NRC Form 313 I (12-81) 10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

1. APPLICATION FOR: *(Check and/or complete as appropriate)*

See attached instructions for details.

Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.

	a. NEW LICENSE
X	b. AMENDMENT TO LICENSE NUMBER 12-24371-01
	c. RENEWAL OF LICENSE NUMBER

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*
International Minerals & Chemical Corp.
Northbrook R&D Laboratories
TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
(312) 480-0200

3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION
Timothy M. Sullivan, R.P.O.
TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
(312) 480-0200, ext. 2805

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code)*
(Address to which NRC correspondence, notices, bulletins, etc., should be sent.)
IMC Research & Development
1810 Frontage Road Northbrook, IL 60062

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED *(Include Zip Code)*
IMC R&D
1810 Frontage Road
Northbrook, IL 60062

(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)

6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL
(See Items 16 and 17 for required training and experience of each individual named below)

	FULL NAME	TITLE
a.	See Item 6 attached.	
b.		
c.		

7. RADIATION PROTECTION OFFICER
As per license number 12-24371-01

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.

8. LICENSED MATERIAL

LINE NO.	A ELEMENT AND MASS NUMBER	B CHEMICAL AND/OR PHYSICAL FORM	C NAME OF MANUFACTURER AND MODEL NUMBER *(If Sealed Source)*	D MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)	See Item 8 attached.			
(2)				
(3)				
(4)				

DESCRIBE USE OF LICENSED MATERIAL

Applicant Oct 2011

(1) Check No. 06746 0726 E $105

(2) Amount/Fee Category 3A $125 2E

Type of Fee APP

(3) Date Check Rec'd 10/25/85

(4) Received By JBC NOV 25 PAID CP CONTROL NO. 79964

9. STORAGE OF SEALED SOURCES

LINE NO.	A. CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED.	B. NAME OF MANUFACTURER	C. MODEL NUMBER
(1)	Scintillation counter	Beckman	LS 3800
(2)	Irradiator (See Item 9 attached)	Atomic Energy of Canada	GammaCell1000
(3)			
(4)			

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	A TYPE OF INSTRUMENT	B MANUFACTURER'S NAME	C MODEL NUMBER	D NUMBER AVAILABLE	E RADIATION DETECTED (alpha, beta, gamma, neutron)	F SENSITIVITY RANGE (milliroentgens/hour or counts/minute)
(1)	Survey Meter	Ludlum	Model 3	Five	alpha, beta, gamma	0.1 mR/hr
(2)	Gamma Counter	Micromedic	Apex	One	gamma	50 cpm
(3)	Scintillation Counter	Beckman	LS3800	One	alpha, beta, gamma	50 cpm
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☒ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY YEARLY
Health Physics Associates, Ltd.
Northbrook, Illinois

☐ b. CALIBRATED BY APPLICANT

Attach a separate sheet describing method, frequency and standards used for calibrating instruments.

12. PERSONNEL MONITORING DEVICES

A TYPE (Check and/or complete as appropriate.)	B SUPPLIER (Service Company)	C EXCHANGE FREQUENCY
☒ (1) FILM BADGE ☒ (2) THERMOLUMINESCENCE DOSIMETER (TLD) ☐ (3) OTHER (Specify): _____	As per license number 12-24371-01	☒ MONTHLY ☐ QUARTERLY ☐ OTHER (Specify):

13. FACILITIES AND EQUIPMENT (Check were appropriate and attach annotated sketch(es) and description(s).

☒ a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS (Include filtration, if any), ETC.
☒ b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING (fixed and/or temporary), ETC.
☐ c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC.
☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

See Item 13 attached.

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED
As per license number 12-24371-01

b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE.

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

Describe in detail the information required for Items 15, 16 and 17. Begin each item on a separate page and key to the application as follows:

15. RADIATION PROTECTION PROGRAM. Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures *(if needed)*, day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit.

16. FORMAL TRAINING IN RADIATION SAFETY. Attach a resume fo. each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc.

    a. Principles and practices of radiation protection.

    b. Radioactivity measurement standardization and monitoring techniques and instruments.

    c. Mathematics and calculations basic to the use nd measurement of radioactivity.

    d. Biological effects of radiation.

17. EXPERIENCE. Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used.

18. CERTIFICATE

(This item must be completed by applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 30, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

RECEIVED OCT 18 1985 REGION III

WARNING.—18 U.S.C., Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

CONTROL NO. 79964

a. LICENSE FEE REQUIRED *(See Section 170.31, 10 CFR 170)* $120.00	b. CERTIFYING OFFICIAL *(Signature)* Timothy M. Sullivan
	c. NAME *(Type or print)* Timothy M. Sullivan
(1) LICENSE FEE CATEGORY: M	d. TITLE Radiation Protection Officer
(2) LICENSE FEE ENCLOSED: $ 120.00	e. DATE October 16, 1985

Item 6. Individual(s) who will use or directly supervise the use of licensed material.

NRC license 12-24371-01 lists the following as approved users: Timothy M. Sullivan, David K. Howard, Chandra K. Parekh, and Maria Luisa.

Two changes are submitted.

a. The name of user "Maria Luisa" in the approved license is in error. The correct name, as per the New License Application filed by IMC and dated August 2, 1984, is "Maria-Luisa Maccecchini". This item was not corrected immediately because of its minor significance, as per advice from the NRC.

b. The following persons are submitted for approval as additions to the user list.

NAME	TITLE
James E. Seely	Research Biochemist
Paul R. Atkinson	Research Biochemist
Susan M. Drengler	Research Biochemist
Alvin M. Janski	Research Biochemist
B. Dan Burleigh	Research Biochemist
Ellen R. Clough	Research Immunologist
Anthony F. Abruzzini	Research Immunologist

Item 8. License Material

One sealed source is submitted for inclusion with the list of licensed material under 12-2453-1-01 for use as described below.

Element and Mass Number:	Cesium-137
Chemical and/or Physical Form:	Cesium chloride
Model and Manufacturer:	"Gamma Cell 1000" Atomic Energy of Canada Kanata, Ontario
Maximum Source Activity:	1000 Curies

Use: Inactivation of in vitro cell populations for the investigation of immune responses. Any additional uses will be subject to the approval of the Radiation Protection Officer

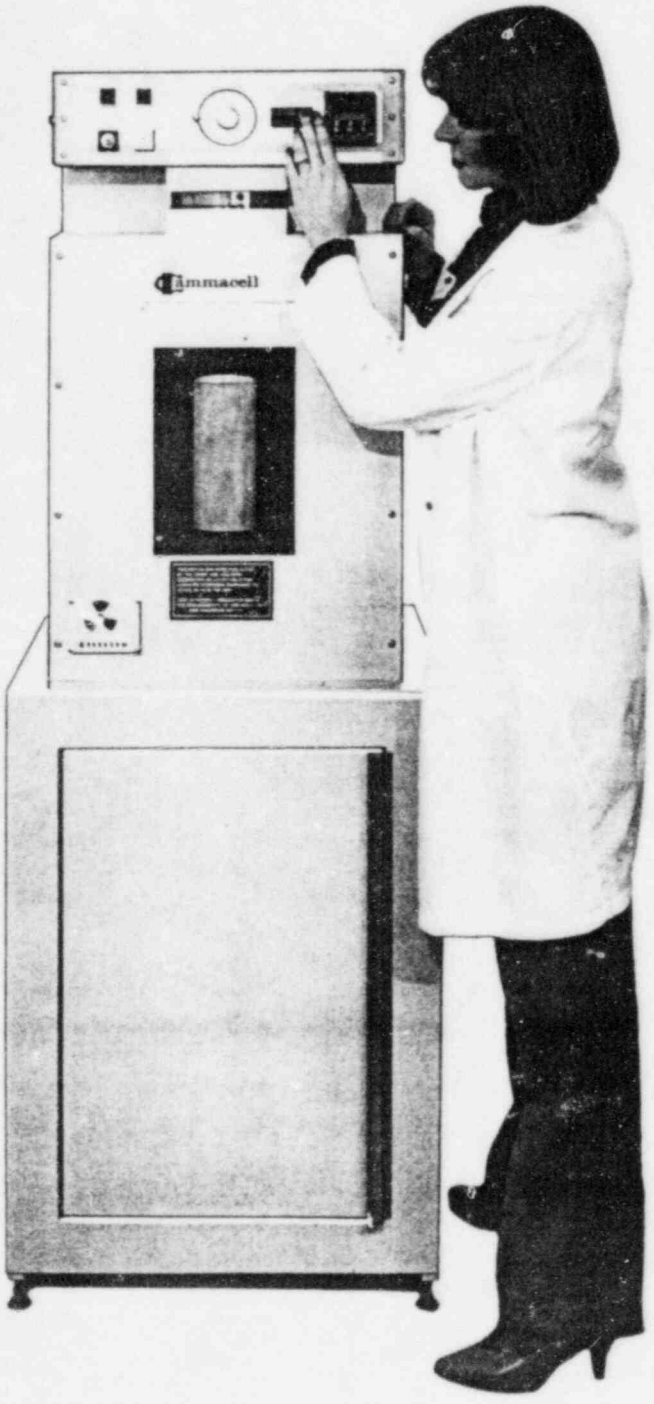
Item 9. Storage of Sealed Sources

The manufacturer's specifications for the Gamma Cell 1000 irradiator are attached.

AECL Industrial Irradiators

Gammacell 1000

Blood Irradiator



The Gammacell 1000 irradiator is designed for the irradiation of blood and blood components to inactivate leukocytes. It is also well suited to irradiate biological or other samples.

The Gammacell 1000 is self-shielded and can be safely operated in an existing laboratory environment. When fully loaded, the external radiation level of the Gammacell 1000 is less than 2.0 mrem/h at 1 m from the source and 20 mrem/h at 5 cm from the surface of the unit*

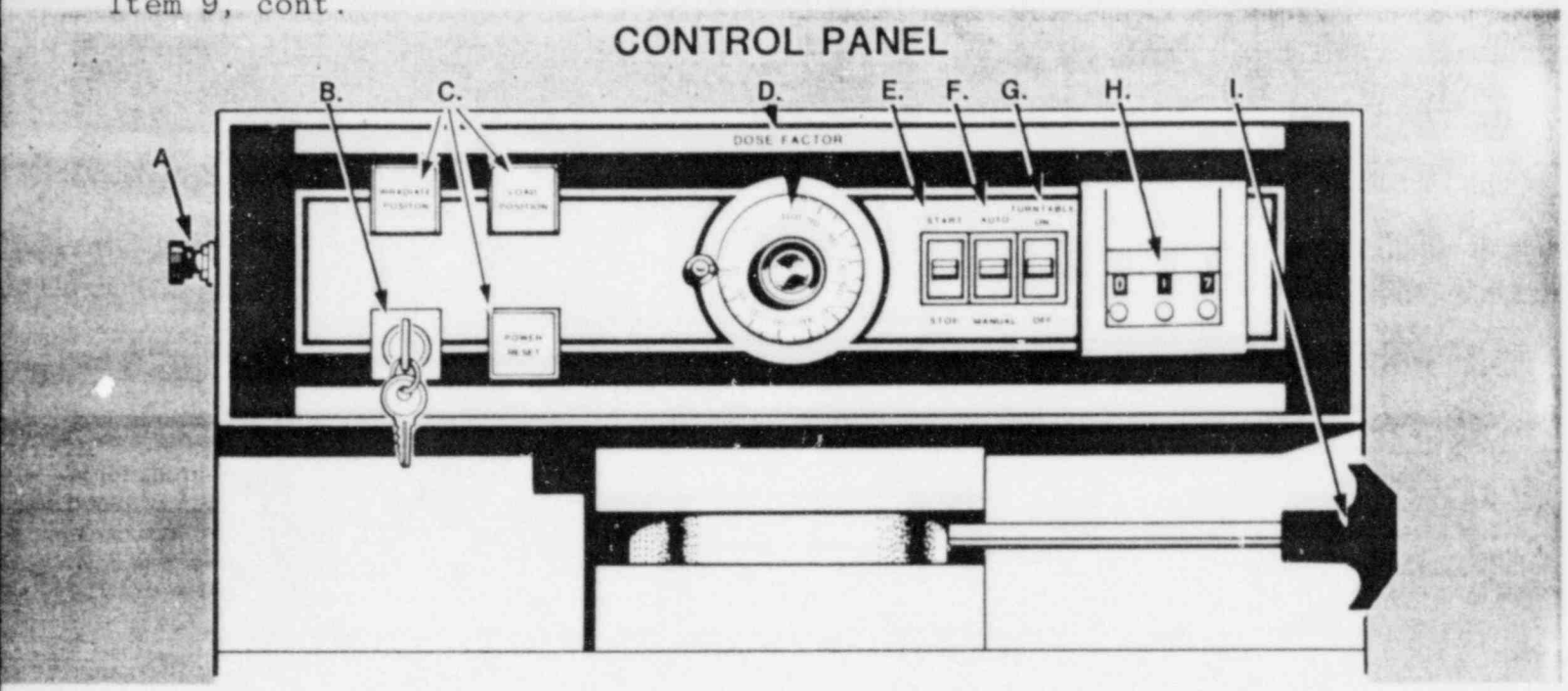
A 3000 rad dose can be delivered in 2-7 minutes depending on source size selected.

The gamma irradiation source is cesium 137, which has a half-life of 30.2 years. This source is permanently sealed in a stationary position within a lead shield. The sample chamber is rotated to and from the source by a shielded rotor. Within the sample chamber there is a turntable, with a removable beaker. Good dose uniformity (± 14%) is given when the turntable is rotating. A test tube holder can also be used in the sample chamber and is available as an optional accessory.

Three access tubes are provided for instrumentation. They enter the sample chamber from the storage cabinet.

* These external radiation levels meet the requirement of the International Commission in Radiation Protection, Publication No. 15 (ICRP #15)

CONTROL PANEL



A. Safety Switch Button
(see item E)

B. Key Operated Power Switch
Controls power to the irradiator.

C. Indicator Lights
When illuminated, these lights indicate: — "POWER RESET" (White)
"LOAD POSITION" (Green)
Sample chamber in the "Load/Unload" position.
"IRRADIATE POSITION" (Red)
Sample chamber in the irradiate position.

D. Dose Factor
With this control it is possible to rotate the rotor so that the sample chamber is only partially exposed to the radioactive source, thus reducing the dose rate in the sample chamber. Determination of the Dose Rate distribution at any of the partial irradiate positions is left up to the customer to perform.

E. Stop/Start Switch
Controls movement of the rotor. The sample chamber can be rotated to the "Irradiate" position only when the "Safety Switch Button" (item A) is pressed and the "Stop/Start Switch is held in the "Start" position.
The sample chamber can be returned to the "Load/Unload" position by holding the Stop/Start Switch in the "Stop" position.

F. Auto/Manual Switch
Determines mode of equipment operation. When the switch is in the "Auto" position the sample chamber will be automatically returned to the "Load/Unload" position by the expiration of the preset time of the digital timer. When the switch is in the "Manual" position, the digital timer will act as an elapsed time indicator only. The sample chamber can be returned to the "Load/Unload" position by pressing the "Stop Button".

G. Turntable Switch
Controls power to the sample chamber turntable drive. When this switch is on, the turntable is rotating.

H. Digital Timer
In the automatic mode, a three digit readout timer controls the irradiation time. Readout range is 0.1 to 99.9 minutes. Timer accuracy is comparable to the accuracy of an electrical clock.

I. Emergency Lever
In the event of a power failure the sample chamber can be manually rotated from the "Irradiate" position to the "Load/Unload" position.

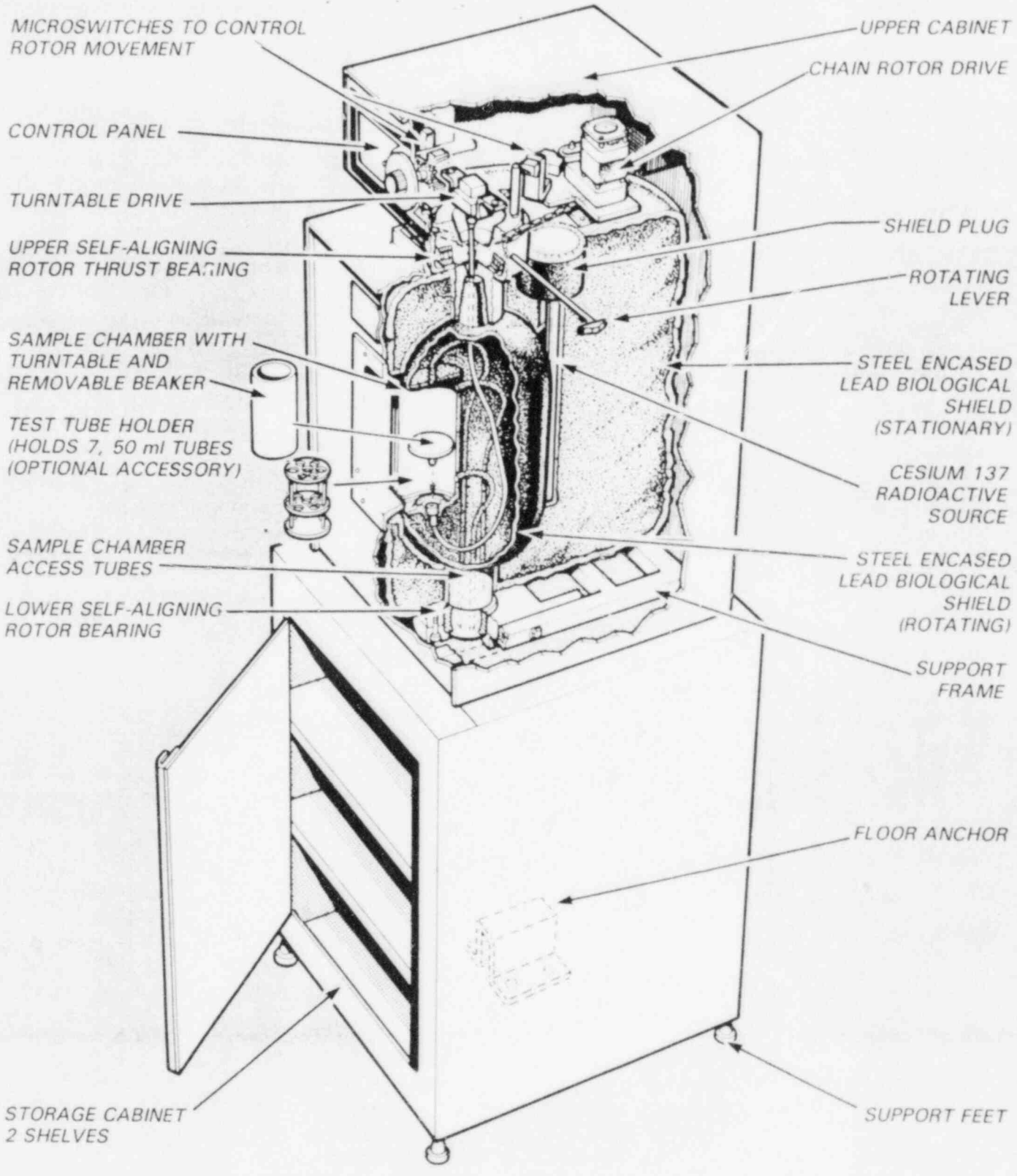
Electrical Power Requirements

Standard: 110/120V, 60Hz, standard North American wall outlet three prong plug.

Optional: 220/230V, 50Hz, standard wall outlet three prong plug.

Note: The type of power supply available (50Hz or 60Hz) is to be specified at the time of ordering.

Power Cable: A 3m (10 ft power cable is provided with the unit.



WEIGHTS

Total Weight:	1,134 kg (2,500 lbs.)
Floor Loading:	3,052 kg/m^2 (625 lbs/ft^2)
Projected Floor area:	0.372 m^2 (4 ft^2)

DIMENSIONS

Width:	61 cm (24 in)
Length:	61 cm (24 in)
Height:	165 cm (65 in)
Colour scheme:	beige and blue

BEAKER DIMENSIONS

Height	16.5 cm (6.5 in)
	7.6 cm (3 in)

SAMPLE CHAMBER DIMENSIONS

Height (Without turntable)	21.3 cm (8.4 in)
Height (With turntable)	20.3 cm (8.0 in)
Diameter	8.5 cm (3.35 in)

Radiation Specifications

The Cesium 137 sources are doubly encapsulated in stainless steel and are held in a source holder.

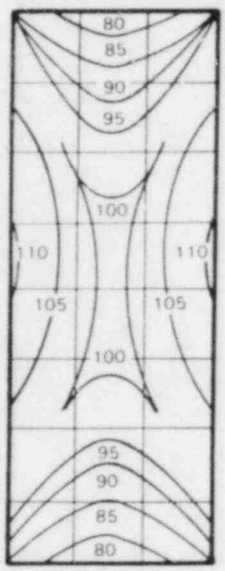
The source holder is permanently installed and sealed within the steel encased biological shield.

The curies contained in each Gammacell 1000 model and the corresponding Central Dose Rates are listed as follows:

Gammacell 1000 Model	No. of Sources	Nominal Curie Content ± 20%	Central Dose Rate (CDR) ± 10% rad/min/Ci	Nominal CDR rad/min
A	1	540	0.833	450
B	2	1,080	0.833	900
C	3	1,620	0.806	1,305
D	4	2,160	0.792	1,710

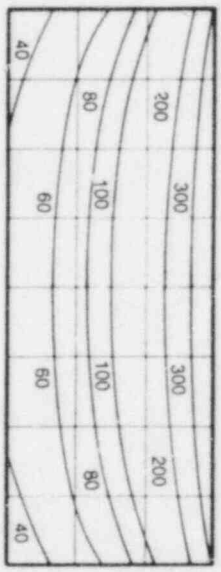
The central dose rates in the table represent measurements with the beaker in place and in an air medium. For a liquid, such as blood, the central dose rates should be decreased by 10%.

Fig. 1
Isodose Rate Curves Turntable Rotating



The approximate dose rate distribution in the sample chamber with the turntable rotating at 4.0 rpm is shown in Fig. 1. The approximate dose rate distribution with the turntable stationary is shown in Fig. 2.

Fig. 2
Isodose Rate Curves Turntable Stationary



Figures 1 and 2 represent typical Dose Rate Distribution in an air medium. These measurements are not carried out on each individual unit. Numbers shown in the Figures represent percentage of measured central dose rate.

Shipping

The Gammacell 1000 is shipped in two shipping packages. One contains the upper and lower cabinets; the other is a returnable overpack which contains the radiation shield assembly complete with cesium sources. A nominal charge is levied for rental of this overpack.

Shipping Weights and dimensions are as follows:

Active package
Weight: 1,270 kg (2800 lb)
Height: 142 cm (56 in)
Base: 92 cm × 92 cm (36 in × 36 in)
Volume: 1.2 m^3 (42 ft^3)

Non-Active Package
Weight: 91 kg (200 lb)
Length: 152 cm (60 in)
Width: 76 cm (30 in)
Height: 102 cm (40 in)
Volume: 1.18 m^3 (41 ft^3)

The gammacell 1000 active shipping package meets the requirements of the USDOT, AECB, CSA and complies with the IAEA Regulations for the Safe Transport of Radioactive materials 1973 edition (as amended)

Certification and Documentation

The cesium 137 sources are individually tested for leakage and contamination. A leak certificate is provided with each source.

Also provided are measurement certificates of curie content and central dose rate.

An operation and maintenance manual is shipped with each unit.

Customers in the United States and Canada when applying for their radioactive materials licence should apply for 20% more than the amount of curies of cesium 137 in the source ordered to allow for the ± 20% source loading tolerance.

Gammacell 1000

Blood Irradiator

Atomic Energy of Canada Limited/ Radiochemical Company **413 March Road, P.O. Box 13500, Kanata, Ontario, Canada, K2K 1X8**
Tel. (613) 592-2790, Cable Nemota Telex: 053-4162

GC 1000 SEPT 1984

Item 13. Facilities and Equipment

The following rooms of Building 9 of the facility, as described in the original license application, are submitted for approval for radiation work as indicated below.

Room Number	Type of Radiation Work
118	Scintillation counting, biochemistry
139	Location of the 1000-Curie irradiator
302, 327, 340, 348, 320	Animal studies

No other changes in the facilities and equipment descriptions of the original license application are submitted.

Item 15: Radiation Protection Program

As per the original license application for license 12-24371-01.

Item 16. Formal Training in Radiation Safety

Item 17. Experience

The training and experience qualifications for the new users submitted in this amendment are detailed as follows.

JAMES E. SEELY

Data with respect to Training and Experience
(Reference: Items 16 & 17, Form NRC-313-1)

James E. Seely
Research Scientist

Ph.D.-University of South Dakota
Vermillion, South Dakota

B.S.-Buena Vista College
Storm Lake, Iowa

Item 16. Type of Training

	Where	Duration	On the Job	Formal Course
a) Radioisotope techniques	Univ. of S. Dakota	1 sem.	no	yes
b) Radioactivity Measurement	Univ. of S. Dakota	4 yrs	yes	no
	Hershey Medical Center of Penn State Univ.	3 yrs	yes	no

Item 17. Experience with Radiation

Isotope	Max. Amount	Where	Duration	Type of Use
^{3}H	1 mCi	Univ. of S. Dakota	2 yr	Enzyme assay
	5 mCi	Hershey Med Center	2 yr	Radioimmunoassay
^{14}C	5 mCi	Univ. of S. Dakota	4 yr	Enzyme assay
	2 mCi	Hershey Med. Center of Penn State Univ.	3 yr	Enzyme assay
^{32}P	2 mCi	Univ. of S. Dakota	1 yr	Enzyme assay
	1 mCi	Hershey Med. Center of Penn State Univ.	6 mo	Enzyme assay
^{125}I	2 mCi	Univ. of S. Dakota	6 mo	Radioimmunoassay
	2 mCi	Hershey Med. Center of Penn State Univ.	6 mo	Radioimmunoassay
^{35}S	10 mCi	Hershey Med. Center of Penn State Univ.	1 yr	Protein Synthesis Determination

PAUL R. ATKINSON

Data with respect to Training and Experience
(Reference: Items 16 & 17, Form NRC-313-1)

Paul R. Atkinson
Research Assistant

B.S.-Indiana University
Bloomington, IN

Item 16. Type of Training

	Where	Duration	On the Job	Formal Course
a) Principles of Radiation Protection	Indiana University, Bloomington	1 yr	yes	no
	International Minerals & Chemical Corp., Terre Haute, IN	3 yrs	yes	no
b) Radioactivity Measurement	I.U.	1 yr	yes	no
	IMC	3 yrs	yes	no
c) Mathematics and Calculations	I.U.	4 hrs	no	yes
	I.U.	1 yr	yes	no
	IMC	2 hrs	yes	no
d) Biological Effects of Radiation	IMC	2 hrs	yes	no

Item 17. Experience with Radiation

Isotope	Max. Amount	Where	Duration	Type of Use
^{32}P	10 mCi	Indiana University	1 yr	Labeling of Biological Material
^{3}H	25 mCi	IMC	6 mo.	Labeling of Biological Material
	0.1 mCi	Indiana University	6 mo.	Bio-Assay
^{125}I	10 mCi	IMC	3 yr	Lableing of Biological Material, Bio-Assay

CONTROL NO. 79964

SUSAN MEADE DRENGLER

Data with Respect to Training and Experience
(Reference: Items 16 & 17, Form NRC-313-1)

Susan Meade Drengler
Research Assistant

B.A.-Albion College, Albion, MI

Item 16. Type of Training

	Where	Duration	On the Job	Formal Course
a) Principles of Radiation Protection	Albion College	1/2 sem	no	yes
	Univ. of Illinois	5 years	yes	no
	EMT Training	2 days	no	yes
b) Radioactivity Measurement	Univ. of Illinois	5 years	yes	no
	IMC, Terre Haute	3 years	yes	no
c) Mathematics & Calculations	Univ. of Illinois	5 years	yes	no
	IMC, Terre Haute	3 years	yes	no
d) Biological Effects of Radiation	Albion College	1 sem	no	yes
	Univ. of Illinois	5 years	yes	no
	IMC, Terre Haute	3 years	yes	no
	EMT Training	2 days	no	yes

Item 17. Experience with Radiation

Isotope	Max. Amount	Where	Duration	Type of Use
^{3}H	0.1 mCi	Univ. of Illinois (Champaign)	5 yr	Membrane studies
	0.1 mCi	IMC, Terre Haute, IN	3 yr	Zeranol recovery
	0.1 mCi	IMC, Terre Haute, IN	3 yr	Zeranol metabolism
^{14}C	1 mCi	Univ. of Illinois	5 yr	Membrane studies
	250 mCi	Univ of Illinois	5 yr	Membrane studies
	0.1 mCi	IMC, Terre Haute	2 yr	Metabolism studies
^{125}I	5 mCi	IMC, Terre Haute	2 yr	Metabolism studies
	1 mCi	IMC, Terre Haute	1 yr	Radioimmuno assays

ALVIN M. JANSKI

Data with Respect to Training and Experience
(Reference: Items 16 & 17, Form NRC-313-1)

Alvin M. Janski
Manager, Biochemistry Research

B.A.-Chemistry, St. Cloud State University, St. Cloud, Minnesota
Ph.D.-Biochemistry, No. Dakota State Univeristy, Fargo, North Dakota

Item 16. Type of Training

	Where	Duration	On the Job	Formal Course
a) Radiochemistry Lecture (1969)	St. Cloud State Univ.	1 qtr	no	yes
b) Radiochemistry Laboratory (1969)	St. Cloud State Univ.	1 qtr	no	yes
c) Radiation Safety Course (1979)	NIH Bethesda, Md.	1 day	no	yes
d) Radioactivity Measurement and Calculations	North Dakota State	4 yr	yes	no
	Iowa State Univ.	3 yr	yes	no
	NIH, Bethesda, Md.	3 yr	yes	no
	IMC, Terre Haute, IN	3 1/2 yr	yes	no

Item 17. Experience with Radiation

Iostope	Max. Amount	Where	Duration	Type of Use
^{125}H	100 mCi	N. Dakota State Univ	4 yr	Nuclease Assay
	1 mCi	Iowa State Univ	3 yr	RIA's
	5 mCi	NIH	3 yr	Metabolite Assay
	1 mCi	IMC	3 1/2 yr	RIA's
^{14}C	100 mCi	N. Dakota State Univ	4 yr	Nuclease Assay
	100 mCi	Iowas State Univ	3 yr	Enzyme Assay
	250 mCi	NIH	3 yr	Metabolite Assay
	50 mCi	IMC	3 1/2 yr	Enzyme Assay
^{32}P	50 mCi	Iowa State Univ	3 yr	Protein Phosphorylate
	50 mCi	NIH	3 yr	Protein Phosphorylate
^{125}I	1 mCi	IMC	3 1/2 yr	Protein Iodination

B. Dan Burleigh

Data with Respect to Training and Experience
(Reference: Items 16 & 17, Form NRC-313-1)

B. Dan Burleigh
Senior Research Scientist

B. S. - Chemistry
Carnegie-Mellon Univ., 1964

M.S. - Biological Chemistry
Univ. of Michigan, 1967

Ph.D. - Biological Chemistry
Univ. of Michigan, 1970

Item 16: Type of Training

Type of Training	Where	Duration	On the Job	Formal Course
Graduate training; general biochemical use of radioisotopes	Univ. of Michigan, Ann Arbor, MI	4 yrs	yes	no
Graduate training; safe practices of radioisotope use	Univ. of Michigan, Ann Arbor, MI	4 yrs	yes	no
Graduate training; radioisotope calculations and experimental design	Univ. of Michigan, Ann Arbor, MI	4 yrs	yes	no
Safe use and monitoring of radioiodine	M.D. Anderson Hospital, Univ. of Texas System Cancer Center, Houston, TX	7 1/2 yrs	yes	short course and seminar workshops

Item 17: Experience with Radiation

Isotope	Max. Amount	Where	Duration	Type of Use
^{3}H	<10 mCi/yr	Univ. of Michigan Ann Arbor, MI	4 yrs	protein and metabolite labeling
	<50 mCi/yr	M. D. Anderson Hospital, Houston, TX	7 1/2 yrs	protein and metabolite labeling
	<50 mCi/yr	IMC R&D Terre Haute, Indiana	3 1/2 yrs	protein and metabolite labeling
^{14}C	<5 mCi/yr	Univ. of Michigan, Ann Arbor, MI	4 yrs	protein and metabolite labeling
	<20 mCi/yr	MRC lab of Mol. Biol. Cambridge, England	3 yrs	protein labeling
	<25 mCi/yr	M. D. Anderson Hospital Houston, TX	7 1/2 yrs	protein and metabolite labeling
	<10 mCi/yr	IMC R&D Terre Haute, Indiana	3 1/2 yrs	protein labeling, small molecular substrates
^{32}P	<5 mCi/yr	Univ. of Michigan, Ann Arbor, MI	4 yrs	metabolite studies
	<10 mCi/yr	MRC lab of Mol. Biol. Cambridge, England	3 yrs	nucleotides nucleic acids

Isotope	Max. Amount	Where	Duration	Type of Use
^{35}S	<500 mCi/yr	MRC lab of Mol. Biol. Cambridge, England	3 yrs	^{35}S-met labelled protein synthesis
^{125}I	<50 mCi/yr	M. D. Anderson Hospital Houston, TX	7 1/2 yrs	protein trace labeling
	<100 mCi/yr	IMC R&D Terre Haute, Indiana	3 1/2 yrs	protein trace labeling

ELLEN R. CLOUGH
Research Immunologist

B.S. Pomona College, Claremont, CA
Ph.D. Johns Hopkins U., Baltimore, Md

Item 16 Type of Training

a. Principles of Radiation Protection (No formal courses)

Johns Hopkins (JHU	On the job	1 yr
U. of Pennsylvania (UP)	"	3
Institute Pasteur, Paris (IP)	"	2

b,c,d) See a.

Item 17 Experience with Radiation

Nuclide	Max. Amount	Where	Duration	Type of Use
^{125}I	5 mCi	IP	2 yr	Labeling immuno globulin for use in RIA
^{125}I	1 mCi	UP	3	" "
^{3}H	1 mCi	IP	2	Proliferation assays
^{35}S	1 mCi	Up	2	Labeling cells
^{125}I	.5 mCi	JHU	1	RIA

ANTHONY F. ABRUZZINI
Research Scientist

B.A. The Johns Hopkins University
M.S.E. The Johns Hopkins University
Ph.D. University of Florida College of Medicine

Item 16 Type of Training

		Where	Duration	On The Job	Formal Course
a. Principles	1.	Johns Hopkins	3 years	Yes	No
	2.	U. Florida	4.5 years	Yes	No
	3.	Washington U.	4.5 years	Yes	Yes
b. Measurement	1.)			Yes	No
	2.)	As above	As above	Yes	No
	3.)			Yes	Yes
c. Math	Washington U.		As above	No	Yes
d. Bio Effects	1.)			No	No
	2.)	As above	As above	Yes	No
	3.)			Yes	Yes

Item 17. Experience with Radiation

Nuclide	Max. Amount	Where	Duration	Type of Use
^{3}H	10 m Ci	Washington U.	4.5 years	Biomedical research
^{14}C	5 m Ci	Johns Hopkins	1.0 years	"
^{125}I	5 m Ci	Washington U.	2.0 years	"
^{51}Cr	5 m Ci	Washington U.	1 year	"
^{137}Cs	-	Washington U.	3 years	Irradiation of biological matter

Washington University School of Medicine
RADIATION HAZARDS COMMITTEE

Safe Handling of Radioactive Isotopes
Certificate of Examination

This certifies that ANTHONY ABRUZZINI has successfully completed an examination to demonstrate a basic knowledge of the safety aspects of handling radioactive isotopes.

Certificate No. 1550

APRIL 8, 1980

C A Perez
CHAIRMAN, RADIATION HAZARDS COMMITTEE

John Eichling
SECRETARY, RADIATION HAZARDS COMMITTEE