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Title: Generation and Application of NCF Data Network Layers for Risk Analysis via Functional Decomposition

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Primary Specialty Group (I am using Resilience Analysis): Resilience Analysis

Rationale (e.g., What is the problem?) 3500 Characters:

The security and economic well-being of the United States depends on a vast network of critical infrastructure systems and 55 National Critical Functions (NCFs). The disruption, degradation, or destruction of NCFs could result in adverse impacts to national security, public health, and the economy. In order to best protect and mitigate against potential adverse impacts, the Department of Homeland Security's National Risk Management Center (NRMC) seeks to better understand the sub-functions, systems, and components of NCFs, as well as the interdependencies across these critical infrastructure systems. NRMC has tasked Sandia National Laboratories (SNL), as part of a multi-national lab effort, with creating initial functional decompositions of each of the 55 NCFs in order to gather sufficient data in support of NRMC's NCF Functional Architecture.

Approach (e.g., What are you doing to address the problem) 125 words: Understanding cross-sector risk to National Critical Functions is a primary goal of the NRMC. The development of the Risk Architecture (RA) will enable advanced analysis of nationally critical systemic risk and will inform decision-making at the government level. The RA workflow and associated products will rely on a database of national assets, including the NCF functional decomposition data. The functional decomposition data set, produced for all 55 NCFs, will enable NRMC risk analysts to identify and communicate risks to an NCF by understanding the constituent components of that NCF and related dependencies more effectively. Through the development and implementation of a decomposition framework and standardized methodology, SNL was able to generate robust data sets to support a comprehensive set of risk analytic questions.

Results and Discussion (e.g., What did you or do you expect to learn?) 125 words:

The systematic decomposition of eight "Connect" category NCFs led to the development of a standardized functional decomposition methodology that is applicable across the four categories of NCFs. The method development process highlighted and ultimately enabled a need for consistency in decomposition structure for defining dependency links that inform large-scale systemic risk assessment. The standardized method supports analysis at any level of decomposition and readily accommodates novel technologies, developments, or processes within the NCFs. Additionally, the method makes the decomposition constructable and identifiable by leveraging systems-thinking but does not require subject matter expertise for the higher levels, which also enables scalability in generating and updating the data. Ultimately, the data that is produced is more analytically useful given their successful leveraging in evaluating diverse risk scenarios.

Management/Policy Implications (e.g., Why does it matter?) 125 words:

A functional decomposition and dependency data set enables defensible and repeatable analysis to risks across the 55 NCFs. Implementing a standardized decomposition framework for NCF data will greatly facilitate analysis at various levels of fidelity and will help communicate risks concerning dependencies. The methodology enables data generation in a resource- and time-efficient manner, which is critical for long-term sustainability. Adherence to a standardized method will also streamline dependency identification by defining dependency connections between similar and dissimilar sub-function layers, which is critical to inform accurate risk products. And finally, the methodology provides a systematic

way to move from functional needs to systems and asset-level data through targeted decompositions to support complex analytical requests from government and industry.