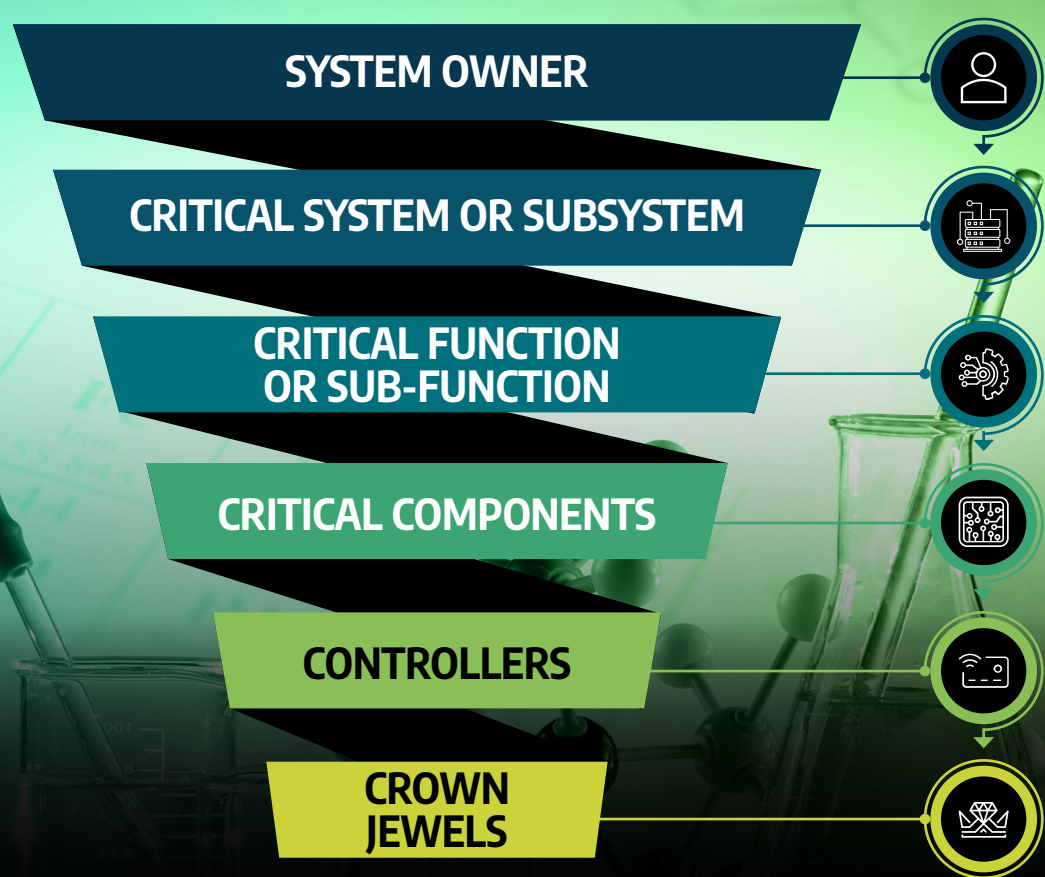


# CROWN JEWEL ANALYSIS



SECTOR: CHEMICAL

**Crown Jewel Analysis** (CJA) is an iterative process that works top-down to systematically determine the physical & logical assets, data, and communication and control interfaces required for primary system function. Knowing the specific devices required for operation enables every aspect of vulnerability management, incident response, disaster recovery, and where protection and detection should be prioritized.

The chemical industry is one of the world-largest manufacturing industries, and it is central to several aspects of modern life. The main challenge is the diversity of products and processes with unique operations and/or materials. From specialty chemicals produced in liquid form to industrial gases, including plastics, polymers, and rubbers, the massive amount of final products makes it challenging to establish defined groups for Crown Jewel Analysis. Additionally, some ONG industries overlap with chemicals (e.g., polymers), adding more variables to the examination.

Below is a simplified example of a Crown Jewel Analysis for the chemical industry. Categories below are arbitrary and some products could be placed in more than one (or many) categories.

<div></div> <div><b>SYSTEM OWNER</b></div> <div>Specific provider within an industry discipline, geographic region or demographic that may be targeted</div>	<div>INDUSTRIAL GASSES</div> <div>PLASTICS AND RESINS</div> <div>FERTILIZERS</div> <div>RUBBERS</div> <div>SPECIALTY CHEMICALS (E.G. CATALYSTS)</div> <div>POLYMERS</div> <div>EXPLOSIVES</div>	<div></div> <div>FERTILIZERS</div>
<div></div> <div><b>CRITICAL SYSTEM OR SUBSYSTEM</b></div> <div>Collection of assets, facilities, networks and/or operators that provide a specific, collective function and output</div>	<div>NITROGENOUS FERTILIZER MANUFACTURING (E.G. AMMONIA)</div> <div>PHOSPHATIC FERTILIZER MANUFACTURING</div> <div>AGRICULTURE FERTILIZER MANUFACTURING</div>	<div></div> <div>NITROGENOUS FERTILIZER MANUFACTURING</div>
<div></div> <div><b>CRITICAL FUNCTION OR SUB-FUNCTION</b></div> <div>Required principal tasks of a system such as heating, cooling, exchanging, pumping, separating, compressing, distributing, storing, etc.</div>	<div>RAW MATERIALS RECEPTION AND STORAGE</div> <div>STEAM REFORMER</div> <div>CO<sub>2</sub> SEPARATOR</div> <div>AMMONIA SYNTHESIS</div> <div>AMMONIA STORAGE</div>	<div>DESULPHURIZATION</div> <div>WATER-GAS SHIFT REACTOR</div> <div>METHANATION</div> <div>AMMONIA SEPARATION</div> <div>DISTRIBUTION</div>

Shown here are examples of physical and logical devices that are representative of these levels of the model. These will be unique to the critical function of the CJA. Items listed below are commonly found in the chemical industry and are not CJA specific for this example.

<div></div> <div><b>CRITICAL COMPONENTS</b></div> <div>Physical assets required to complete a system critical function</div>	<div>DISTRIBUTED CONTROL SYSTEM</div> <div>HEAT EXCHANGERS</div> <div>REACTION VESSELS</div> <div>PRE-HEATERS</div> <div>SATURATORS</div> <div>AIR COMPRESSORS</div>	<div>REFORMERS</div> <div>FIRE HEATER</div> <div>SHIFT CONVERTERS</div> <div>VARIABLE FREQUENCY DRIVES</div> <div>ELECTRIC MOTORS</div> <div>PUMPS</div>	<div>ABSORBER &amp; STRIPPERS</div> <div>SENSORS (FLOW, PRESSURE, TEMPERATURE, LEVEL)</div> <div>DISTILLATION TOWER</div> <div>BOILERS &amp; STEAM HEADERS</div> <div>WATER SUPPLY</div> <div>SAFETY INSTRUMENTED SYSTEM/ EMERGENCY SHUTDOWN SYSTEM</div>
<div></div> <div><b>CONTROLLERS</b></div> <div>Represented by their direct interconnection between the logical and the physical network</div>	<div>PLCs</div> <div>RTUs</div> <div>FRONT END PROCESSORS (FEP)</div>	<div>APPLICATION AND SCADA SERVERS</div> <div>REAL-TIME AUTOMATION CONTROLLER (RTAC)</div> <div>SUBSTATION INTERFACES</div>	<div>INTERLOCKS</div>
<div></div> <div><b>CROWN JEWELS</b></div> <div>Critical data, logical assets and/or communication and control interfaces required to exercise control over components, and thus, functions</div>	<div>RTUs</div> <div>D-SCADA SERVER</div> <div>HISTORIAN</div> <div>REAL-TIME AUTOMATION CONTROLLER (RTAC)</div>	<div>FRONT-END PROCESSORS (FEP)</div> <div>REMOTE ACCESS CONNECTION</div> <div>FIREWALLS</div> <div>SWITCHES</div>	<div>SUBSTATION INTERFACES</div> <div>CONTROL ROOM OPERATOR WORKSTATION</div> <div>ENGINEER WORKSTATION</div>

COMMON VENDORS: