712422 973

12/04/86

ROUTINE HFIR PRODUCTS

Radioisotope	Customer and Impact	Alternatives
Gadolinium-153	Commercial medical use in bone-scanners. Relatively new market; competitive technologies are available.	Shelf supply will last at least 3 months, then ORR can be used to meet demand. Long-term alternatives have been under review for several months.
Iridium-192	Weld radiography in Navy, and oil and construction industries. Foreign competition would meet iridium demand if DOE stopped producing.	Expect a slight delay of shipments (3 weeks). Then ORR and ATR material will replace HFIR production.
Cobalt-60 (High Specific Activity)	Medical teletherapy. Small market that would be easily met by foreign competition if DOE stopped producing.	Just shipped a 7-cycle and 14-cycle harvest. Can use ATR to make next scheduled shipment.

REPOSITORY Oak Ridge Operations Records Holding area
COLLECTION Documents 1944-94
BOX No. B-144-15 Bldg. 2714-H
FOLDER Shortages of Isotopes #2 Special Demand

1081304

OAK RIDGE NATIONAL LABORATORY
OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC

POST OFFICE BOX X
OAK RIDGE TENNESSEE 37831

December 4, 1986

Sylvia Wolfe
Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37831

Dear Ms. Wolfe:

The information you requested concerning the shutdown of the High Flux Isotope Reactor on our nuclear medicine research program is summarized below.

OHER Designation: Nuclear Medicine and Biomedical Radioisotope Program

HA 02 07 01 0 (001161)

OHER Contact: J. Robertson, M.D. (FTS 233-5355)

ORNL Program: Nuclear Medicine Group, Health & Safety Research Division

Technical Contact: F. F. (Russ) Knapp, Jr., Group Leader (Tel. 615 574-6225)

Radioisotope	Impact	Alternative
Osmium-191	Crucial - Used for ORNL osmium-191/iridium-191m generator system - clinical trials in progress.	Requires High Flux - arrangements have been made at BNL
Copper-64	Important for ORNL research and ORAU collaboration.	Possibility of ORR-production is being assessed - BNL also possible.
Rhenium-188	Important ORNL project - development of generator for tumor therapy.	Possibility of ORR - production is being assessed.
Platinum-195m	Used for synthesis of anti-tumor agent for research - important for Sales cusotmers - no ORNL research.	Requires High Flux - unavailable until HFIR resumes operation.

(2)

1081305

Sincerely,

Russ Knapp

F. F. (Russ) Knapp, Jr., Ph.D.
Group Leader
Nuclear Medicine Group
Health and Safety Research Division
(615) 574-6225

FFK:la

cc: T. Dahl
S. V. Kaye
C. R. Richmond
J. Setaro
P. J. Walsh

TABLE I ROUTINE HFIR PRODUCTS

Nuclide	Customers and Uses	Supply Picture
^{249}Bk	Distributed through Transplutonium Program Committee to ANL, LBL, LANL, LLNL, and ORNL. Largely used to study basic chemical and solid state properties. Useful to compare with rare earth properties, sometimes used as a target for production of heavier nuclides. Produces ^{249}Cf by decay.	Half-life of 320 days means that present supply will dwindle away. Possibly could be produced by irradiating our inventory of curium in ORR.
^{252}Cf	Largely distributed through the Californium Industrial Sales/Loan Programs to a wide variety of users (see Attachment A) who are greatly dependent on the material. Not useful for research, but alpha decay daughter quite useful.	Present inventory probably will last 4 to 5 years. Production in any other reactor is impractical.
^{253}Es	Principal customers ANL and ORNL research groups. Basic chemical and solid state studies. Highest atomic number element available in multi-microgram amounts for this type of research. Very valuable in helping to establish series trends.	No alternative to HFIR. Short half-life (20 d) means no inventory. However, we are about to process some targets discharged November 14 that will provide some material (~1/3 of a usual campaign).
^{254}Es	Principal customer LLNL, however, material used in collaborative research with LBL, LANL, and ORNL. Heaviest nuclide available in microgram quantities. Key to production of a number of heavy isotopes useful in establishing new data in relativistic chemistry and theory of fission.	With moderate half-life (276 d), present campaign will produce ~90% of usual yield. No more until HFIR or CNR is in operation.
^{257}Fm	Has been distributed to ANL, LBL, LANL, LLNL, and ORNL. Most experiments that can be performed with current supplies ($\leq$1 picogram) have been done. All are waiting for larger quantities.	Only from HFIR or higher flux reactor.

1081301

TABLE II SPECIAL OR INDIRECT HFIR PRODUCTS

Nuclide	Customers and Uses	Supply Picture
^{242}Cm	LLNL received a small quantity for cross-section measurements.	Probably could use ORR if required again.
^{248}Cm	Distributed by Transplutonium Program Committee to ANL, LBL, LANL, LLNL, and ORNL. Some has been sent to laboratories in West Germany. Long-lived decay product of ^{252}Cf, it is very valuable in chemical and solid state research and also as a target for production of very heavy nuclides.	Can only be produced in high isotopic purity by decay of purified ^{252}Cf. It will continue to be produced for several years in more than adequate supply.
^{249}Cf	Distributed through Transplutonium Program Committee to ANL, LBL, LANL, LLNL, and ORNL. Largely used to study basic chemical and solid state properties. Useful to compare with rare earth properties, sometimes used as a target for production of heavier nuclides.	Dependent on production of ^{249}Bk.
^{250}Cf	Batches have been prepared for ANL, LBL, LLNL, and ORNL.	Produced by irradiation of ^{249}Bk. While ORR could make ^{250}Cf, it would be of lesser quality due to continual decay of ^{249}Bk to ^{249}Cf.
^{255}Fm	Customers are ORAU and ORNL. ORAU is using it for cancer research, ORNL for chemical and solid-state studies on nanogram level.	Very short half life (20 h) precludes shipment elsewhere. None available without HFIR.

1081308

TABLE III POTENTIAL HFIR PRODUCTS

(The following materials could be produced or upgraded by irradiation in HFIR. While we have not actually done so, as yet, plans are being made along those lines.)

Nuclide	Customers and Uses	Supply Picture
^{244}Pu	DOE production sites, International Safeguards Community, etc.	Very high flux required.
	^{244}Pu contributes materially to improved precision and reduced cost of plutonium analyses, because it is not a significant component of plutonium mixtures produced in most reactors (^{243}Pu has a 5-h half life).	
^{243}Am	DOE Weapons Labs	
	Needed for test diagnostics. Current supplies of separated ^{243}Am are dwindling. Savannah River could furnish this material but would require startup of a new facility that is oversized for this job.	Alternate sources are very expensive at this time.
^{244}Cm	DOE Weapons Labs	
	Needed for test diagnostics. Current supplies of separated ^{244}Cm are dwindling. Savannah River could furnish this material but would require startup of a new facility that is oversized for this job.	Alternate sources are very expensive at this time.

Attachment A

MEDICAL AND HEALTH-RELATED APPLICATIONS OF ^{252}Cf

- ^{252}Cf NEUTRON THERAPY FOLLOWED BY X-RAY OR GAMMA RAY THERAPY HAS BEEN SHOWN TO BE PARTICULARLY EFFECTIVE IN THE TREATMENT OF ADVANCED, HYPOXIC TUMORS OF THE CERVIX

- FOUR HUNDRED AND FIFTY PATIENTS HAVE BEEN TREATED USING THIS TYPE OF RADIOTHERAPY AND HAVE SHOWN A 5-YEAR SURVIVAL RATE OF 54% VS A 12% RATE FOR CONVENTIONAL RADIOTHERAPY

- A PROPOSAL HAS BEEN MADE TO NCI THAT CLINICAL TRIALS OF THE CERVICAL CANCER THERAPY BE UNDERTAKEN

- ^{252}Cf IS ALSO BEING DEVELOPED AS AN IN VIVO NEUTRON ACTIVATION TOOL FOR ULTIMATE CLINICAL USE IN DIAGNOSIS AND MONITORING OF SEVERAL MEDICAL CONDITIONS INVOLVING ABNORMAL QUANTITIES OF LITHIUM OR ALUMINUM

- ^{252}Cf IS ALSO BEING PROPOSED BY THE FDA AS A NEUTRON ACTIVATION SOURCE FOR DETERMINING THE SODIUM CONTENT OF CERTAIN FOODSTUFF

1081310

DOE PRODUCTION AND MILITARY APPLICATIONS OF ^{252}Cf

- ^{252}Cf NEUTRON SOURCES ARE ON LOAN TO 23 DOE OR DOE CONTRACTOR FACILITIES AND TO 6 MILITARY AND NASA INSTALLATIONS.

- ^{252}Cf USED AT MOUND LABORATORY FOR NONDESTRUCTIVE INSPECTION OF EXPLOSIVE FILL IN PERCUSSION CAPS SINCE 1971.

- USED FOR NEUTRON GAUGING OF REACTOR COMPONENTS AT THE HANFORD N REACTOR.

- USED AS A NEUTRON SOURCE FOR "TRU" WASTE ASSAY SYSTEMS DESIGNED BY LOS ALAMOS.

- ^{252}Cf NEUTRON RADIOGRAPHY OF F-111 AND A-10 MILITARY AIRCRAFT AT MCCLELLAN AIR FORCE BASE SERVES AS A DIAGNOSTIC TOOL FOR LOCATING CORROSION OF ALUMINUM HONEYCOMB AND DEBONDING OF COMPOSITES. FACILITY SHOULD BE COMPLETED IN LATE 1987 AT A COST OF $22 MILLION AND WILL REQUIRE AN INVENTORY OF 100 MG OF ^{252}Cf WITH AN ANNUAL RESUPPLY OF ~33 MG. OTHER MILITARY INSTALLATIONS HAVE SHOWN INTEREST.

- ^{252}Cf NEUTRON RADIOGRAPHY USING A 150 MG SOURCE HAS BEEN PROPOSED AS A REPLACEMENT FOR THE VAN DE GRAAFF AT THE PANTEX PLANT. ULTIMATE USE WILL BE FOR NONDESTRUCTIVE EXAMINATION OF CLASSIFIED WEAPON COMPONENTS.

1081311

INDUSTRIAL APPLICATIONS OF ^{252}Cf

- FIRST USED AS A REACTOR STARTUP SOURCE IN 1973. CURRENTLY THE INDUSTRY STANDARD FOR PWRS. ABOUT 50% OF ^{252}Cf SOLD GOES TOWARD THIS APPLICATION.

- NONDESTRUCTIVE EXAMINATION OF REACTOR FUEL RODS.

- NEUTRON ACTIVATION ANALYSIS — NO OTHER SINGLE ANALYTICAL METHOD GIVES AS COMPLETE A PROFILE OF ELEMENTAL COMPOSITION.

- INSTRUMENT CALIBRATION, DOSIMETRY STUDIES, AND INDUSTRIAL GAUGING ALSO UTILIZE ABOUT 10% OF THE ^{252}Cf SOLD.

EDUCATION AND TRAINING USES OF ^{252}Cf

- USED AS AN ACTIVATION SOURCE FOR PRODUCING SHORT-LIVED RADIOISOTOPES USED IN TRAINING RADIOCHEMISTS, RADIOLOGISTS, HEALTH PHYSICS PERSONNEL, ETC.

- MATERIALS ALSO PROVIDED TO REAC/TS (RADIATION EMERGENCY ASSISTANCE CENTER/TRAINING SITE) WHERE PHYSICIANS ARE TRAINED TO CARE FOR POTENTIAL VICTIMS OF RADIATION ACCIDENTS