INDUSTRIAL SOLUTIONS LABORATORY

Company Information

Company Name	*EnergySolutions*	**Date Submitted**	*09/25/2023*
Project Title	*Design of a Remote Parts Shredder* ***(ENERGY_SHRED)***	**Planned Starting Semester**	*Spring 2024*

Senior Design Project Description

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.

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	2
Computer		Systems	

Company and Project Overview:

EnergySolutions is an international nuclear services company headquartered in Salt Lake City, Utah, with operations throughout the United States, Canada and Japan. EnergySolutions is an industry leader in the safe recycling, processing and disposal of nuclear material. Our customers include the United States Government, all United States Nuclear Power Plants, along with various medical and research facilities. EnergySolutions Dismantling and Decontamination (D&D) business is headquartered in Charlotte, NC and offers a full range of services for the decommissioning and remediation of nuclear sites and facilities, management of spent nuclear fuel, the transportation of nuclear material and environmental cleanup of nuclear legacy sites. On-going D&D projects include San Onofre 2 &3 in California; Ft. Calhoun in Nebraska; Kewaunee in Wisconsin and Three Mile Island 2 (TMI2) in Pennsylvania.

This project will be focused on solving a challenge the TMI2 project is facing.

In March 1979, TMI-2 experienced an accident initiated by interruption of secondary feedwater flow. This led to a core heat-up that resulted in damage to the fuel and permanent shutdown of

the facility. As a result of the accident, small quantities of damaged core material (DCM) and fission products were transported through the reactor coolant system and the reactor building. Approximately 99 percent (%) of the damaged fuel was successfully removed in the post-accident defueling effort. Additionally, large quantities of radioactive fission products released into various systems and structures were removed as part of the waste processing activities during the TMI-2 Cleanup Program which spanned over a decade.

Following decontamination activities, only the reactor building and a few areas in the auxiliary and fuel handling buildings continued to have general area radiation levels higher than those of an undamaged reactor facility nearing the end of its operating life. These high radiation levels will require the use of remote and robotic tooling to remove plant components, decontaminate them, and downsize them for efficient packaging and disposal.

Project Requirements:

The containment building contains many structures and components that will need to be downsized for efficient packaging and disposal. The focus of this project will be on downsizing and transporting mirror insulation, ductwork, small bore piping and instrumentation, and other 'shreddible' materials. Metal shredders are available commercially, see examples below:

Taskmaster® TM3000

Due to the radiological conditions in the plant, more remote processing is required. It is envisioned that commercially available machines could be modified to remove manual operations from the process, add containments, and allow remote maintenance of these machines. The system should be modular with each module being a standard 10' or 20' sealand container.

The scope of this project will be to:

1. Design a modular system to feed, shred, and convey shredded materials to a rad waste container by integrating commercially available components to the extent practicable.
2. Design modifications to the system to contain radioactive contaminants and provide shielding to technicians during operations and maintenance.
3. Design modifications to the system to facilitate remote operation and maintenance.
4. Design modifications to the system to allow for upfront radiological surveys, as well as

back-end characterization to ensure shredded components meet waste acceptance criteria.

5. Design modifications to allow for system's operation in harsh radiological environment.

Expected Deliverables/Results:

- Specifications for the system – including power needs
- Drawings of the system and modifications to commercially available components
- Calculations associated with the design
- Prototype of a scale model of the system– This could be limited to a full 3D CAD model or a 3D print of the system in lieu of a physical prototype due to cost constraints
- Testing of the prototype to the extent possible
- Draft Operating procedures for the system including startup, shutdown, and maintenance.
- Bill of materials for all components within the system, including recommended spare parts or consumables.
- Full concept of operations describing and illustrating how the item operates and functions, expected throughput and costs to operate.

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

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

- This project is expected to require coordination of Mechanical and Electrical and engineering disciplines. Students should have good machine design skills.
- Interested in nuclear power.
- MET students should have completed ETME 3213.
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