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Overview of Operation Technology (OT) Critical Infrastructure Cybersecurity

HSB, a Munich Re company, is a technology-driven company built on a foundation of specialty insurance, engineering, and technology, all working together to drive innovation in a modern world.

Critical Infrastructure consists of various types of assets, systems, and networks that are critical and essential to United States' national security. We can categorize the attacks to such assets as physical, cyber, and cyber-physical. Examples include:

Physical attack
Destruction of a water dam by way of explosive devices, for instance.

Cyberattack
Penetrating a water treatment plant's operational control system with the bad actor then making erroneous changes to the chemical additive concentrations designed to clean the water.

Cyber-physical attack
Penetrating the electrical grid's control system. The hacker then shoots several high-voltage transformers associated with the substation. The encroached control system is not able to inhibit a cascading outage.

Protecting OT critical assets

The destruction of such systems or networks could potentially cripple life as we know it today. To be clear, when referring to cyber assets, it's the Operation Technology (OT) critical assets that are referred to in this overview document. Examples of national critical asset sectors, as defined by the Cybersecurity and Infrastructure Security Agency (CISA), are the following:

Water and wastewater systems
Having access to clean water is the essence for all human life. Protecting water systems is vital to everyone's health.

Communication systems
The modern-day communications sector is an array of complex communication systems, satellites, and wireless systems with countless interdependencies. CISA works very closely with private sector stakeholders to manage and protect the physical and cyber risks associated with this sector.

Food and agriculture (FA)
This sector includes farms, restaurants, and food manufacturing, processing, and storage facilities. CISA provides extensive guidance, resources, and collaboration with interdependent sectors to protect against a range of risks. The FA sector leans very heavily on the resiliency and reliability of other sectors such as water and wastewater and transportation and energy. FA business continuity is paramount to our everyday lives.

Energy
The energy sector is by far the most critical when it comes to resiliency and reliability. All other sectors depend on energy reliability and resilience. The energy sector consists of oil, natural gas, and electricity (power generation and transmission). Cooperation through industry groups has resulted in substantial information sharing of best practices across the sector with heavy focus on cybersecurity and cyber-physical defense.

Impact of OT system cyberattacks

Attacks on OT can shut down production and be extremely costly, especially if they happen at the top of the supply chain. These attacks can cascade downward to other critical businesses. Attacks on OT critical infrastructure can also be dangerous. Beyond just having equipment come to a grinding halt or create cascading outages, malfunctioning equipment that has been hacked can injure workers, release dangerous chemicals and pollutants, ignite fires, explode, and cause other catastrophes.

New technology and engineering solutions needed

The increasing frequency and severity of cyberattacks and physical security attacks are driving the need for new technologies and engineering solutions that can monitor and protect critical infrastructures against these threats.

The OT cybersecurity and physical security designs that are enjoyed by the energy sector may be implemented at scale for other critical infrastructure sectors. An example of these designs and methodologies is the implementation requirements set forth by the NERC CIP programs. Similar implementations and principles may be leveraged by other sectors with some minor modifications. This is key for substantially increasing our critical infrastructure protection posture as a country. The details and design criteria for such systems is beyond the scope of this overview.

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