

## Senior Design Project Description

<b>Company Name</b>	<i>EPRI</i>	<b>Date Submitted</b>	<i>04/26/2020</i>
<b>Project Title</b>	<i>Remote System for Radiological Survey of Vertical Surfaces (EPRI XRAY)</i>	<b>Planned Starting Semester</b>	Fall 2020

### Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

<b>Discipline</b>	<b>Number</b>	<b>Discipline</b>	<b>Number</b>
Mechanical	3	Electrical	2
Computer	2	Systems	
Other ( )			

### Company and Project Overview:

The Electric Power Research Institute (EPRI) conducts research, development, and demonstration projects for the benefit of the public in the United States and internationally. As an independent, nonprofit organization for public interest energy and environmental research, we focus on electricity generation, delivery, and use in collaboration with the electricity sector, its stakeholders and others to enhance the quality of life by making electric power safe, reliable, affordable, and environmentally responsible.

Complete radiological characterization of site structures is required to support decommissioning of nuclear facilities. Characterization is required on many 1000's of square meters of potentially contaminated surfaces and may be required multiple times: to establish initial conditions; one or more times during remediation (as required); and to demonstrate that site release requirements have been satisfied. These characterization efforts are labor intensive, time consuming and represent a substantial cost in the decommissioning process (millions of dollars).

Characterization requires accurate positioning of a radiation detection device at a specified offset from the surface (typically 0.5 to 1.0 m), and for a specified period to achieve the required measurement accuracy (up to ten minutes). Measurements are taken on a grid of overlapping 1-meter circles to provide complete coverage of a target surface (see Figure 1).

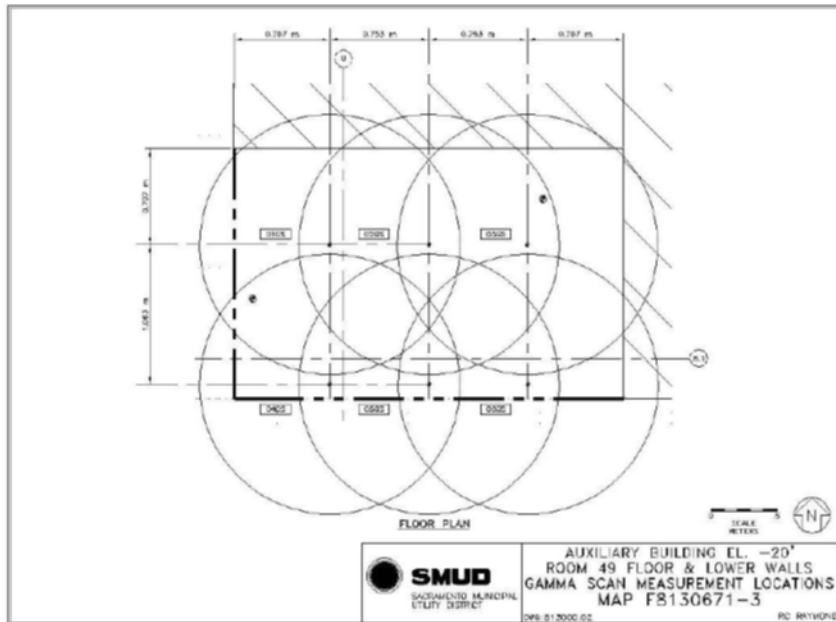


Figure 1 Example Radiation Measurement Surface Coverage

In current practice, delivery of the detector is performed manually, using handheld devices or equipment mounted on carts or other manually maneuvered devices such as cranes (see Figure 2). For characterization of walls and other vertical surfaces, erection of scaffolding is required if handheld devices are used.



Figure 2 Current Radiation Measurement Techniques for Vertical Surfaces

**Project Requirements:**

The objective of this project is to develop a remotely operated system for delivery of a detector for radiological characterization of vertical surfaces. A fully autonomously operated system is preferred.

#### Specifications and Assumptions:

- The weight of the detector is 5 kg;
- The mass of the complete system shall be capable of delivery on an assumed autonomous robotic system with the following capabilities:
  - Maximum payload of 40 kg
  - Known horizontal positioning (x-y coordinates) relative to a prescribed point
  - Mass of 75 kg
  - Dimensions of 0.5 m length, 0.5 m width and 0.25 m height
- The system shall accurately position the detector to a programmed position within 1-cm accuracy relative to a prescribed fixed point:
  - Horizontal (x and y coordinate) positions may be assumed to be provided by the delivery robot, but in any event, vertical position (z coordinate) shall be provided and recorded along with the radiation measurement
  - Independent recording of all coordinates relative to a fixed position is preferred
- The control system shall provide an interface with the control system for the detection device such that coordinates are matched with measurement;
- The system shall be physically stable on the delivery robot, including both during measurements and movements over obstacles up to 2-cm;
- The system shall be capable of delivering the detector to a minimum height of 3 meters, with a delivery height of 4 meters or more preferred;
- The system shall be capable of accurately positioning the detector in prescribed increments (approximately 0.56 m vertically and horizontally) in order to take measurements; and
- The system shall be reliably functional in a typical industrial environment, including typical dust/particulate loadings, and temperatures (10 to 40°C).

#### **Expected Deliverables/Results:**

- A prototype system for delivery of a 5-kg detector system as prescribed
- A conceptual design of the mechanical system as designed
- A conceptual design of the control system for the as-designed system, including coding and specification for required software systems
  - Focus on the measurement location indexing system

#### **Disposition of Deliverables at the End of the Project:**

Delivered to EPRI after the conclusion of the Expo.

**List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):**



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