



SECURE TOMORROW SERIES CROSS-IMPACTS READ AHEAD: SYNTHETIC BIOLOGY



CROSS-IMPACTS SESSION

In this facilitated activity, participants will brainstorm how drivers of change for synthetic biology might impact our nation’s critical infrastructure in the future by using the [National Critical Functions \(NCFs\)](#)¹ Framework to identify and analyze risk. Specifically, participants will seek to identify risks to critical infrastructure,² organized around NCFs, related to synthetic biology that we can expect in the next 10–15 years; make distinctions about which risks are unique to individual NCFs or specific critical infrastructure; and identify strategies to mitigate those risks.

No advance preparation is necessary. However, participants may wish to familiarize themselves with the drivers of change and NCFs that they will be “crossing” during the session. The intersection point of a particular driver of change and NCF (i.e., what risks the driver of change poses to that NCF) forms the basis for discussions during the activity. Ultimately, participants will focus on six of these intersection points which will be selected based on a prioritization exercise that they will conduct at the start of the session.

Table 1 lists the seven drivers of change that participants will choose from during the session and provides a brief description of each.

Table 1: Drivers of change addressed in the cross-impacts session

Driver of Change	Description
International competition	To include the negative economic and national security consequences of failing to protect U.S. leadership in the field of synthetic biology
Public acceptance	To include how communication will shape public awareness and acceptance of synthetic biology
Shift to biomanufacturing	To include opportunities and risks of producing goods through biomanufacturing versus through past means of sourcing and production
Technological advancements	To include the ramifications of progress in genetic sequencing, gene editing, lab-on-chip systems, artificial intelligence, robotics, and other synthetic biology tools
Technology democratization	To include potential risks emerging from increased accessibility of sophisticated synthetic biology capabilities by individuals and groups (versus nation-states)
Translating research into practice	To include risks arising from scaling up manufacturing and introducing synthetic biological organisms and components into the environment
Workforce shortages	To include risks stemming from an inadequate workforce to drive the bioeconomy

¹ NCFs are those functions of government and the private sector so vital to the United States that their disruption, corruption, or dysfunction would have a debilitating effect on national security, national economic security, national public health or safety, or any combination thereof.

² For a complete list and description of the 16 critical infrastructure sectors, see www.cisa.gov/critical-infrastructure-sectors.

Table 2 provides definitions for the seven NCFs addressed in the session. For brief descriptions of all 55 NCFs, participants may wish to review [National Critical Functions: Status Update to the Critical Infrastructure Community](#).

Table 1: NCFs addressed in the cross-impacts session

National Critical Function	Definition
Manage Hazardous Materials	Safely identify, monitor, handle, store, transport, use, and dispose of hazardous materials (including chemical, biological, radioactive, nuclear, and explosive substances) under normal operations and in response to emergencies
Manage Wastewater	Collect and treat industrial and residential wastewater to meet applicable public health and environmental standards prior to discharge into a receiving body
Produce and Provide Agricultural Products and Services	Grow and harvest plant and animal commodities (including crops, livestock, dairy, aquaculture, and timber) and produce inputs required to support agricultural production (e.g., fertilizers, pesticides, animal food, crop seeds, and veterinary services)
Produce and Provide Human and Animal Food Products and Services	Produce food products from raw agricultural commodities and provide to final consumers (including processing, packaging and production, product storage as well as retail and food service)
Produce Chemicals	Manufacture basic chemicals from raw organic and inorganic materials and manufacture intermediate and final products from basic chemicals
Provide Medical Care	Ensure the provision of healthcare services
Supply Water	Maintain availability of water (raw and treated)

Participants are reminded that any information shared during this activity is provided on a voluntary basis. Sensitive information, including confidential or proprietary information, should not be shared. Information shared during this activity may be recorded for the purposes of facilitating the program and discussions; however, discussion or disclosure of information in these sessions is not a substitute for submission under the Protected Critical Infrastructure Information Program. Information may therefore be subject to Freedom of Information Act requests or other mechanisms that would publicize any information shared or recorded.