

Program A.3 – Wind Energy Cyber-Physical Security Track

Distance Education

Cyber-Physical Security Training		Team Member
Program Topics	Topic Contents	
Topic 1.0: Physical Process in Wind Farms	Objective: Understand the physical processes in wind systems	
Subtopic 1.1: Wind energy production and control	Aerodynamics, Mechanical and electrical systems	TTU
Subtopic 1.2: Devices and Equipment	Instrumentations and control equipment for wind operations	TTU
Topic 2.0: SCADA for Wind Farms	Objective: What is an Industrial Control System ?	
Subtopic 2.1: Operation, Design and Vulnerabilities	ICS architecture, ICS "operational" security	TTU
Subtopic 2.2: Networking and Industrial Protocols	OSI 7-Layer Model, Protocols, Ports and Services, Routers and Firewalls	TTU
Topic 3.0: Cyber-Physical Disturbances	Objective: Develop an understanding of the cyber-physical threats	
Subtopic 3.1: Natural Hazards	Natural Hazards Effects on Electric Operations	TTU
Subtopic 3.2: Cyber-Attacks	Cyber Threat Vectors, Effects on Electric and Water	TTU
Subtopic 3.3: Accidents	Fire, transportation accident, toxic gas, flooding	TTU
Subtopic 3.4: Degradation Failure	Power transformer, circuitbreaker	TTU
Topic 4.0: Cybersecurity	Objective: Develop an understanding of the cybersecurity vulnerabilities	
Subtopic 4.1: Cyber Risk in Industrial Control Systems (ICS)	Problems of cyber risk assessment and management with an emphasis on application to ICS analysis	WTAMU
Subtopic 4.2: Responding to cyberattacks	Different case studies that highlight active and military response to an attack on ICS	WTAMU
Subtopic 4.3: Security Metrics and Intrusion Detection	Cyber security metrics that are uniquely identified for ICS	WTAMU
Subtopic 4.4: Vulnerabilities and Attacks, Security Standards	Vulnerabilities and attacks associated with SCADA systems. SCADA security standards, methods, and techniques	WTAMU
Subtopic 4.5: SCADA and Critical Infrastructure Incidents	Misuse case analysis, analyzing the impact, and countermeasures will be studied in this module.	WTAMU
Subtopic 4.5: Cybersecurity in Electric, Wind, and Water Industry	Cybersecurity issues pertaining specifically to electric, water, and wind industries	WTAMU
Topic 5.0: Extreme weather	Objective: Develop an understanding of the extreme-weather events on electric and water utilities	
Subtopic 5.1: Extreme weather events effects	Natural Hazards, Effects on Electric and water Operations	GroupNIRE
Subtopic 5.2: Case studies	Extreme events real-world case studies: e.g. Hurricane Harvey, etc.	GroupNIRE
Subtopic 5.3: Live-Recovery from disturbances	Forecasting tool training and Recovery techniques from disturbances - microgrids, system restoration	GroupNIRE
Subtopic 5.4: Improving system robustness and resiliency	Techniques to make system more resilient and robust	GroupNIRE
Topic 6.0: Introduction to Practical Training	Objective: To learn about the resources for hands-on training	
Subtopic 6.1: SPC Lab	SPC lab resource introduction	SPC
Subtopic 6.2: GroupNIRE Lab	GNIRE building resource introduction	GNIRE
Subtopic 6.3: TTU Lab	OPAL- RT, Survalent and Exata CPS introduction	TTU, Survalent, WTAMU

* At the end of each topic, assignments/tests will be conducted to check the learning outcomes

In-person Labs

Cyber-Physical Security Training		Team Member
Lab Topics*	Topic Contents	
Topic 1.0: Cybersecurity and SCADA (8 hours)	Practical Intro on Arduino hands-on and cybersecurity lab	SPC
Topic 2.1: Cyber-physical training at Building 540 (8 hours) [#]	Natural-Hazard scenarios and live recovery training from Hazards using Distributed Energy Resources	GNIRE
Topic 2.2: Cyber-physical training at Building 250 (8 hours) [#]	SCADA and Cybersecurity training on digital twins	TTU, Survalent, WTAMU

* At the end of each lab, students will perform assigned tasks up to satisfactory levels to complete the lab sessions

[#] Option to choose between two lab topics on second day