

## The planning strategy of robotics technology for revitalizing nuclear facility: a review

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The revitalization of abandoned nuclear facilities requires a strategic approach that emphasizes safety, operational efficiency, and sustainability. Robotics technology has emerged as a transformative solution, offering remote operation capabilities that reduce human exposure to hazardous environments while increasing precision and effectiveness in revitalization tasks. International examples demonstrate the potential of repurposing nuclear sites for research and industrial use through robotics-enabled interventions.

Radiation mapping is a foundational task during revitalization. Traditional manual methods are labor-intensive, hazardous, and offer limited spatial resolution. Robotic systems equipped with gamma sensors and advanced path-planning algorithms enable efficient, high-resolution radiation mapping in complex environments. Planning strategies that integrate coverage path planning and real-time data acquisition significantly enhance mapping performance while maintaining safety.

In the cleaning and dismantling phase, robotics facilitates safe handling of contaminated materials. Technologies such as remote manipulators, autonomous vehicles, and hybrid robots extend capabilities to navigate confined, unpredictable environments. These systems mitigate risks posed by radiation, structural degradation, and chemical hazards, while modular and adaptable configurations improve task versatility.

Despite these advancements, technical limitations remain. Challenges include radiation-induced degradation, navigation in unstructured environments, and integration with digital infrastructure. Addressing these requires robust design, radiation-hardened components, and intelligent control frameworks. Future strategies should incorporate digital twin environments, AI-assisted planning, and human-in-the-loop systems to improve adaptability and coordination.

This review presents a roadmap for robotics planning in nuclear facility revitalization, synthesizing best practices and identifying innovation pathways. Implementing such strategies can convert high-risk legacy sites into productive, safe, and sustainable assets, contributing to environmental restoration and socio-technical resilience in the nuclear sector.

### Technical Track

Safety and Severe Accidents

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