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Advances in the Global Use of Isotopes for Medicine, Industry and Environmental Science

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The topic of Isotopes is one of incredible importance and versatility with numerous applications in the fields of physics, chemistry, biology, medicine, industry, agriculture, environment, safety and security and many more. Medical applications include nuclear imaging with Tc-99m (SPECT) and F-18 (PET) and therapeutic treatments with I-131 (thyroid), Lu-177 (pancreatic) and Ra-223 (bone metastases). Industrial applications employ isotopes in power generation, oil discovery and processing, food and waste product sterilization, border security, wear analysis and many others. Environmental studies explore rock, water, soil and sediment worldwide by examining the stable isotopic content. Scientific applications of isotopes include uses in detectors, beams and targets for material analyses and particle physics studies. Developing new applications and isotopes for scientific and commercial uses is an ongoing effort both at academic institutions and commercial companies. Manufacturing isotopes in sufficient quantities often requires innovative improvements to accelerator or reactor production systems. An example is Sn-117m which is an isotope with very desirable physical characteristics and applications in nuclear medicine. Historically, its use was severely restricted due to the difficulty of producing high specific activity product that is essential for its application. Recent advances in accelerator technology have now allowed this isotope to be produced commercially prompting its use many new medical products. One of the greatest challenges of supplying the essential resource of isotopes is ensuring safety, security and sustainability. An example is the recent worldwide program to convert highly enriched U-235 reactors to low enriched material. This fuel and target material is used to manufacture Tc-99m (and other isotopes) for life-saving nuclear medicine scans. The growing field of isotopes is a dynamic area for physicists and other scientists with a strong and rewarding future.