SOLUTIONS™
Integrated Critical Infrastructure Specialists

Case Study
Nuclear / Robotic NDE & Aging Management

Turkey Point Nuclear Generating Station

Robotic Internal Inspection of a Refueling Water Storage Tank

Owner	Florida Power & Light — Homestead, FL
Facility	Turkey Point Nuclear Generating Station — Refueling Water Storage Tank (RWST)
SI Capability	Robotic NDE Delivery, Guided Wave Phased Array, Automated Ultrasonic Testing, sUAS (drone) Visual Inspection, Coating Inspection, Fitness-for-Service Evaluation
Project Type	Atmospheric Storage Tank Internal Inspection

"Our goal was to help Turkey Point meet its tank floor inspection commitment as thoroughly and efficiently as possible, without sending inspectors into the tank. We did this using first-of-a-kind technology, experienced NDE personnel, and solid engineering analysis – building a strong case for keeping their RWST operating safely for the next 10+ years."

— Jason K. Van Velsor, Ph.D., Executive Director of NDE & Instrumentation

The Complex Challenge

A contaminated tank. A hard deadline. Regulatory requirements.

The Unit 3 Refueling Water Storage Tank at Turkey Point holds roughly 332,000 gallons of the water used to flood the reactor cavity during refueling. That water is radiological material, and it leaves every internal surface contaminated when the tank is drained. The tank sits inside the Radiologically Controlled Area and was built from A-283C carbon steel.

Florida Power & Light needed to perform the internal condition assessment required to support an aging management program under NUREG-2191. That meant a complete visual inspection of the floor, shell, and roof, and a volumetric assessment of the entire floor for internal and external corrosion wall loss. Not a representative sample. The whole floor.

Conventional approaches would have meant putting technicians into a contaminated confined space for days. Full coverage with point-by-point ultrasonic thickness mapping of an entire tank floor — through a 30-to-50-mil epoxy coating — would not fit inside an outage schedule. And whatever went into the tank had to fit through a single 24-inch manway.

The Core Challenge

Achieve 100% visual coverage of the tank interior and 100% volumetric coverage of the tank floor — through a 24-inch manway, in a contaminated environment, without manual entry — and convert the results into a defensible remaining-life basis for continued operation through the next inspection interval.

Real Problems

Contaminated interior. Regulatory standards. A fixed outage window.

Tank water is radiological material – internal surfaces are contaminated once drained.

The Aging Management Plan for Turkey Point's RWST requires 100% volumetric evidence for the floor, not just a sampling plan.

The only access is a 24-inch manway with a centerline 36 inches above the floor.

A 30–50 mil epoxy coating and point-by-point UT would make full-floor coverage impractical in the outage window.

Critical Capabilities

Guided waves. Robotics. Absolute position. Contingency Plan.

GWPA screens large plate areas in seconds to quickly identify areas of interest.

Purpose-built robotic crawler is less than 20 inches wide and is rated for submerged service.

LiDAR and acoustic position tracking for accurate relocation of areas of interest.

Industrial drone with 4K camera and LiDAR mapping for 100% internal visual coveage.

Encoded automated UT returns 57,600 thickness readings per square foot.

Pre-evaluation mockup with engineered flaws, demonstrated live before mobilization.

Developed contingency FEA model for emergent evaluation of potential flaws.

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Critical Capabilities Deployed

Guided wave phased array. Robotic delivery. Absolute position tracking. Encoded UT. Precision Mockup Demonstration.

SI deployed a three-technology sequence — aerial visual, guided wave screening, and encoded ultrasonic characterization — delivered entirely by remote platforms. Eight NDE specialists ran 24-hour coverage for the duration of the 4-day inspection window.

Aerial Visual Inspection by Drone

A collision-resilient inspection drone built for confined, cluttered, GPS-denied spaces flew the tank interior. Simultaneous Localization and Mapping via LiDAR and visual odometry held the aircraft stable without line-of-sight and produced a real-time three-dimensional view of its surroundings. A high resolution camera with 4K video and 180-degree tilt, paired with a powerful lighting system, covered 100% of the floor, shell, roof, and internal attachments in a single 12-hour shift. The flight trajectory map, created using data from the LiDAR point cloud, documented that coverage.

Guided Wave Phased Array: Screening the Whole Floor

Conventional ultrasonics only interrogates the material directly beneath the transducer, which is why full-floor coverage would demand exhaustive and impractical raster scanning. GWPA inverts that constraint. The probe stays stationary while an array of specialized guided wave elements electronically steers a focused beam 360 degrees around it. The result is a guided wave sector scan that reveals reflectors through coatings and around welds, with a single scan that covers up to 150 square feet.

SI collected GWPA data from 100 locations across the tank floor over two consecutive shifts, with additional locations added where thicker coating impeded energy transmission. Individual sector scans were combined into a composite image of the entire floor, from which ten indications of interest were identified and prioritized for follow-up.

GWPA screens a tank floor the way radar screens airspace — the probe remains stationary and the beam does the searching. It turns 100% volumetric coverage from a scheduling impossibility into two shifts of work.

Robotic Delivery and Position Tracking

Both the GWPA probe and the follow-up UT scanner were deployed on SI's remotely operated tank-floor crawler, designed to pass through unobstructed openings of 20 inches or more and rated for submerged service to approximately 200 feet. Independently controlled tracks and removable permanent-magnet banks let the robot traverse ferrous surfaces, including vertical ones; a rotating articulating arm carries the sensor payload; a 1,000-foot tether supplies power and communications.

Knowing where the robot is matters as much as what it sees. Encoder slippage, drift, and turning error accumulate, and a mis-located indication is a finding you cannot revisit.

Essential Outcomes

Full coverage. Quantified margin. Documented results.

100% visual inspection of floor, shell, and roof; 100% volumetric screening of the tank floor.

Completed within the scheduled inspection window with minimal dose to the inspection crew.

Determined that minimum remaining thickness exceeded minimum allowable thicknesses.

Coating anomalies located and documented for remediation before return to service.

Documented margin supporting continued operation through the next 10-year inspection interval.

Documentation in MAPProView data visualization software.

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For this project, SI established a labeled floor-plate layout and x-y coordinate system, then used the robot's LiDAR to save the coordinates of every GWPA scan position. Indication coordinates were computed from those known probe positions and cross-checked two further ways — by locating shared welds in both the GWPA data and the robot cameras, and by measuring travel from those welds with the indexing encoder. For submerged work, the platform carries a proprietary acoustic positioning system that tracks absolute position with sound pulses, independent of water clarity.

Encoded Automated UT for Characterization

GWPA finds and ranks; UT quantifies. A 20-inch arm scanner with a built-in encoder, mounted to the robot and paired with an indexing encoder, produced two-dimensional thickness maps of each area of interest. Scanning resolution of 0.025 inches by 0.1 inches yields 57,600 thickness readings per square foot. Every area was scanned to the GWPA indication footprint plus six inches in all directions.

Coordinated, planned, and demonstrated before mobilization

Planning began with an in-person meeting at the station and continued through weekly working sessions with plant personnel. SI prepared a technical justification documenting how the approach satisfies the license renewal requirements of NUREG-2191, then established the minimum allowable wall thickness for continued operation — the number that determined what the inspection had to be capable of finding.

That threshold drove the demonstration. SI built a precision mockup replicating the actual tank floor construction and coating, seeded it with engineered flaws sized against the acceptance criteria, and ran the full inspection sequence on it in a live demonstration at SI's State College, Pennsylvania facility, with FPL representatives. Robotic UT sizing matched the known flaw dimensions to the thousandth of an inch. Contingency planning was handled with the same discipline: a three-dimensional finite element model was built in advance, ready to disposition any locally thinned region found below allowable without stalling the outage.

Definitive, No-Fail Solutions

Complete Coverage, Minimal Dose	Quantified, Defensible Margin	Inside the Outage Window
100% visual inspection of the floor, shell, roof, and internal attachments, and 100% volumetric screening of the tank floor — all of it delivered robotically, with minimal dose received by the inspection crew.	Coating anomalies located for remediation. Floor indications characterized by encoded UT. Minimum remaining thickness well above the 0.125-inch allowable.	Visual data in one 12-hour shift, GWPA in two shifts, UT in two and a half shifts. All inspections completed within the scheduled window.

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The results gave Florida Power & Light what their Aging Management Plan/Program (AMP) actually requires: coverage that can be demonstrated, indications that can be relocated, and thickness data traceable to a qualified procedure and a demonstrated performance basis. External corrosion and pitting were found and measured. Mid-wall indications — laminations, voids, and inclusions consistent with original manufacturing rather than an active degradation mechanism — were documented where they occurred. Nothing approached the minimum allowable thickness.

Because every scan position was saved in a fixed coordinate system, the 2026 inspection is not a one-time snapshot. It is a baseline. The next crew can return to precise locations, deploy a sensor, and trend real corrosion rates instead of inferring them from a single conservative minimum.

The SI Solutions Difference

Why This Required SI Solutions

This inspection required capabilities that almost never sit under one roof: a first-of-a-kind implementation of a novel guided wave phased array technology, a robotic platform engineered to carry it through a 24-inch opening, a position-tracking methodology rigorous enough to make findings relocatable years later, the NDE qualifications and quality program a nuclear station can accept, and the engineering expertise to convert thickness readings into a remaining-life basis. SI brought all of it as one team — the same organization that designed the mockup, ran the demonstration, drove the robot, analyzed the data, and performed the fitness-for-service evaluation.

This is what "integrated critical infrastructure specialist" means in practice: not a technology looking for an application, but an end-to-end solution for an inspection problem: obtaining 100% volumetric coverage of a contaminated tank, in essentially 2 days of inspection to meet the demands of the client's AMP and keep the outage on schedule.