

# Precision

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# Engineering

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2014 MAR 24

ATTN: Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

SUBJECT: Notice of Intent to Site, Construct, and License a Class 104a Reactor under 10CFR50

Dear NRC Staff,

With this letter Precision Engineering Consultants, Inc. of Salt Lake City, Utah (PEC) is providing notice of the intent to initiate the licensing process for the site, construction, and operation of one (1) 10-20 Mw open pool, non-power reactor as a Fully Dedicated Isotope Reactor (FDIR) for the primary purpose of commercial production of Mo-99 for medical uses. The reactor would be operated under a Class 104a license (10CFR50.21). Licensing of by-product material would be in the jurisdiction of the reactor license. PEC was incorporated January 26, 1994 in Utah, USA, and is wholly owned and operated by native US citizens. PEC is requesting the assignment of an NRC licensing project manager to provide direction in all related NRC licensing issues.

**Method of Production.** Economic studies, including the Office of Economic Cooperation and Development's Nuclear Energy Agency November 2010 publication titled, "*The Supply of Medical Isotopes: Review of Potential Molybdenum-99/Technitium-99m Production Technologies,*" clearly point out with detailed capital and operational costs that accelerator production of Mo-99 is unacceptably costly in comparison to fission reactor production. This relative cost comparison prevents private capital investment in accelerator facilities. Furthermore, the staff of the US Dept. of Health and Human Services, Office of Medicare and Medicaid have publicly stated numerous times since 2011 that Medicare/Medicaid will not pay the exorbitantly high costs of accelerator produced Mo-99 on medical procedure claims.

The American Medical Isotopes Production clause (AMIPA) of the National Defense Appropriations Act of 2013 requires the DOE to progress away from supporting use of HEU in Mo-99 production when production from LEU targets and LEU cores are available, and directs DOE to report annually to Congress on their progress in eliminating the use of HEU in the production of medical isotopes. Fission reactors with a thermal neutron flux less than about

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$5 \times 10^{13}$  nt/cm<sup>2</sup>-sec necessarily produce prohibitively costly waste in the processing of LEU targets. The only non-federal reactor capable of producing Mo-99 by LEU targets is the 10Mw reactor at MURR, which, unfortunate for MURR, is HEU fueled. It can only provide interim production until a LEU reactor enters Mo-99 production. And as we know, the latest MURR LEU fuel design was rejected by the NRC in 2013. Conversion of MURR for RERTR is not going to be any time soon, and would only disrupt MURR Mo-99 production in any case.

Hence, PEC has pursued plans to construct a 10-20Mw reactor for Mo-99 production. The technology planned for Mo-99 production is thermal neutron bombardment of molybdenum enriched in the Mo-98 isotope, and purchased from the DOE. PEC recently acquired exclusive use of a provisional application for patent filed with the US Patent and Trademark Office November 13, 2013, for a cost efficient, simple, in situ technique to separate product Mo-99 from the target Mo-98. See the addendum marked "Confidential information submitted under 10CFR2.390" enclosed with this LOI for details on the process. This technique eliminates the need for LEU targets, and all of the radiation safety and national security problems and costs associated with LEU target processing and waste disposal. In compliance with both RERTR and AMIPA, the only LEU used in this process is the encased reactor fuel. **No HEU will be used in any phase of this project.**

**Reactor.** TRIGA fuel by General Atomics Corporation of La Jolla, CA (GA) has been selected for the core. Of the TRIGA fuel options, the as yet uncertified HD 45/20 (Zr-H-U, 45 w/o U, 20% enriched, 1.5% Er burnable poison) is the fuel of choice. Tony Veca of the GA TRIGA Office has committed to submitting GA's already prepared 45/20 fuel certification petition to the NRC in line with our schedule. The fuel will be configured with 0.5" diameter rods, in 4x4 (16) trapezoidal bundles (hexagonal lattice), in a hexagonal core geometry designed for optimum neutron conservation. The core will be force cooled with redundant systems, and all of the waste heat dumped to the environment in summer and part of the waste heat to the buildings in winter. To open our fuel options, if HD 45/20 fuel runs into problems, we are considering simultaneously licensing already certified HD 30/20. Upon analysis, if cooling presents a highly unlikely fuel temperature problem, then 0.33" diameter fuel will be considered.

The new TRIGA fuel production facility in France is nearing the beginning of construction, with production for the new MIT LEU fuel planned for mid-2017. This project is keying on this schedule, knowing that it has +/- 6 months flexibility.

The TRIGA reactor monitoring, control, and safety systems will be purchased from the GA Electronics Division.

**Facility.** The central reactor room will be 50 feet high. The bottom floor will be 10 feet below grade. It is an octagonal geometry, with each side 38 feet long, and 90 feet across the center. The open pool will have one service bay (depth 15', width 15', length 30', capacity 50,000 gallons) and two reactor bays (depth 30', diameter 12', capacity 25,000 gallons each), each separated from the service bay by removable dams. The Control Room will be located to the side of the pool tower top. Below the Control Room is the Sample Preparation Room. Below the Sample Preparation Room is the Equipment Room where the heat exchangers, pumps, and demineralizers will be located. Primary coolant pumps will be located under the service bay for sufficient N<sup>16</sup> shielding.

The Administration Wing will be constructed on the Reactor Building side closest the Control Room. The Air Lock Wing will be constructed on the Reactor Building side opposite the Administration Wing. The Hot Cell Wing will be constructed on a side of the Reactor Building perpendicular to the other two wings. Future plans include a Research Wing to develop new products. The remaining four sides of the octagonal Reactor Building are reserved for production wings for future downstream clients.

Symmetrically placed around the Air Lock Wing truck ramp will be a stand-alone maintenance shop, a solid waste storage building, two 50,000 gallon above ground liquid waste storage tanks, and two evaporative cooling towers.

The five acre property perimeter fence is planned to be K-12 anti-terrorist security fence. Entrance through the K-12 fence will be gate controlled, video monitored and recorded, and key card accessed. Four perimeter cameras and four outward looking Reactor Building cameras will record exterior activity. Face and vehicle identification at the main gate will be video recorded, as well as 13 other interior locations.

**Owner.** The owner of the facility will be Precision Engineering Consultants, Inc. of Utah. The corporate operating officers are: (1) President Kevan C. Crawford, PhD (USNRC Op Lic 4966, USNRC Sr Op Lic 4233, USNRC Sr Op Lic 43399, USNRC Sr Op Lic 70033), (2) Vice President Craig M. Jensen, PhD of currently of Springfield, VA (USNRC Op Lic UofUtah, US NRC Sr Op Lic UofUtah, USNRC Sr Op Lic UofOklahoma), (3) Vice President David M. Slaughter, PhD of Sandy, UT (USNRC Sr Op Lic UofUtah, USNRC Sr Op Lic WASStateU), (4) Secretary R. Joyce Peterson, CLA of Salt Lake City, UT (native US citizen). The corporate Board of Directors are Kevan Crawford, PhD previously mentioned, Robin P. Crawford of Salt Lake City, Utah (native US citizen), and Timothy B. Crawford of Lacy, WA (native US citizen).

It was the original intention for the construction to be a turn-key contract. Since GA's TRIGA office does not have the personnel able to conduct nuclear design and licensing without going to other GA departments, PEC will work with the NRC and their licensing contractors to conduct the licensing procedures for this facility. All three of the PEC operating officers have experience over the last 40 years in either initial licensing or relicensing of NRC licensed facilities.

The facility owner will contract for emergency services with the Salt Lake Unified Police Department, the Salt Lake Unified Fire Department, and most likely with the University of Utah satellite hospital located less than two miles from the site. Facility personnel will provide training to emergency personnel on site. These organizations are being informed of project progress via their representatives attending planning meetings held in City Hall.

**Constructor.** The company selected for the design and construction of the building facilities is Layton Construction Company of Sandy, UT (<http://www.laytoncompanies.com/>). Steve Bowers (of Sandy, UT) is the Senior Vice President supervising this project, with David Ridgway (of Layton, UT) as the pre-construction services coordinator. The architect firm selected for facility design is Architectural Nexus of Salt Lake City, UT (<http://www.archnexus.com/>), with John Erdmann (of Draper, UT and North Dakota) supervising. The company selected for hot cell design and construction, core structure machining, and stainless steel pool liner is Peterson, Inc. (<http://www.peterseninc.com/>) of Ogden UT with Rob Despain supervising. Peterson frequently contracts with General Atomics and is an excellent match for this project.

**Operations Personnel.** The operations personnel will be: (1) Facility Director Kevan Crawford, PhD (mentioned previously), (2) Manager of Reactor Operations Craig Jensen, PhD (mentioned previously), and (3) Manager of Nuclear Services David Slaughter, PhD (mentioned previously). The facility operational staff and oversight committees will be structured pursuant to ANSI/ANS 15 standards, with additional positions for commercial aspects of this venture. Reactor operations staff as well as radiation safety staff will be divided into six shifts with HP shifts and RO shifts unsynchronized to mix crews. The target preparation and processing staff will be five or fewer engineers on work staggered shifts for one day per week to process targets, and day shifts the remainder of the work week to clean up and prepare new targets.

**Site.** The preliminary site selected for study is a five acre parcel on undeveloped former agricultural land west of 6400 West street (yet to be paved) and south of 11800 South street in Herriman, UT (a remote suburb of Salt Lake City, UT). The site is approximately three miles from the outer boundaries of the Kennecott Copper Open Pit Mine Operations of Rio Tinto, and about 28 miles from the 100 Kw TRIGA reactor operated by the University of Utah and licensed by the NRC. The Herriman City contact is Asst. City Manager Gordon Haight.

Of course, documentary evidence on the site will be prepared and submitted to the NRC at the appropriate time. However, a summary description of the site indicates that the surface soil is relatively flat for 3 miles in all directions. Surface water is only a minor consideration with no up-slope dams, no significant continual surface flow within five miles, and a yet to be developed dry drainage area running along the southern boundary of the site (future greenway) for precipitation run-off. The bedrock layer is relatively high for the area. The nearest geologic faults are found 20 miles north and 20 miles east.

The municipality, in partnership with Salt Lake County, has identified this area for a light industry business park. The project has been presented to the City Council, and approved. Both the State Science Advisor (Carol Curchoe) and the Governor's Office for Economic Development, Life Sciences Cluster Director (Kevin Jessing) have been informed and are eager to contribute.

**Schedule.** At present, the architectural plans have been outlined. The plans are currently being adapted to the preliminary site. Preliminary engineering design on the facility is nearing completion to provide input for a preliminary construction cost estimate. A 3D model is being prepared by Layton Construction based on the architectural figures.

Site development via joint municipal and county funding is scheduled to begin summer 2014. The facility construction is preliminarily scheduled to begin around August, 2015. The schedule has construction finishing in the period Jan-Mar 2017, with installation of nuclear systems beginning immediately. Fuel is expected in the last half of 2017. The verbal commitment of TRIGA International to have fuel production running by mid-2017 is subject to some skepticism. Therefore, the proposed schedule is acknowledged to be optimistic.

Assuming fuel is loaded around September 2017 or shortly thereafter then we have allowed six months for certification and calibration operations while target processing is refined. We have notified potential downstream clients that we will notify after Mar 2018 to begin to certify our Mo-99 product for their processes. It is realistic that this date would slip to later in 2018. Upon product certification by downstream clients under the specifications for Sodium Molybdate (Mo-99) described in the European Pharmacopeia we will begin full operations. The schedule for submissions to the NRC and subsequent reviews can be determined by the NRC based on this schedule.

The information provided in the attached addendum contains a description of the intellectual property covering the Mo-98/Mo-99 separation process in an early draft of the provisional

application for patent to the US Patent and Trademark Office filed on November 13, 2013. The proprietor of the intellectual property has given PEC permission to use this property. Until a full patent application has been submitted, the information has not been made public and the proprietor has requested that the intellectual property not be publicly disclosed. Therefore, PEC is requesting that this information contained in the addendum be withheld from public disclosure as a trade secret under 10CFR2.390.

Please send written communications to me directly at the corporate address listed below. Informal communications may be directed to my business email address (dr\_fission@comcast.net) and verbal communications to my company mobile phone (801-554-0901).

Regards,



Kevan C. Crawford, PhD

Precision Engineering Consultants, Inc.

3781 S. 3145 E.

Salt Lake City, Utah 84109-3744

Enc: Affidavit - 2 pages

Addendum: The Provisional Application for Patent - 12 pages

**AFFIDAVIT OF KEVAN C. CRAWFORD, PhD**

*In re: Addendum, Provisional Application for Patent  
Exemption from Public Disclosure under 10 CFR §2.390(a)(4): Trade secrets*

STATE OF UTAH            )  
  :SS  
County of Salt Lake        )

Kevan C. Crawford, being first duly sworn, deposes and states as follows:

1. I have personal knowledge of the matters set forth herein.
2. I am a resident of Salt Lake County, I am over the age of twenty-one years, and I am otherwise legally competent to make this Affidavit.
3. I am the owner and President of Precision Engineering Consultants, Inc.
4. On behalf of Precision Engineering Consultants, Inc., I have submitted to the NRC the letter titled *Notice of Intent to Site, Construct, and License a Class 104a Reactor under 10CFR50*, dated March 24, 2014, for the purpose of commercial production of Mo-99.
5. Attached to the *Notice of Intent to Site, Construct, and License a Class 104a Reactor under 10CFR50* is a twelve page Addendum titled *Provisional Application of Patent*.
6. The original Provisional Application of Patent has not been published by the United States Patent and Trademark Office.
7. A copy of the original Provisional Application of Patent is included with the Notice of Intent letter with the express permission of the applicant.

8. According to 10 CFR §2.390, "Public Inspections, exemptions, requests for withholding," subsection (a)(4) indicates one may exempt from public disclosure documents that contain trade secrets.

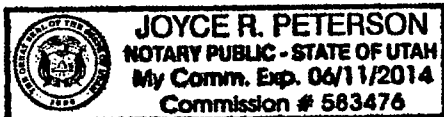
9. The *Provisional Application for Patent* contains trade secrets, namely, methods and procedures that will be utilized in the production of Mo-99 in this Class 104a facility which are unique from procedures used by current Mo-99 producers, as well as procedures proposed by current and future applicants for Mo-99 production.

10. Disclosing the trade secrets in the *Provisional Application for Patent* would cause considerable harm to this project by requiring substantial resources to defend the right to intellectual property contained in the Addendum. Furthermore, a competitive cost advantage provided by the proposed process would be lost during the critical capital repayment period after the start of production and before those who would infringe on this property right by implementing the processes could be shutdown. The loss of income would interfere with operations.

DATED this 23<sup>RD</sup> day of March, 2014.

  
KEVAN C. CRAWFORD, PhD

Subscribed and sworn to before me on this 23<sup>rd</sup> day of March, 2014.



  
NOTARY PUBLIC  
Residing in Salt Lake County, Utah

My Commission Expires:

6/11/14