A Status Update
Resilient Hospital Reference Model (RHRM) MBSE Project

JAMES A. JOHNSON
DOUGLAS E. ANDERSON
CAREN C. ROSSOW

HEALTH SYSTEMS THINKING

A PRIMER

HEALTH SYSTEMS THINKING

A PRIMER

JAMES A. JOHNSON, PhD, MPA, MSc
Professor, School of Health Sciences
Central Michigan University
and
Visiting Professor, St. George's University
Grenada, West Indies

DOUGLAS E. ANDERSON, DHA, MSS, MBA, LFACHE
Adjunct Professor and Healthcare Consultant
Washington, DC Metro Area

https://www.amazon.com/Health-Systems-Thinking-James-Johnson/dp/1284167143

Resilient Hospital
Systems Engineering Team (RHSET)
Members and Key Stakeholders

https://www.infragard.org/

National Association of County and City Health Officials

https://www.naccho.org/

https://sdmph.org/

RHRM MBSE Project - Background

-- The **Resilient Hospital Reference Model (RHRM) Model-Based Systems Engineering (MBSE)** project was motivated by work detailed in the booklet, "Resilient Hospital Handbook", authored by INCOSE member Charles Manto; as well as Earl Motzer, PhD; and James Terbush, MD, MPH.

-- Following its publication, in a series of subsequent discussions, it was decided that follow-up systems engineering work could provide added value, based on "model-based" contributions from several INCOSE working groups, IEEE, and FBI/InfraGard, in collaboration with key stakeholders from SDMPH, NACCHO, and other healthcare organizations.

-- The RHRM MBSE project has been underway since 2018; building on 2017 initial efforts of a "Microgrid Reference Model" MBSE project.

-- As work continues on the Microgrid Reference Model MBSE project, the work of the RHRM MBSE project has garnered significant interest from several healthcare-related organizations.

Buy at Amazon:
https://tinyurl.com/qIjruxj
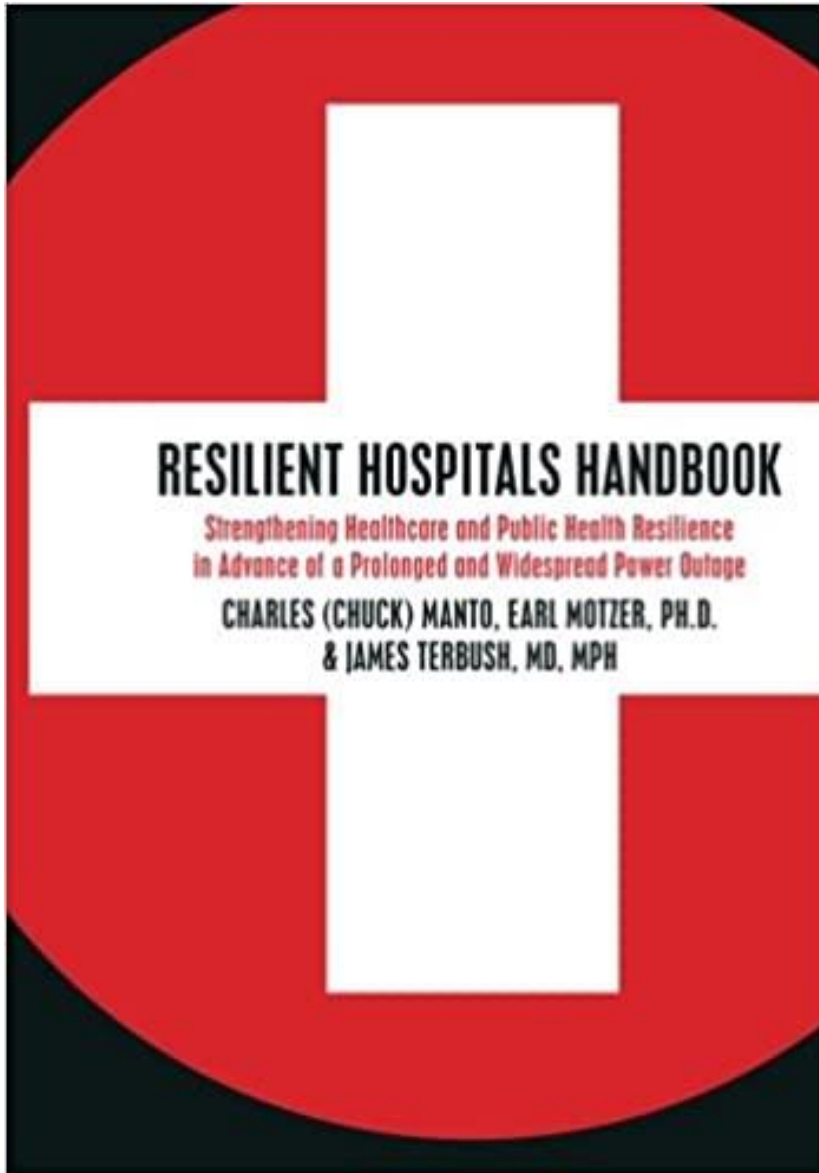
Free Working PDF at InfraGard:
https://tinyurl.com/y3sqv4y8

Project Purpose, Goal, and Vision

Project Purpose: To develop a *generic* **Resilient Hospital Reference Model (RHRM)** to enhance current planning for preparedness, protection, prevention, response, mitigation, and recovery; initially as they pertain to hospital prolonged power outages.

Project Goal: To provide all hospitals with a **Resilient Hospital decision support capability** (leveraging Model-Based Systems Engineering (MBSE) techniques and tools) that hospitals can use to enhance planning before, during, and after a prolonged power outage.

Project Vision: This Resilient Hospital decision support capability can be **replicated and scaled**; to offer the same kinds of model-based tools and resources at the public health care local, tribal, state, regional, and national levels.

Resilient Hospital Reference Models

-- Enable **hospitals in general** to:
  - Collaboratively model (i.e., describe and diagram, in a
    common repository) and share reference data and
    information about hospital critical operations.
  - Establish a common reference framework.
  - Effectively and efficiently coordinate the provision of
    resources and services.

-- Will enable planning and decision-making in compliance with all local,
tribal, state, regional, and national guidance, requirements, and standards
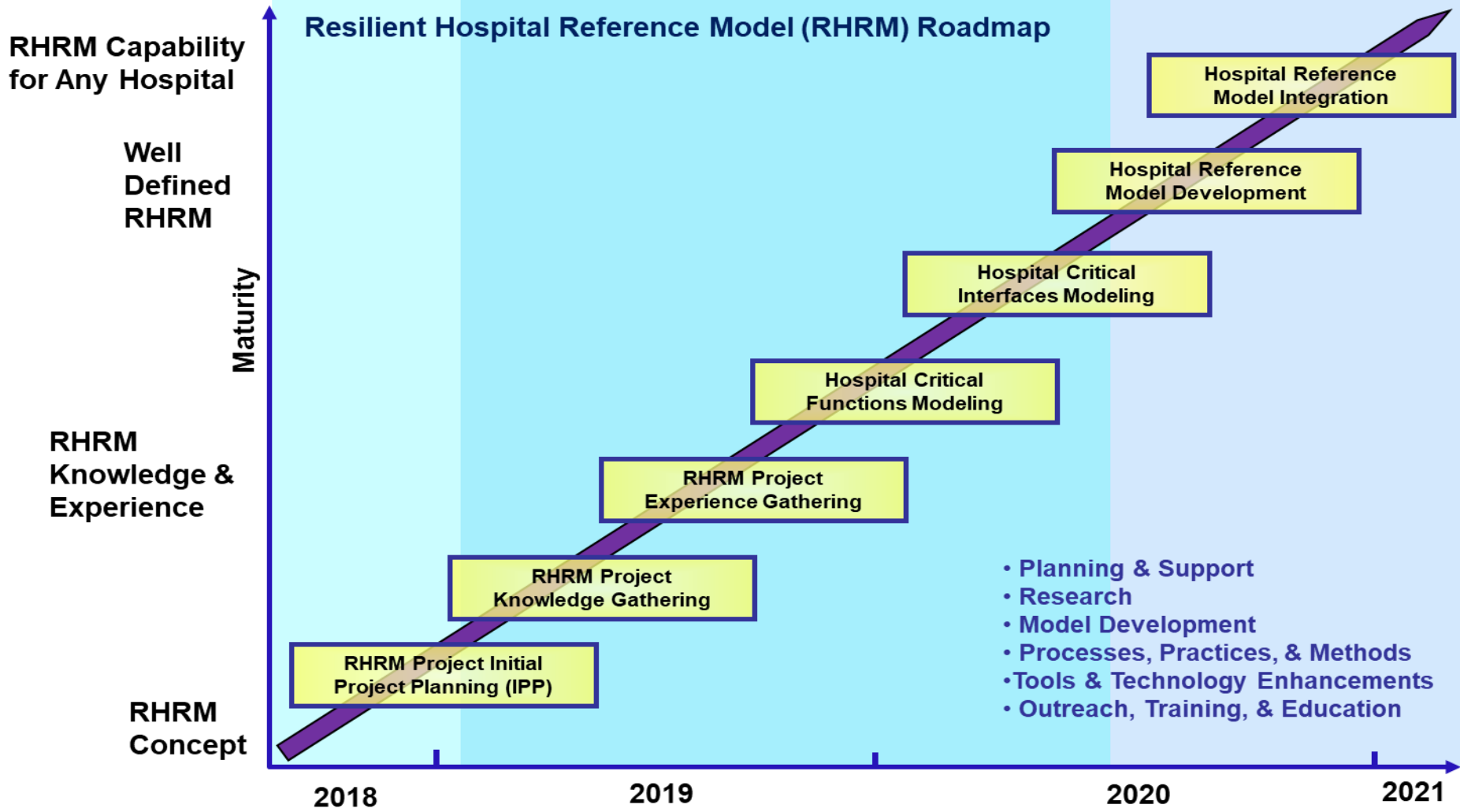(i.e., references).

-- Meant to be flexible & scalable, to enable hospitals to successfully
integrate their operational references into broader health care coalition
catastrophic event planning, execution, and evaluation frameworks, as well
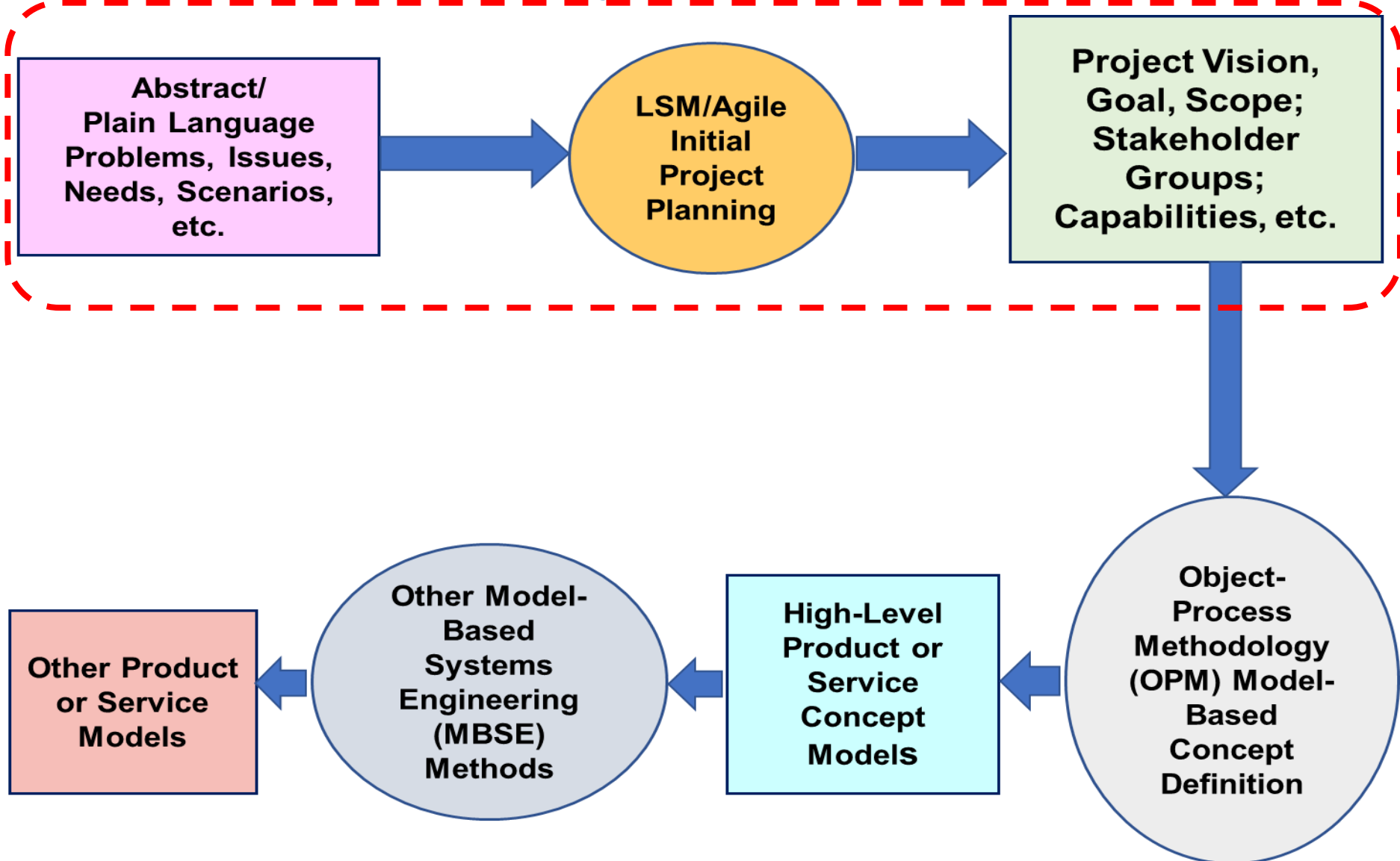as national emergency healthcare response systems.
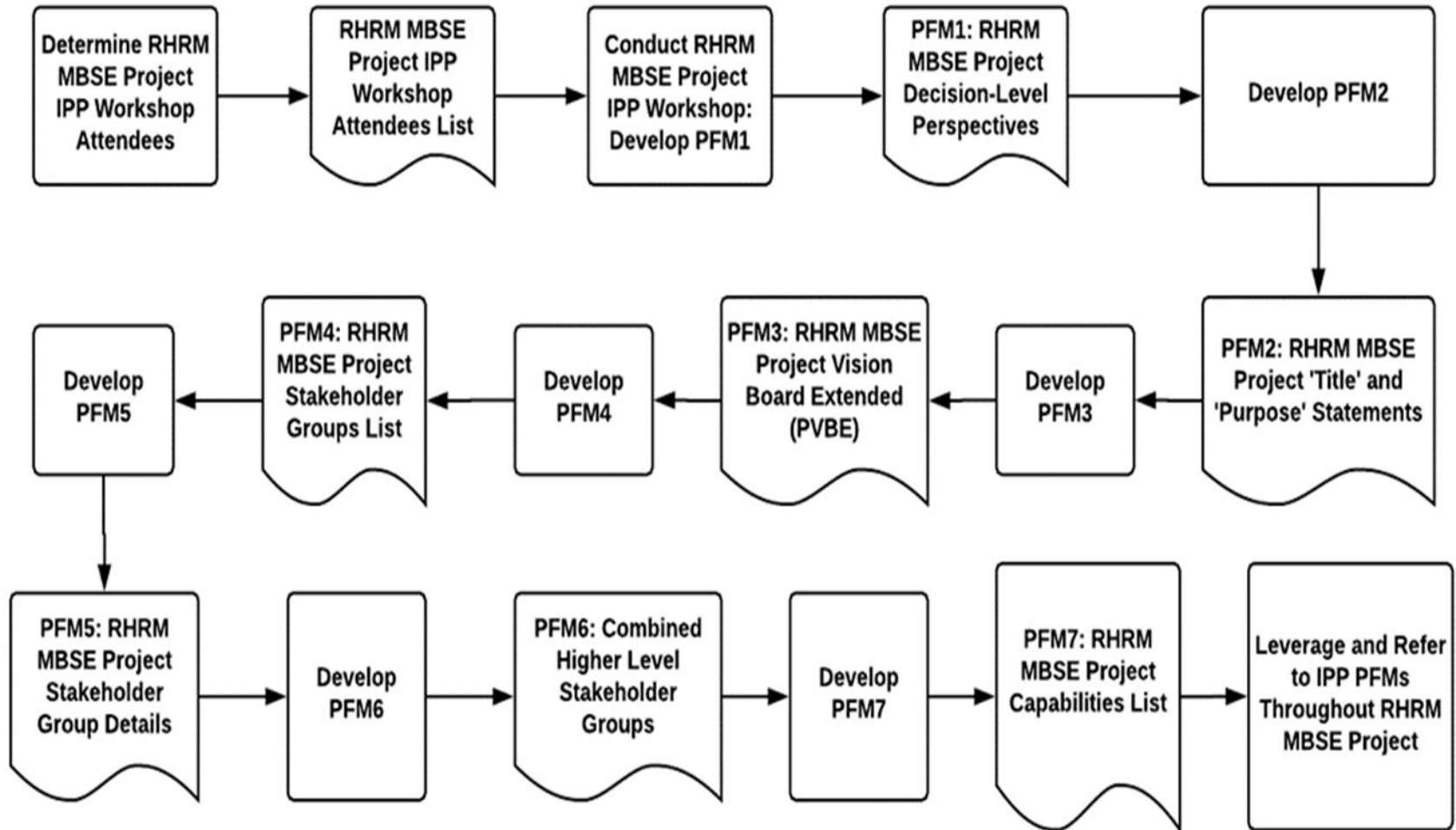
RHRM MBSE Project Roadmap

RHRM Capability	Situational Awareness	Resource Readiness	Enhanced Interoperability	Assured Communications	Sharable Knowledge	Assured Compliance

Resilient Hospital Reference Model (RHRM) Roadmap

RHRM Capability for Any Hospital

Well Defined RHRM

Maturity

RHRM Knowledge & Experience

RHRM Concept

- Hospital Reference Model Integration
- Hospital Reference Model Development
- Hospital Critical Interfaces Modeling
- Hospital Critical Functions Modeling
- RHRM Project Experience Gathering
- RHRM Project Knowledge Gathering
- RHRM Project Initial Project Planning (IPP)

• Planning & Support
• Research
• Model Development
• Processes, Practices, & Methods
•Tools & Technology Enhancements
• Outreach, Training, & Education

2018   2019   2020   2021

https://www.incose-cc.org

9

RHRM MBSE Project Flow

Abstract/ Plain Language Problems, Issues, Needs, Scenarios, etc.

→ LSM/Agile Initial Project Planning

→ Project Vision, Goal, Scope; Stakeholder Groups; Capabilities, etc.

Object-Process Methodology (OPM) Model-Based Concept Definition

→ High-Level Product or Service Concept Models

→ Other Model-Based Systems Engineering (MBSE) Methods

→ Other Product or Service Models

RHRM MBSE Project IPP

RHRM MBSE Project IPP

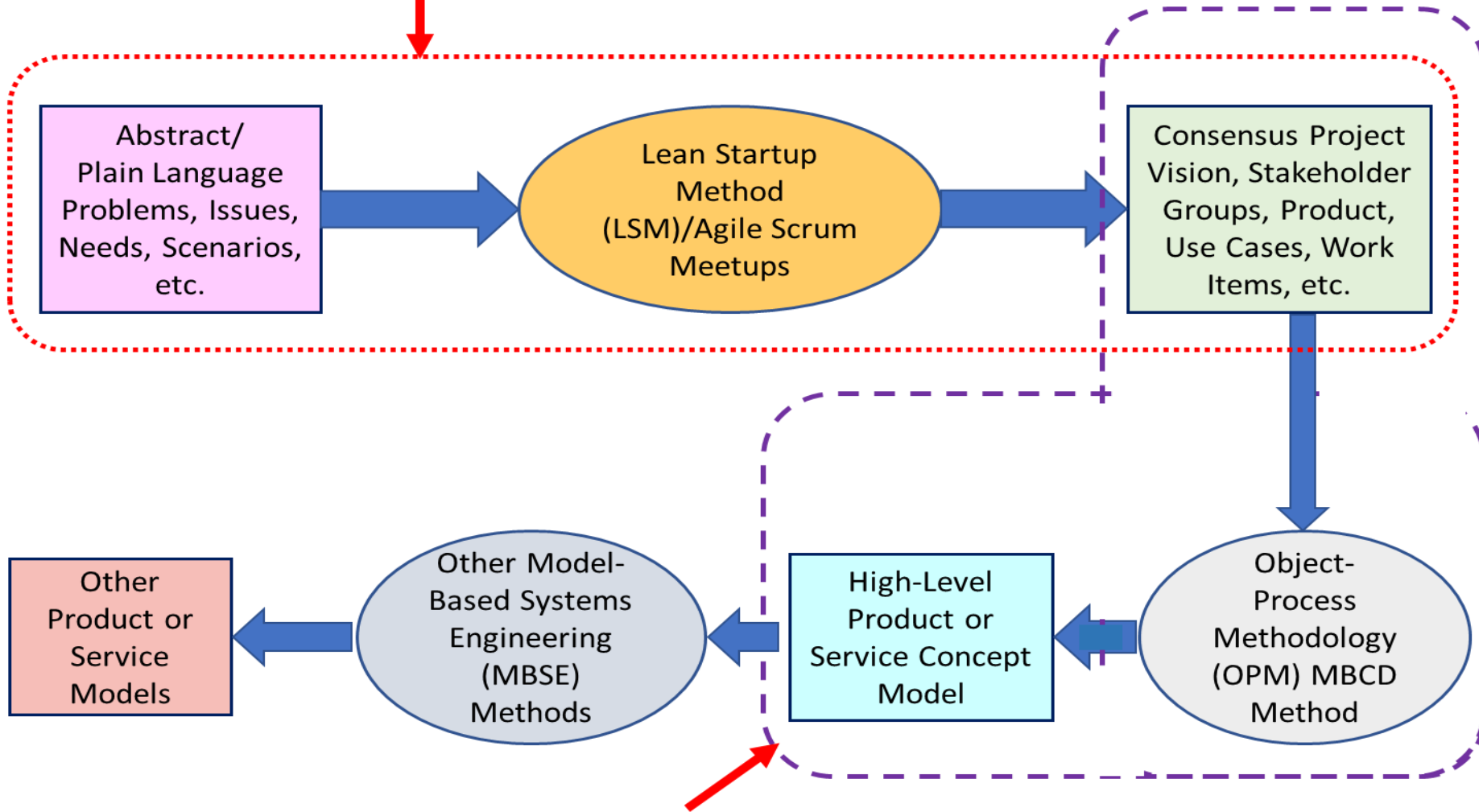# RHRM MBSE Project IPP

Lucidchart

https://www.lucidchart.com

INCOSE CONNECT RHRM MBSE Project IPP Materials:
- CONNECT Login
- Working Groups (menu)
- Object-Oriented SE Method
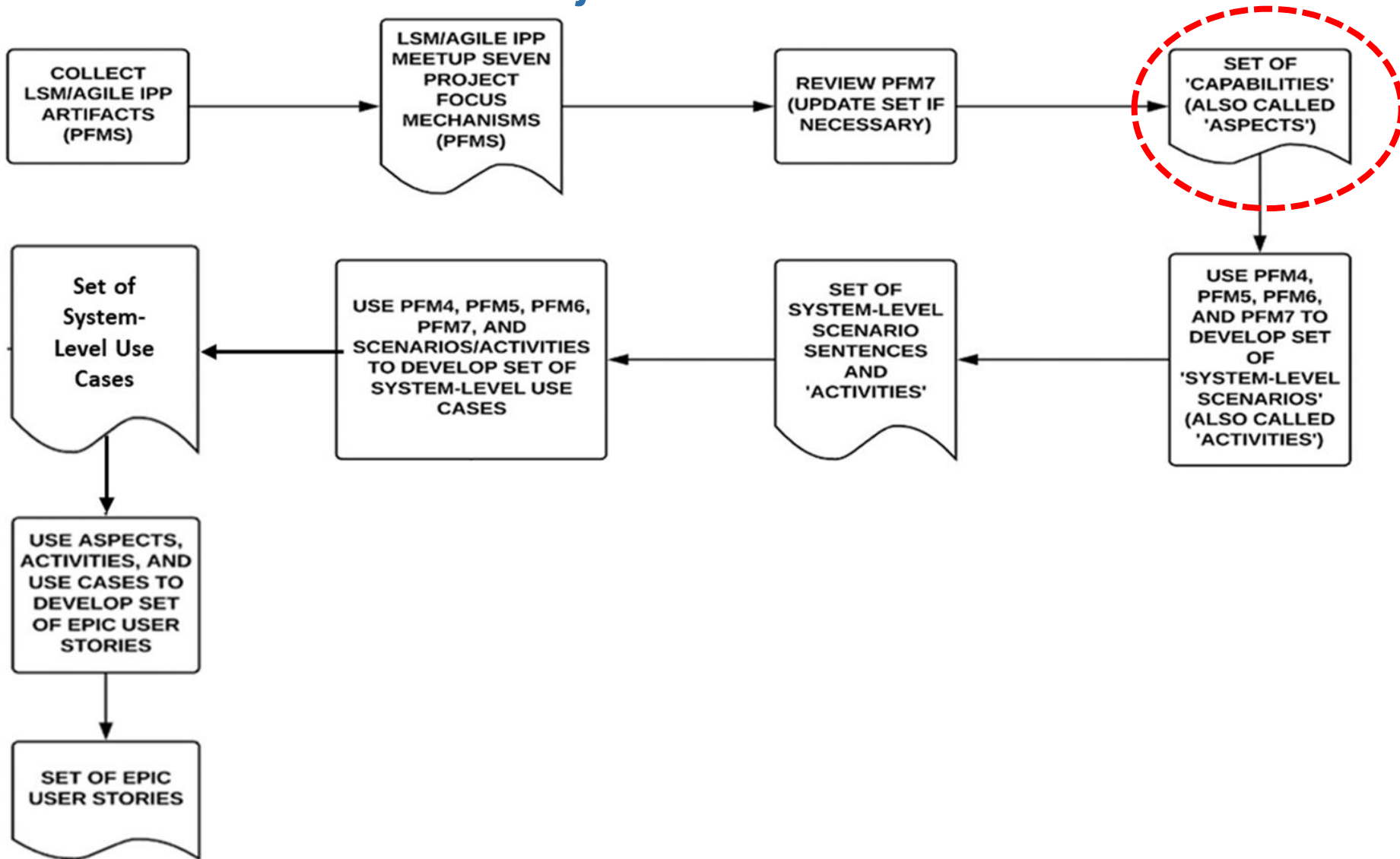- Resilient Hospital Reference Model (RHRM) Project
- RHRM Project IPP

RHRM MBSE Project Flow

LSM/Agile IPP "Meetup, Clean Up, and Post Up"

Abstract/ Plain Language Problems, Issues, Needs, Scenarios, etc. → Lean Startup Method (LSM)/Agile Scrum Meetups → Consensus Project Vision, Stakeholder Groups, Product, Use Cases, Work Items, etc.

Object-Process Methodology (OPM) MBCD Method → High-Level Product or Service Concept Model → Other Model-Based Systems Engineering (MBSE) Methods → Other Product or Service Models

OPM-Based "Model-Based Concept Definition (MBCD)"

RHRM MBSE Project IPE

COLLECT LSM/AGILE IPP ARTIFACTS (PFMS) → LSM/AGILE IPP MEETUP SEVEN PROJECT FOCUS MECHANISMS (PFMS) → REVIEW PFM7 (UPDATE SET IF NECESSARY) → SET OF 'CAPABILITIES' (ALSO CALLED 'ASPECTS')

SET OF 'CAPABILITIES' (ALSO CALLED 'ASPECTS') → USE PFM4, PFM5, PFM6, AND PFM7 TO DEVELOP SET OF 'SYSTEM-LEVEL SCENARIOS' (ALSO CALLED 'ACTIVITIES')

USE PFM4, PFM5, PFM6, AND PFM7 TO DEVELOP SET OF 'SYSTEM-LEVEL SCENARIOS' (ALSO CALLED 'ACTIVITIES') → SET OF SYSTEM-LEVEL SCENARIO SENTENCES AND 'ACTIVITIES' → USE PFM4, PFM5, PFM6, PFM7, AND SCENARIOS/ACTIVITIES TO DEVELOP SET OF SYSTEM-LEVEL USE CASES → Set of System-Level Use Cases

Set of System-Level Use Cases → USE ASPECTS, ACTIVITIES, AND USE CASES TO DEVELOP SET OF EPIC USER STORIES → SET OF EPIC USER STORIES

RHRM MBSE Project IPE

20200210 Meetup and News PFM7 Capabilities List	PFM7s as Gerund Statements
Assess Impact on Patient Care	Assessing Impact on Patient Care
Maintain Public Communications	Maintaining Public Communications
Provide Backup Power	Providing Backup Power
Test Continuity of Power	Testing Continuity of Power
Manage Equipment and Medical Care Supplies	Managing Equipment and Medical Care Supplies
Provide Alternative Fire Safety	Providing Alternative Fire Safety
Provide Alternative Waste Disposal	Providing Alternative Waste Disposal
Track Lessons Learned	Tracking Lessons Learned
Support telemedicine	Supporting telemedicine
Assess Power-Related Threats	Assessing Power-Related Threats
Determine Feasible Services	Determining Feasible Services
Evacuate Patients	Evacuating Patients
Family Support	Supporting Families
Respond to Zero-Power Situation	Responding to Zero-Power Situation
Provide Critical In-Home Services	Providing Critical In-Home Services
Assess Power-Related Threats	Assessing Power-Related Threats
Allocate Limited Resource (Steam)	Allocating Limited Resource (Steam)

Excerpt from RHRM MBSE Project IPP/IPE Workbook

RHRM MBSE Project IPE
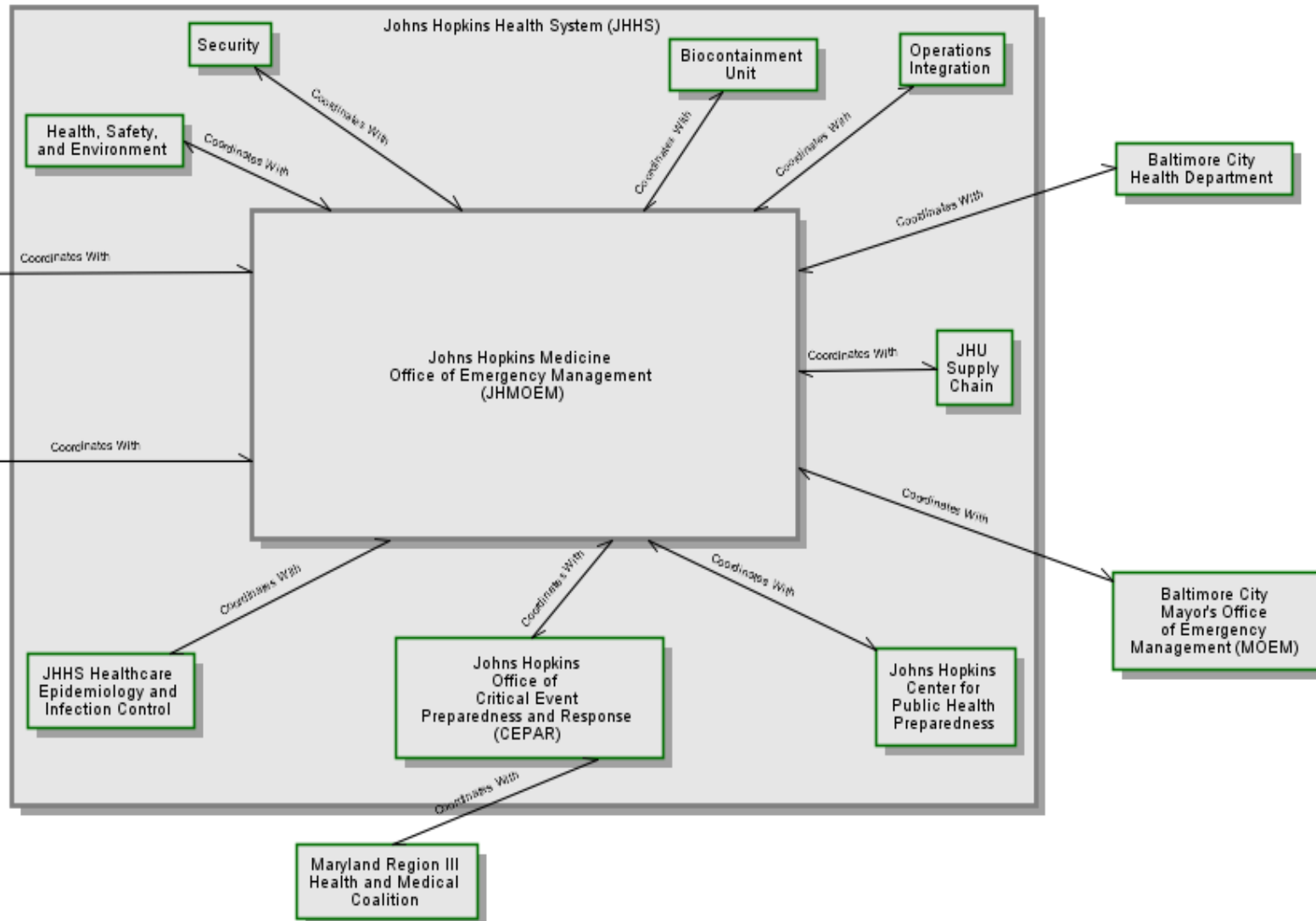
RHRM MBSE Project - Events

-- Three LSM/Agile RHRM MBSE Initial Project Planning (IPP) Workshops at JHU/APL **Apr-Oct 2018**.
  - INCOSE, IEEE, FBI/InfraGard, SDMPH, NACCHO, other Healthcare Leaders
-- 2018 and **2019** Project Presentations/Tutorials:
      INCOSE Chesapeake Chapter - **Feb 2018**
      NASA Goddard - **Mar 2018**
      GLRC 2018 - **Oct 2018**
      EnergyTech 2018 - **Oct 2018**
      INCOSE HWGSEC 2019 - **May 2019**
      EnergyTech 2019/GLRC 2019 - **Oct 2019**
-- Paper presented at SDMPH Meeting in Puerto Rico - **Feb 2019**
-- Project Team Member at SDMPH National Meeting - **Aug 2019**
-- Project Orientation and Other Sessions at INCOSE IW20 - **Jan 2020**
-- Project Briefing at Colorado South Central Healthcare Coalition - **Jan 2020**
-- Project Status Briefing to the INCOSE Requirements Working Group - **Apr 2020**
-- Project Status Briefing to the INCOSE Chesapeake Chapter - **Jun 2020**
-- Attending two upcoming virtual NACCHO Conferences - **Jul and Aug 2020**
-- Proposed Briefing and Tutorial at INCOSE GLRC14 in Detroit, MI - **Sep 2020**
-- On the schedule for INCOSE HWGSEC 2020 in MSP, MN - **Oct 2020**

References
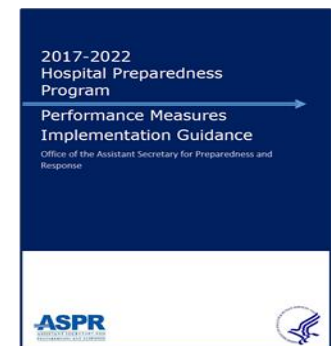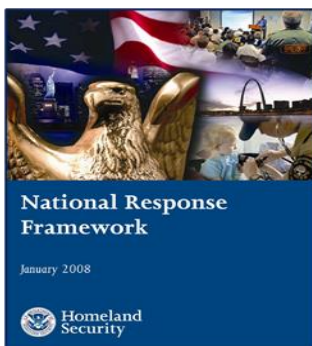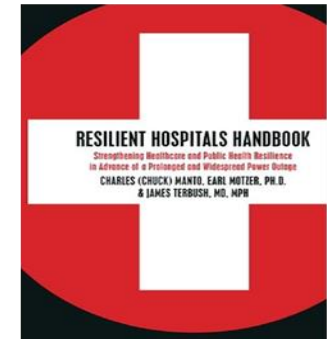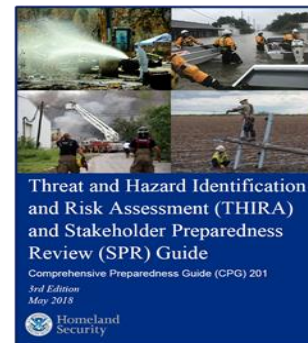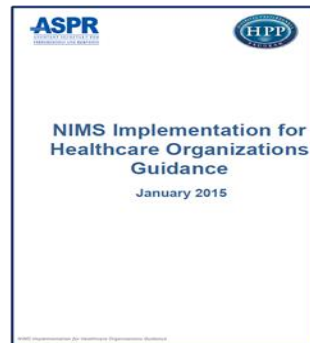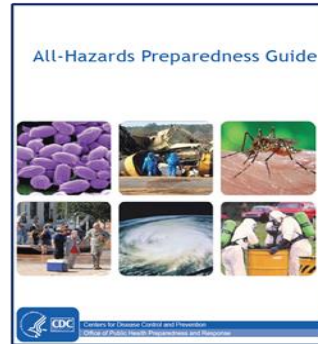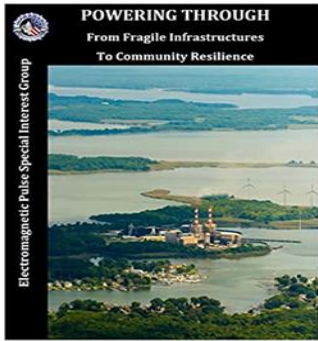
Points of Contact

Project Team Lead:

   Howard Lykins

   howard.lykins@verizon.net

Other Project Contacts:

   John Juhasz

   telepath.juhasz@yahoo.com

   Mike Pafford

   mepafford@verizon.net

https://www.incose-cc.org