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Jacobs Helps NASA Streamline NEPA Compliance for Nuclear-enabled Space Missions

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A multidisciplinary collaboration among Jacobs' environmental and nuclear scientists has resulted in a streamlined programmatic approach for National Environmental Policy Act (NEPA) compliance and recurring cost saving for the National Aeronautics and Space Administration (NASA).

The Jacobs team worked in partnership with NASA's Headquarter NEPA Manager and Environmental Attorney, NASA Science Mission Directorate (SMD) Radioisotope Power System Office, the U.S. Department of Energy (DOE), the U.S. Air Force (USAF) and the Federal Aviation Administration (FAA) to create a Programmatic Environmental Assessment (PEA) for the use of radioisotope heater units (RHUs) in spacecraft launched from Kennedy Space Center and Cape Canaveral Air Force Station in Florida.

Radioisotope Heater Units

Missions into deep space and extended missions to distant planetary surfaces use RHUs for heat, due to the functional limitations of solar heat and the limited life capabilities of electrical heat from batteries.

The current generation of RHUs are referred to as light-weight radioisotope heating units (LWRHUs). A LWRHU contains a fuel pellet, about the size of a pencil eraser, which consists of 2.7 grams of Pu-238 oxide. The heat from the natural decay of radionuclides is a well-tested and efficient technology for keeping spacecraft structures, systems and instruments at the necessary operating temperatures in deep space. Used in U.S. space missions since 1961, the need for RHUs in NASA missions is expected to increase as the agency expands its missions to the Moon, Mars and beyond.

Programmatic Environmental Assessment

Prior to the development of the PEA, NEPA analysis was required for each NASA mission that used RHU technology. However, NASA is also required, per presidential directive, to conduct a detailed safety review prior to the final decision to launch nuclear materials. This is a highly technical effort that requires specific expertise from the DOE. Because of these parallel objectives, NASA was essentially performing nuclear safety analysis twice – once for the NEPA process using a hybrid of multiple potential launch vehicles, and again prior to the official launch decision, which could rely on specific mission parameters that were not known during the NEPA phase. Our team worked closely with NASA and DOE personnel to develop a solutions-oriented approach to more efficiently address the NEPA requirements, while still disclosing to the public the potential for radiation exposure after a launch mishap.

Jacobs senior technologists across diverse disciplines collaborated to help NASA navigate the complex intertwining of nuclear safety and NEPA compliance. Michelle Rau, who also serves as the Jacobs' NEPA practice lead, and Dr. Arthur Desrosiers, Jacobs' senior nuclear health physicist, worked in tandem to apply innovative techniques that considered the potential health effects from a nuclear mishap, in a concise and focused manner that could easily be understood by the general public.

The PEA provides the existing conditions and analyzes the potential of direct, indirect, and cumulative impacts to environmental resources. Resources analyzed include health and safety, land use, water resources, biological resources, cultural resources and hazardous materials. Under normal operating conditions, the most likely outcome of implementing the proposed action is a successful launch with no impacts to these resources, as the RHU has been designed to withstand the majority of launch mishaps. Therefore, any potential impacts to environmental resources would only occur under an extremely unlikely release scenario. In this unlikely scenario, multiple failures would have to occur and the RHU would have to be exposed to an extreme heat or pressure condition for the Pu-238 to be released.

Additionally, the highest estimated dose consequence was compared against known exposure limits and established safety standards to determine the significance of the potential impact. The highest estimated potential public exposure level is beneath the typical annual exposure rates established by the Nuclear Regulatory Commission, the EPA and the DOE.

Finding of No Significant Impact

The PEA fulfills the Science Mission Directorate's goal of streamlining the NEPA process and saving time and money, without compromising NASA's compliance with federal law. On February 13, 2020, the Associate Administrator of the SMD, Thomas Zurbuchen, signed the Finding of No Significant Impact (FONSI). The programmatic document will now be applied each time an RHU is used in a space mission, as long as parameters defined in the PEA are met.

About Jacobs

At Jacobs, we're challenging today to reinvent tomorrow by solving the world's most critical problems for thriving cities, resilient environments, mission-critical outcomes, operational advancement, scientific discovery and cutting-edge manufacturing, turning abstract ideas into realities that transform the world for good. With $13 billion in revenue and a talent force of more than 55,000, Jacobs provides a full spectrum of professional services including consulting, technical, scientific and project delivery for the government and private sector.

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