HERC Project Status Report
Idaho Incubation Fund Program
Final Progress Report
June 30, 2012

Proposal No.	**AHRC25**
P.I. Name:	**Dr. Douglas Wells**
Name of Institution:	**Idaho State University/ Idaho Accelerator Center**
Project Title:	**Commercialization of Copper 67**

Introduction

This is a the final status report beginning FY 2012 for the HERC funded project, Commercialization of Copper 67. The project proposal listed the following major project milestones:

1). Completion of internal infrastructure, 2).Testing of all discrete production steps followed by production of trial samples 3). Approval of tissue, animal and human trial samples, 4). Delivery of approved quantities to researchers for human trials.

The major project milestones including production of trial samples required more resources than was provided in the HERC grant, however, we had high expectations of additional support from a DOE production grant. The follow-on DOE grant was delayed over 7 months and therefore not all the funding was available to meet all of the objectives. Despite this, as will be shown, we have completed all the major process steps and are positioned for success in the next phase of commercialization.

In addition to the above goals, the Copper-67 project was an important training ground for ISU undergraduate and graduate students. Several Chemistry and Physics graduate and undergraduate students, were employed in the research. In addition, the project was an excellent training ground for faculty in the requirements of successful commercial processes and working with external private enterprise.

Each of these key milestones will be detailed below with final progress.

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2 PROJECT STATUS REPORT – Milestone review

For the three months ending June 30st, 2012, (Q4 FY 2012), the following items were completed against the project plan:

1). Completion of internal infrastructure

a). The high power (40 MeV, 10 kW accelerator was successfully commissioned and tested. Very significant equipment was required to be designed, installed and verified before initial testing. Among those items installed and tested were: a high capacity chiller, higher amperage electrical supply, beam line cooling systems, shielding, and beam diagnostics. Tests showed the accelerator performed to design specs and is ready for the next phases including full activation testing.

b). The initial design of the accelerator end-station shielded area was completed and equipment procured for the construction. The high cost of some of the equipment was lowered by a generous donation from Premier Technologies of expensive HEPA filters. The end station shielding construction is underway and will be complete for sample preparation.

c). The initial designs of the isotope target carrier was completed and is in fabrication.

d). Research furnace equipment to support the separation process was defined, procured and the process for separation was determined. Both a vacuum radiant furnace and a vacuum induction furnace were constructed and tested. Specialized sublimation tubes and equipment were developed based on commercially available sources. Over 50 trials and experiments were run using many key variables to determine a process for initial sublimation

separation. The current process has shown over a 90% recovery percentage for the Copper-67 final material. While the sublimation process was dramatically improved, a new furnace design that takes advantages of what has been learned is being constructed. We hope to test the new furnace in Q1 FY 2013.

e). A column chromatography separation process was developed using a novel approach to decrease sample volumes and improve overall effectiveness. The process has been partially automated for use in a hot cell and was tested during a full process test. The separation process must be simplified for use in the commercial partner's hot cell. While results were adequate, process complexity and potential for error by operators is too great. We have devised a new scheme and intend to test it in Q1 FY 2013.

f). We developed a business plan, financial model and forged a partnership with International Isotopes Inc., an Idaho company, for further development and commercialization. A development agreement was signed that among other items provided ISU with the in-kind donations of equipment and expertise. For example, our private partner has made available a $500K hot cell and analytical support from their $150K ICPMS. International Isotopes has participated in process reviews at our facility and have made valuable contributions to the set ups required to operate successfully.

2). Testing of all discrete production steps

a). We have successfully demonstrated all individual process steps including a complete full process test. These process steps were developed: 1) activation using the (Y,p) reaction, 2). First stage separation using vacuum sublimation and both a radiant furnace and an inductive furnace and susceptor, 3). Second stage separation using Chelex and AG ion chromatography. We completed(June 2012) complete process flow testing which includes all the steps in sequence using radioactive samples. The results from our complete flow testing were very encouraging for the ultimate commercialization of the technology. We achieved at least 77% overall yield from the process. We determined that certain steps need additional refinement for commercialization which we plan to complete in FY 2013. FY 2013 work will include: completion of the high power target system, verification of total activation measurements, testing of newly designed sublimation furnace, simplification and testing of the chemical separation process, and improvement in overall yield and cost.

3). Trial samples and approved quantities to researchers.

a). We will be unable to create trial samples for shipment to researchers because this step requires the purchase of approximately $80,000 of Zinc-68, the key material converted into Copper-67. As was mentioned, all trial samples, including material for human trials will be on hold until that material is purchased. However, we will continue to improve the underlying technology for cost effective commercialization.

Student Training

This project has been an excellent training ground for our students, providing real world experience in the requirements of commercial product viability. We have utilized 2 Physics graduate students, 2 Physics undergraduate students, 2 Chemistry graduate students, 2 Chemistry undergraduate students, 1 Post Doctoral Researcher, and additional faculty and support staff. The students have gained skills in accelerator physics, furnace and vacuum system operation and column chromatography with an emphasis on developing cost effective, commercially capable technology.

3 FINANCIAL

See attached final review.

4 INTELLECTUAL PROPERTY, APPLICATIONS, INDUSTRY INVOLVEMENT

We have developed significant technology for commercialization of Copper 67. Our business plan shows excellent potential for technology transfer to private enterprise. Our private sector partner remains enthusiastically in support of full commercialization and production. In addition, the work completed has potential for commercialization of other isotopes. The HERC funding is the starting point for continued technology research and establishes ISU and the Idaho Accelerator Center as one of the world leaders in isotope production.

FINAL EXPENDITURE REPORT

4.1.1 A. FACULTY AND STAFF		
Name/Title	$ Amount Requested	Actual $ Spent
Dr. Douglas Wells / PI	$3400	
Dr. V. Starvoitova / Physics Faculty Dr. F. Harmon	$1300 $2000	
Dr. L. Goss / Chemistry Faculty	$2000	$7931
B. VISITING PROFESSORS		
Name/Title	$ Amount Requested	Actual $ Spent
C. POST DOCTORAL ASSOCIATES/OTHER PROFESSIONALS		
Name/Title	$ Amount Requested	Actual $ Spent
K. Folkman C. O'neil	$1600 $1300	
M. Balzar	$1300	$4130
D. GRADUATE/UNDERGRADUATE STUDENTS		
Name/Title	$ Amount Requested	Actual $ Spent
T. Gardner	0	$2114
Tuition		$342
E. FRINGE BENEFITS		
Rate of Fringe (%) 21%	$ Amount Requested	Actual $ Spent
Fringe	$2700	$2543
Health Ins	$1200	$967
PERSONNEL SUBTOTAL:	**$16800**	**$18026**

F. EQUIPMENT: (List each item with a cost in excess of $1000)		
Item/Description	$ Amount Requested	Actual $ Spent
1.		
2.		
3.		
4.		
EQUIPMENT SUBTOTAL:		

G. TRAVEL		
Description	$ Amount Requested	Actual $ Spent
1.	$3000	$0
2.		
3		
TRAVEL SUBTOTAL:	$3000	$0

H. PARTICIPANT SUPPORT COSTS:		
Description	$ Amount Requested	Actual $ Spent
1.		
2.		
3		
PARTICIPANT SUPPORT COSTS SUBTOTAL:		

I. OTHER DIRECT COSTS:			
Description		$ Amount Requested	Actual $ Spent
1. Research and Business Consultant		$30000	$33000
2.			
3.			
OTHER DIRECT COSTS SUBTOTAL:		$30000	$33000
TOTAL COSTS (Add Subtotals):		$49900	$51026
TOTAL AMOUNT REQUESTED:			50,000
TOTAL AMOUNT SPENT:			51026

Prepared by Jon Stoner
Project Manager