BNL Radioisotope Research & Production Program Overview

Operations Review

Leonard Mausner
Medical Department
BNL

11/19/09

BROOKHAVEN NATIONAL LABORATORY

Future Planning

- Accelerator issues (new cyclotron)
- Staff issues
- Hot cell issues (obsolete manipulators)

Present DOE Accelerator Issues

- Current isotope production relies on other DOE Programs for accelerator operations without coordination of schedule for isotope needs
- Current production sporadically supports short-lived isotopes; insufficient for sustained research or clinical trials
- Current production with low beam current sometimes limits isotope specific activity to unacceptable levels, eg. Cu-67

BNL solution (CDR submitted in 2000)

- Acquire, house, and operate a stand alone cyclotron at BNL to replace BLIP
- Cyclotron Isotope Research Center (CIRC) capabilities
  - Proton beams continuously tunable from 30-70 MeV with intensity up to 750μA (DC beams) because detailed consideration of isotope needs and cyclotron cost indicate optimal cost effectiveness at 70 MeV maximum
  - 4 beam lines and target stations, with 2 simultaneously operable
  - Alpha beam fixed at 70 MeV up to 35μA intensity
  - Deuteron beams 15-35 MeV up to 50μA intensity
  - Location in existing BNL building 912,a part of the AGS/RHIC complex
    - This is a large high bay building with existing 40 ton crane, and all needed services (power, water etc.). It is approximately 1000' from the Isotope Research and Processing Laboratory.
- Project cost - ~$40M (FY09$)
- Status - unfunded

CIRC Mission

- Serve the national need for a year round reliable supply of isotope products and services for medicine, industry and research
  - Provide low volume “orphan” isotopes to researchers
  - Develop isotope production processes to assure the availability of isotopes needed for research
- Produce commercial quantities of isotopes
  - When there is no other reliable supply
  - When unique government facilities are required for production
- Privatize commercial production where possible (eg. commercially operated beam line and target station)
- Provide a much needed facility for hands-on, broad-based, education/training in nuclear and radiochemical techniques

BLIP versus CIRC Comparison

ITEM	BLIP	CIRC
Particle	proton	p, d, α
Beam current	85μA	750μA
Beam lines	1	4
Energy range MeV	118-202	30-70
Energy variability	22MeV steps	continuous
Reliability	98%	98%
Typical availability (5yr av)	17wk/yr	50wk/yr
Accelerator Operating cost	$1120K[1]	$1425K[2]
Other program costs [3]	$3200K	$4000-5000K
Total program costs	$4320K	$5400-6425K

[1]Average, but varies a lot depending on the need for dedicated running, FY09 $

[2]Assumes 40hr/wk required initially

[3] Processing, assay, waste disposal, shipping, hot cell maintenance, target fabrication, ES&H

Education & Training Plan

- Existing BNL/SBU Nuclear Chemistry Summer School
  - R. Ferrieri BNL site Director, R. Lacey, J. Jia SBU instructors
- Existing BNL/SBU Department of Biomedical Engineering collaborative program in medical physics and imaging
  - T. Button, C. Rubin SBU, D. Schlyer, P. Vaska, A. Dilmanian BNL
- Proposed joint BNL/SBU Department of Chemistry program in nuclear and radiochemistry
  - Undergraduate and graduate lecture and laboratory courses (R. Lacey & J. Jia of SBU + L. Mausner & other adjunct staff from BNL)
  - Graduate work (separate MS & PhD programs) at CIRC with BNL adjunct staff
  - SBU prepared to make joint SBU/BNL faculty appointment

Recent developments

- Isotope sales to commercial industry, primarily for Sr-82 and Ge-68, have increased strongly over the last three years. Sales revenue is now sufficient to pay for some supplemental dedicated operation of the Linac in addition to parasitic operation with RHIC. Yearly operations still limited by Linac development and maintenance needs.
- Management of the National Isotope Program has been transferred from DOE Office of Nuclear Energy to Office of Science/Nuclear Physics in 2009.
- Nuclear Physics established a standing Isotope Subcommittee as part of the Nuclear Science Advisory Committee (NSAC) with the charges to recommend both short term and long term plans for the Isotope Program.
  - The long range plan was presented and discussed with NSAC on July 27, 2009.
  - The most significant infrastructure investment recommended was:
    - "Construct and operate a ~30-40 MeV variable-energy, high-current, multiparticle cyclotron and supporting facilities that have the primary mission of isotope production."
  - This recommendation implies continued operation of BLIP for production at higher energy (eg. Sr-82, and Cu-67).
- If DOE goes ahead with an RFP for a cyclotron, we will compete based on a modified CIRC.

Staffing Issue -QA

- We do not have the time or expertise to prepare a Validation Master Plan for Sr-82 process.
- In the short term, it will be necessary to hire a cGMP consultant to help us prepare these documents and other needed improvements to QA program. (It is our impression that LANL faces the same issues, so dealing with it could be at the national level.)
- Note that there will be short term and continuing impact on entire group to then implement and maintain ICH-Q7 requirements.
- Future addition of a QA professional to our group must be considered.

Staffing issues

- FY09 minimum “core” staff to accomplish facility maintenance, and development with appropriated funds was 2.2 FTE PhD, 4.0 FTE technical, 0.55 FTE administrative (does not include CAD engineering assistance that varies between 0.1-0.5 FTE per year)
- FY09 minimum “core” staff to accomplish current isotope production and current small R&D effort supported by revolving sales fund was 0.37 FTE PhD, 1.5 FTE technical
- Since effort on maintenance, production and R&D are carried out by the same people, the “core” staff is essentially the total
- Desired core staff to support extended production (9-10 months BLIP operation) and healthy R&D effort requires additional 1 FTE PhD, 3 FTE technical (2 isotope processing, 1 waste disposal) and 1 FTE administrative (cGMP QA & ESH)
- Age issue – 7 of 10 group members are over age 55. Three or 4 retirements are expected within the next 3 years. Skilled BS and MS level radiochemistry replacements do not exist. Hiring replacements prior to departure of experienced staff is essential for on the job training, but will require temporary budget increase to support staff overlap.

Hot cell manipulator issue

- We have just been informed by Central Research Labs, the manufacturer of all our hot cell manipulators, that fabrication of the ceiling mounted types (Model 7) will shortly be discontinued. Repair parts will only be available as long as existing inventories last! These are used in 6 of the hot cells in the Target Processing Lab and at BLIP. Retrofitting the 6 hot cells with door mounted types (Model G) will be very expensive (possibly >$1M) since the doors will have to be replaced as well as the manipulators. This is not possible at BLIP.
  - Short term strategy will be to buy another spare manipulator for parts. In this fashion we may be able to keep all hot cells functional for approximately another two years. Thereafter manipulators from less used hot cells will have to be transferred to replace damaged ones in the more critical spots.
  - Long term strategy will be to retrofit two hot cells per year from 2012-2014