

Mississippi State University Notice of Proposed Sole Source Purchase

Mississippi State University anticipates purchasing the item(s) listed below as a sole source purchase. Anyone objecting to this purchase shall follow the procedures outlined below.

1. Commodity or commodities to be purchased (make, model, description):
 - Precision X-Ray, X-Rad320, multifunctional, expandable, radiation research irradiation system with external dosimeter system and environmental chamber
2. Explanation of the need to be fulfilled by this item(s), how is it unique from all options, and why it is the only one that can meet the specific needs of the department:

The Mississippi State University's Institute for Clean Energy Technology (ICET) conducts research and qualification testing of nuclear grade high efficiency particulate air (HEPA) filters used in nuclear containment and ventilation systems. HEPA filters are a critical safety component of these nuclear containment and ventilations systems and serve as the last line of defense of release of airborne radioactive particulates to the environment.

These HEPA filters are designed, constructed, and qualified to the American Society of Mechanical Engineers Code on Nuclear Air and Gas Treatment (ASME AG-1). Design, construction and qualification must also fall under an ASME Nuclear Quality Assurance (NQA-1) qualified program per AG-1. ICET is one of the very few universities in the nation that possess such a NQA-1 program.

As part of the ASME AG-1 qualification process, HEPA filter media are to be exposed to gamma-ray (high-energy photon) irradiation for an integrated radiation dose of 6×10^5 grays (Gy) that is not to exceed 2.5×10^4 Gy/hour. After receiving the high dose of radiation, the filter media are tested for their material properties (e.g., tensile strength, water repellency, etc.).

ICET is currently the only research facility in the world conducting research and qualification testing of nuclear grade HEPA filters under a qualified NQA-1 program. ICET supports the United State Department of Energy (DOE) and HEPA filter manufacturers. Research data is used to drive regulatory decisions, DOE procedures and policies, and international codes and standards. Further, it is expected the AG-1 development committee to require irradiation of other HEPA filter components (e.g., gasket material, potting material, etc.) This research is critical to qualification and development of HEPA filters to further the safe operation of nuclear facilities.

ICET does not currently possess the capabilities to perform irradiation of filter media samples, requiring manufacturers to find other means to meet the irradiation portion of AG-1 under an NQA-1 program, which can be difficult and costly to source. ICET maintains the largest inventory of radioactive materials for radiation-based testing; however, none of the materials provide sufficient dose in a cost and time-efficient manner to be effective at meeting AG-1 irradiation requirements.

The Precision X-Ray320 irradiator is a self-contained irradiation chamber. The X-Ray320 irradiator is about the size of a large commercial refrigerator. Inside the top half of the X-Ray320 irradiator is an open-air chamber fitted with an x-ray (energetic photons) generator. The x-ray generator generates a beam of x-rays in a cone shaped volume within the interior chamber. Samples placed within the beam of x-rays and can be irradiated to the AG-1 requirements using the X-Ray320 control system. A dosimeter system is fitted to the window of the x-ray generator to determine the integrated dose to samples placed in the interior chamber. The lower half of the X-Ray320 irradiator is a cooling system to extend the service-life of the x-ray generator. The Precision X-Ray320 irradiator also utilizes an external precision reference dosimeter system for accurate calibration of the internal dosimeter system. This dosimeter system meets the quality assurance requirements of NQA-1.

The Precision X-Ray320 irradiator will allow ICET to perform irradiation qualification tests on HEPA filter components to the AG-1 standard. The Precision X-Ray320 irradiator was developed for irradiation and dosimetry for the medical industry; therefore, it's capabilities and performance are conducive to irradiation research to AG-1 under ICET's NQA-1 program.

The X-Ray320 contains the largest interior volume for a self-contained irradiation system. This internal configuration allows for maximum flexibility for configuration support structures and configuration of samples to be irradiated. This x-ray generator and sample geometry within this volume also allows for a maximum uniform exposure rates from 3-48 Gy/min in depending on the distance from the x-ray tube to the sample.

A variety of self-contained irradiators are available. There are essentially two forms of irradiators: x-ray generating devices like the one described here or ones containing high-activity gamma emitting radioactive isotopes (Cesium-137 (Cs-137) or Cobalt-60 (Co-60)).

The X-Ray320 produces lower energy photons than Cs-137 or Co-60 irradiators; therefore, the device does not require as much radiation shielding to safely protect users. Exterior dose rates to the X-Ray320 is low (0.1 μ Sv/hr) and does not require any special radiation safety precautions. Self-contained Cs-137 or Co-60 sources typically have very small interior volumes and require heavy lead shielding. The small volume results in issues with producing uniform dose. These irradiators require special safety and security precautions because the activity of the sources themselves pose a national security risk. These safety precautions include: a required a dedicated laboratory space with active security systems, personnel dosimeter monitoring, and regular leak-checks of the sealed sources and is a risk to personnel performing the leak-checks. Unintentional exposure to these sources unshielded

can result in acute radiation sickness and death. These types of systems require dedicated facilities because of the shielding requirements to prevent personnel from being exposed to deadly levels of radiation and more advanced security measures to prevent unwanted access. Building or retrofitting a dedicated facility to meet safety and security requirements is not feasible. Source and facility maintenance is also complicated and financially prohibitive for open-room configurations because Co-60 specifically needs to be replaced periodically due to its short half-life. These systems would also involve significant regulatory oversight and likely require MSU to have a separate nuclear materials license issued by the Mississippi State Health Department.

Self-contained and open-room Cs-137 and Co-60 irradiators would also require long-term dedicated staff and financial commitments to at least maintain the security requirements. Disposal of these sources will be very cost prohibitive if support is not available.

Self-contained and open-room irradiators are will also require completely separate metrology and quality assurance components, which increases the overhead of available manpower at ICET. The X-Rad320 considers has been built in quality assurance features that meet the medical industry.

Commercial irradiation sterilization facilities cannot produce or control dose rates to meet the tight range AG-1 calls for, nor can they meet the quality assurance requirements of NQA-1.

3. This unit options, and why it is the only one that can meet the specific needs of the department:

The proposed X-Rad320 is the only device on the market that allows us to expose filter media at a high enough dose rate to meet AG-1. The X-Rad320 also contains all of the quality assurance functionality and options needed to perform irradiation experiments under ICET's NQA-1 program.

The X-Rad320 is needed so ICET can be capable of performing material testing of filter components to AG-1. ICET is currently the only research organization conducting qualification testing of HEPA filters to AG-1 and the X-Ray320 would close a capability gap that ICET currently does not have.

The X-Rad320 also does not require the need for building dedicated facilities, additional security, additional personnel dosimetry monitoring, regulatory oversight, long-term financial maintenance and disposal support of radioactive materials.

4. Name of company/individual selling the item and why that source is the only possible source that can provide the required item(s):

Precision X-Ray – They're the only supplier of self-contained alpha irradiation systems with an large internal volume that meet all of the needs of conducting irradiation testing to AG-1 and NQA-1 requirements.

5. Estimated cost of item(s) and an explanation why the amount to be expended is considered reasonable:

- Precision X-Ray X-Rad320 – Total Cost: \$282,450, including the following options:
 - a. X-Rad320 unit
 - b. Motorized rotating specimen shelf
 - c. TouchRAD measurement and control
 - d. External dose monitor
 - e. Environmental chamber
 - f. Shipping, installation, and training

6. Explanation of the efforts taken by the department to determine this is the only source and the efforts used to obtain the best possible price:

The department reviewed specifications of similarly produced items and determine Precision X-Ray is the only supplier that meets the project needs. Self-contained and open-room irradiators do not meet project quality assurance requirements or are cost prohibitive due to the need for dedicated facilities, security, and costly long-term financial support.

Any person or entity that objects and proposes that the commodity listed is not sole source and can be provided by another person or entity shall submit a written notice to:

Jennifer Mayfield, CPPO
Director of Procurement & Contracts
jmayfield@procurement.msstate.edu
Subject Line must read "Sole Source Objection"

The notice shall contain a detailed explanation of why the commodity is not a sole source procurement. Appropriate documentation shall also be submitted if applicable.

If after a review of the submitted notice and documents, MSU determines that the commodity in the proposed sole source request can be provided by another person or entity, then MSU will withdraw the sole source request publication from the procurement portal website and submit the procurement of the commodity to an advertised competitive bid or selection process. If MSU determines after review that there is only one (1) source for the required commodity, then MSU will appeal to the Public Procurement Review Board. MSU will have the burden of proving that the commodity is only provided by one (1) source.