is information needed about socially vulnerable, demographic trends, and/or demographic within the area of interest?

Figure 7 Situational Awareness Workflow Considerations

Resource Management Standards

The Resource Management workflow branch asks a series of questions about the kind of information needing to be shared. These are loosely based on the Resource Management

requirements defined by NAPSG Foundation in the [Summary Report: Mutual Aid Information Requirements](#). They are broken down in the Figure 9.

Resource Management Workflow and Standards

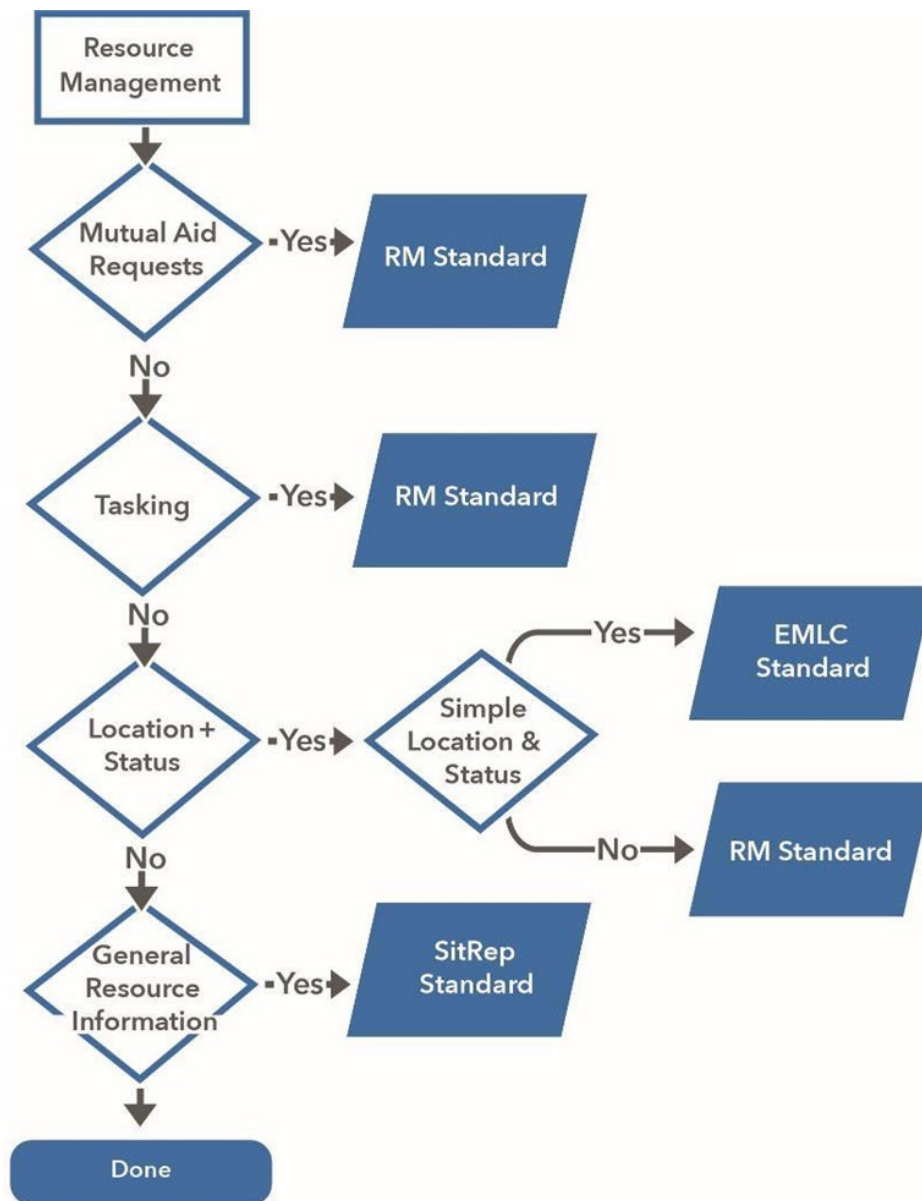


Figure 8 Resource Management Workflow and Standards

General Category	SA Requirements	Workflow Considerations	Explanation
Mutual Aid	Resource Kind, Resource Response Availability, Resource Readiness, Deployment Time, Resource Cost	Mutual Aid Request	Is a request and response for aid needed, including costing?
Tasking	Status of taskings during the response	Tasking	Is the ability to task a responding resource needed?
Current Status	Resource Kind, Resource Response Availability, Resource Readiness	Location + Status	Is the status and location of a specific resource needed?
General Status	Resource Kind, Resource Response Availability, Resource Readiness	General Resource Information	Is a general status about a specific responding resource and/or all responding resources needed?

Figure 9 Resource Management Workflow Considerations

The intent of the workflow is to match high-level information sharing needs to a recommended standard as simply as possible. In a few cases, there is no existing standard that meets an information need from the Resource Management requirements.

The standards that align with the resource management workflow include the following:

- EDXL RM - <https://docs.oasis-open.org/emergency/edxl-rm/v1.0/EDXL-RM-SPEC-V1.0.html>
- EDXL SitRep - <https://docs.oasis-open.org/emergency/edxl-sitrep/v1.0/edxl-sitrep-v1.0.html>
- NIEM EMLC - <https://niem.github.io/niem-releases/>