

ATTACHMENT 3

BioSurface Technology, Inc.  
One Kendall Square  
Building 200  
Cambridge, MA 02139

(617) 494-8484  
FAX (617) 494-6561

**BIO SURFACE  
TECHNOLOGY**

22 February 1991

Mr. John White, Supervisor  
Licensing Materials Section  
Nuclear Materials Safety & Safeguards Branch  
U.S. Nuclear Regulatory Commission, Region I  
475 Aliendale Road  
King of Prussia, PA 19406

RE: License Number 20-28072-02

Dear Mr. White:

BioSurface Technology, Inc. (BTI) hereby requests a one time shipment authorization using the Type B packaging materials originally used to transport (import) the licensed material, a Cobalt-60 irradiator, to its current address. By amendment letter of 13 December 1991, BTI requested authorization to change its license address from One Kendall Square, Cambridge to 64 Sidney Street, Cambridge. This request is supplemental to that amendment. The expected time for this move is now predicted to be the end of May 1991. Originally, this move was scheduled for the end of March 1991. (The byproduct materials subject to license number 20-28072-01 are still scheduled for an end of March 1992 move and are the subject of a separate license amendment.)

Discussions with Kristen Smith, Research & Special Programs Administration, US DOT, (202-366-4491) and Charles MacDonald, US NRC, (301-492-3382) have confirmed the Type B packaging materials used in the initial shipment from NORDION (AECL) in Canada to the current address at One Kendall Square, Cambridge are not approved for domestic transport. The US DOT has revalidated Canadian Certificate CDN/2013.B(U) (USA/6125/B(U)) for import/export purposes. BTI knows of the availability of no other Type B packing suitable and available for this shipment. Therefore, it is this packaging that BTI requests authorization to use in a one-time shipment of the irradiator from One Kendall Square to 64 Sidney Street, Cambridge.

In support of the above petition, the following information is provided.

- A. BTI will transport the irradiator at time of low road usage; likely to be in the early morning hours of the day.
- B. Roads projected to be used during the transport are noted in Appendix 1. The route shown traverses a commercial/industrial area having little or no residential use.

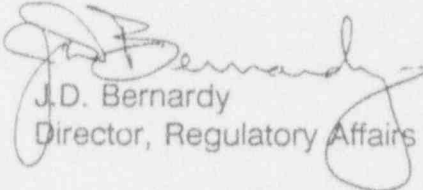
9404260271 940421  
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- C. The shipment will be accompanied by an escort knowledgeable in the use of radiation survey instrumentation from NORDION (AECL), the original vendor and shipper.
- D. The escort will be capable of establishing a radiation exclusion area if required.
- E. NORDION (AECL), in addition to providing escort services, will provide all written emergency procedures. A copy of their emergency response form is enclosed as Appendix 2.
- F. BTI will be responsible for rigging, shoring and shipping the irradiator in an exclusive use vehicle. NORDION will be responsible for verifying the Type B packaging integrity.
- G. City and state officials have been advised of expected shipment. When the exact date and time of shipment is determined, these officials will be notified of all particulars. See Appendix 3.

A portion of the Operations Manual including engineering drawings, and the US DOT and Canadian Atomic Energy Control Board certifications for the import/export packaging, are provided in Appendices 4 & 5.

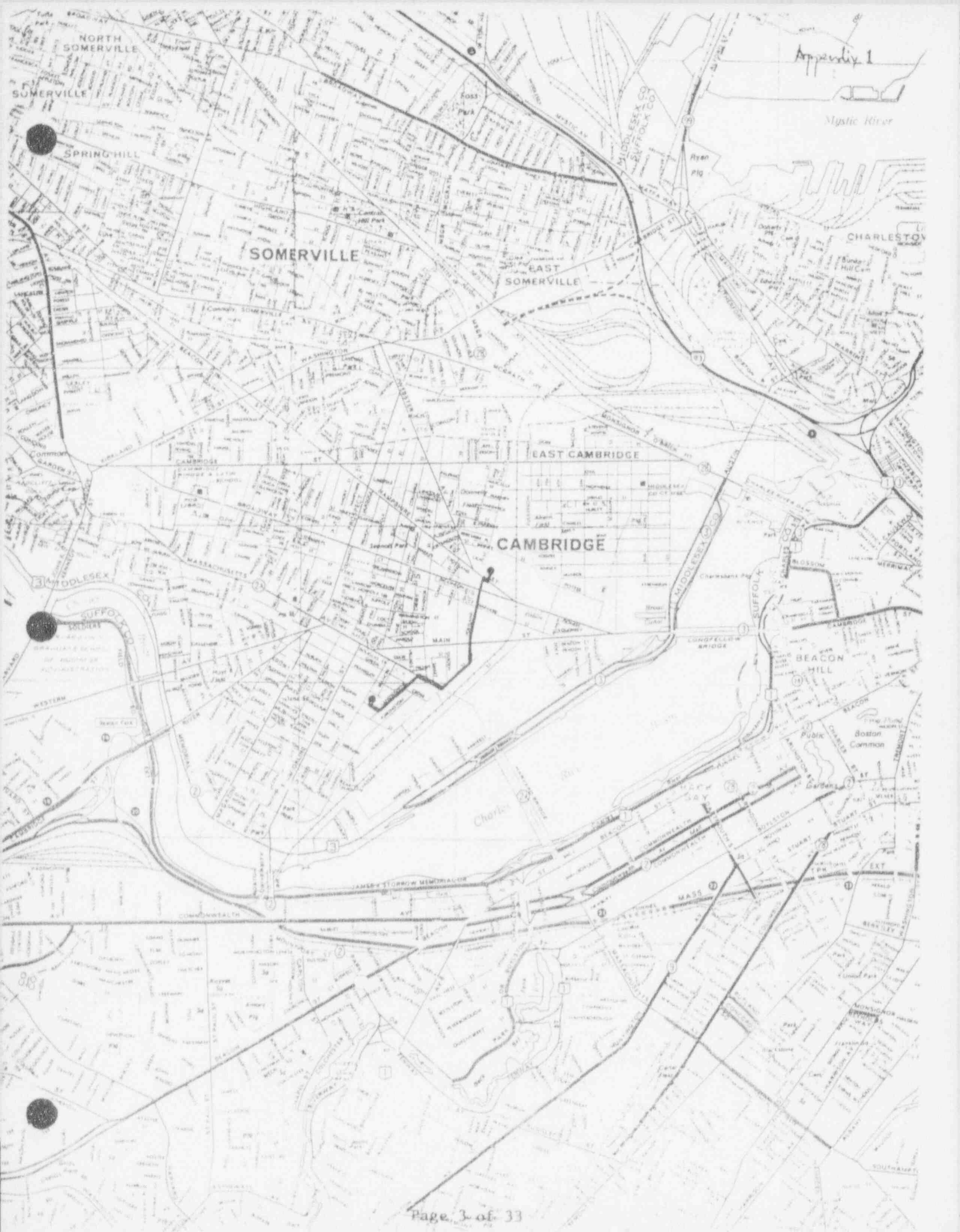
If there is any other information you require in processing this amendment, please contact me at the above address and phone number.

Sincerely,

  
J.D. Bernardy  
Director, Regulatory Affairs

JDB:ac

Encl: Amendment application (2 copies)



Appendix 1

Placard Notation: RADIOACTIVE

SHIP TO:	SHIPPER:
DATE:	ORDER NO.:
CLASSIFICATION: (7) RADIOACTIVE MATERIAL <input type="checkbox"/> Normal Form <input type="checkbox"/> Special Form	CAR NO.:
RADIONUCLIDE: _____	ROUTING:
CURIE CONTENT: _____	
LABEL: <input type="checkbox"/> RADIOACTIVE I (White) <input type="checkbox"/> RADIOACTIVE II (Yellow) <input type="checkbox"/> RADIOACTIVE III (Yellow)	
TRANSPORT INDEX: _____ <input type="checkbox"/> Type 'A' <input type="checkbox"/> Type 'B'	ORIGIN: Kanata, Ontario, Canada
MODEL: _____ SERIAL NO: _____	WEIGHT OR VOLUME: _____
AECB Certificate: CDN/ _____	USA Certificate: USA/ _____
RADIOACTIVE PLACARD IN CANADA: Placard road vehicles/rail cars when transporting Radioactive I (white) OR Radioactive II (yellow) OR Radioactive III (yellow) labelled packages. IN USA: Placard road vehicles/rail cars when transporting Radioactive III (yellow) labelled packages only.	SHIPPER'S CERTIFICATION This is to certify that the above named materials are properly classified, described, packaged, marked and labelled, and are in proper condition for transportation according to the applicable regulations of Transport Canada and the United States Department of Transportation.  SHIPPER'S SIGNATURE: _____

POTENTIAL HAZARDS

**HEALTH**      Radiation hazard may be internal due to breathing vapour or dust or contamination of skin, open cuts, etc. Radiation hazard may be external (like x-rays) from contamination on skin or exposure to unshielded material. Prolonged exposure may be a threat to health or life. Effects of radiation may be delayed.

EMERGENCY ACTION

Keep unnecessary people away. Keep upwind, isolate hazard area (at least 50 meters - 164 ft). Wear self-contained breathing apparatus and full protective clothing. Delay cleanup until arrival of qualified radiation monitoring assistance.

**FIRE**      Small fires: Dry Chemical or CO<sub>2</sub>  
 Large fires: Foam or water  
 Fight fire from maximum distance. Move undamaged packages from fire area if without risk. Do NOT move damaged packages.

**SPILL OR LEAK**      Do not touch spilled material or leaking or damaged packages.  
 Small Spills: Take up with sand, earth or other noncombustible absorbent material.  
 Large Spills: Dike for later decontamination and disposal. Do not enter the spill area unless absolutely necessary to save life. Limit entries to shortest possible time. Alternate persons for entry if possible.

**FIRST AID**      Call physician. Use standard first aid procedures. Remove contaminated clothing and shower with soap and water. Advise rescue personnel and physicians that person or equipment may be radioactively contaminated.

EMERGENCY - TELEPHONE

**IN CANADA:**      1. Local Police AND *NuMedics Inst. Inc*  
 2. Transport Canada (Canutec) (613) 996-6666 (24 hour)      *1-800-465-3666*

**IN U.S.A.:**      1. State Police AND Chemtrec (800) 424-9300 (toll free)  
 OR Coast Guard National Response Centre (800) 424-8802 (toll free)

**BIO SURFACE**  
**TECHNOLOGY**

20 February 1991

Capt. Joseph Grainger  
Cambridge Police Department  
5 Western Avenue  
Cambridge, MA 02139

Dear Captain Grainger:

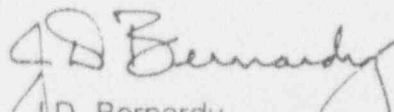
BioSurface Technology, Inc. is in the process of obtaining permission from the Nuclear Regulatory Commission to move a sealed source irradiator in its import/export certified Type B packing from our present address at One Kendall Square, Cambridge to our new facility at 64 Sidney Street, University Park (near Central Square), Cambridge. This irradiator is used in the manufacturing of cultured epidermis (skin).

We expect to make the move near the end of May 1991. The proposed route for an exclusive use truck shipment is marked on the attached map. It lies principally in a commercial/industrial area. The proposed move will be scheduled at a time of low road usage, likely in the early morning hours. A copy of the Type B(U) packaging certifications for import/export is also attached.

When the exact date and time of transport can be determined, we will again notify your office. Please advise us if there are any special permitting or transport requirements that we must satisfy with your office.

If you have any questions or require any further information, please contact me at the above address and phone number.

Sincerely,

  
J.D. Bernardy  
Director, Regulatory Affairs

JDB:ac

encl: 2 copies of letter with attachments

cc: Mr. L. Richard Adams, Department of Labor & Industries  
Deputy Chief William Cantwell, Cambridge Fire Department

**BIO SURFACE**  
**TECHNOLOGY**

20 February 1991

Deputy Chief William Cantwell  
Cambridge Fire Department  
491 Broadway  
Cambridge, MA 02138

Dear Deputy Chief Cantwell:

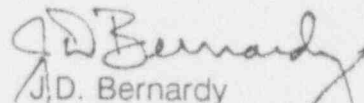
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Director, Regulatory Affairs

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cc: Mr. L. Richard Adams, Department of Labor & Industries  
Captain Joseph Grainger, Cambridge Police Department

**BIO SURFACE**  
**TECHNOLOGY**

20 February 1991

Mr. L. Richard Adams  
Radiation Control Program  
Division of Occupational Hygiene  
Department of Labor & Industries  
1001 Watertown Street  
West Newton, MA 02165

Dear Mr. Adams:

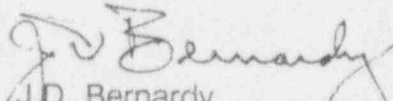
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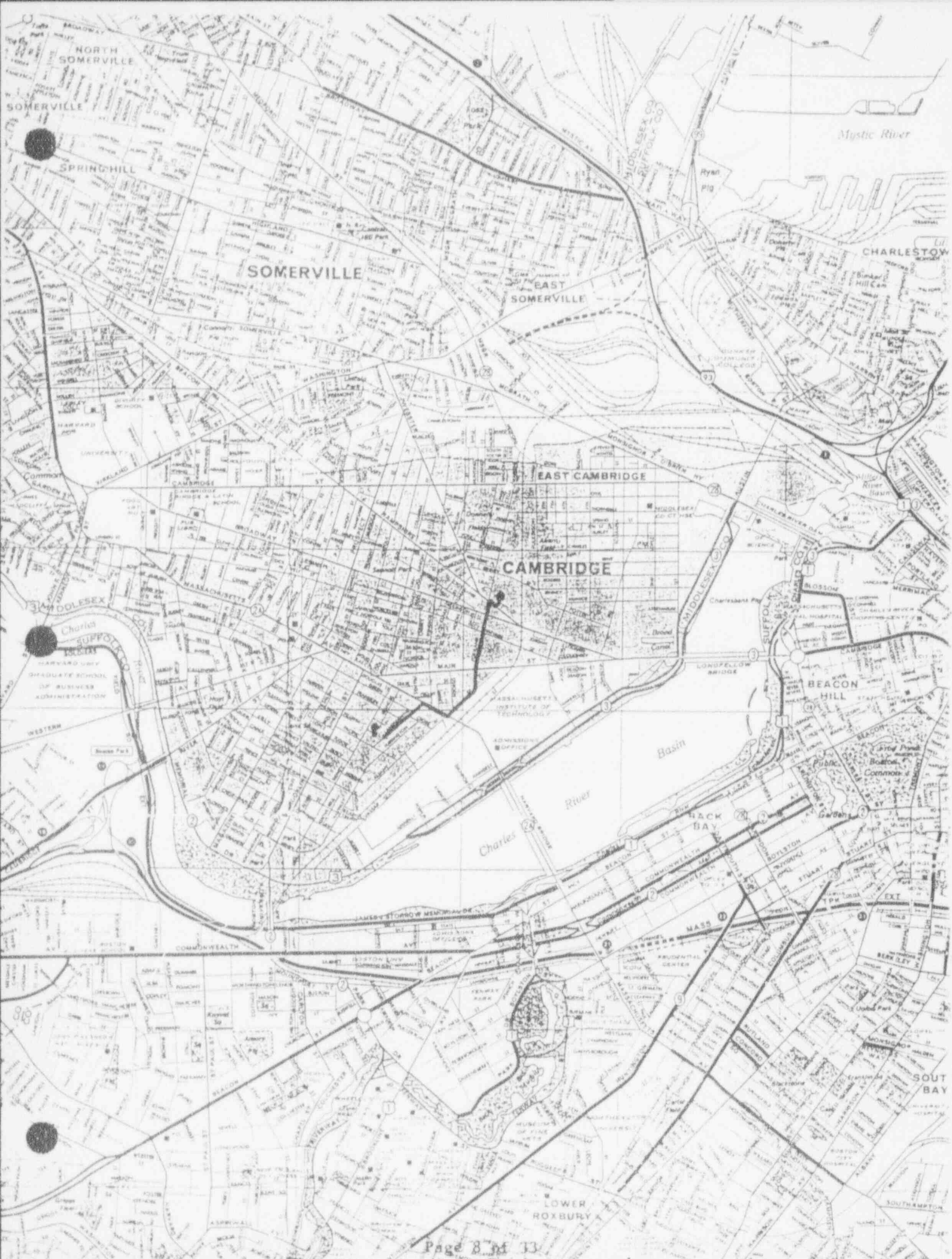
Sincerely,

  
J.D. Bernardy  
Director, Regulatory Affairs

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encl: 2 copies of letter with attachments

cc: Deputy Chief William Cantwell, Cambridge Fire Department  
Captain Joseph Grainger, Cambridge Police Department



SOMERVILLE

EAST SOMERVILLE

EAST CAMBRIDGE

CAMBRIDGE

CHARLESTOWN

Mystic River

Charles River

Basin

BACK BAY

BEACON HILL

SOUTH BAY

LOWER ROXBURY



PART 1  
DESCRIPTION

1.1 GENERAL

The Gammacell 220 is a Cobalt-60 irradiation facility manufactured by Atomic Energy of Canada Limited for use in an unshielded room. Fig. 1-1 illustrates the external features and Fig. 1-2 the general dimensions of the unit. Part 6 contains the accessories that are available for use with the Gammacell 220.

The unit basically consists of an annular source (see Fig. 1-3) permanently enclosed within a lead shield, a cylindrical drawer, and a drive mechanism to move the drawer up or down along the vertical source centre-line. The drawer has a chamber to carry samples to be irradiated from outside the shield to the source.

Samples up to approximately six inches in diameter and eight inches in height can be accommodated in the chamber. Liquid, gaseous, electrical or mechanical connections can be introduced into the sample chamber through an access tube in the upper portion of the drawer. An electrically powered digital timer automatically signals the drawer to raise at the termination of a sample irradiation. Times may be preset between 1 and 9999 seconds or minutes. Manual operation is also provided for.

1.2 ELECTRICAL

The Gammacell 220 operates on a 200V, 3 phase, 50/60 Hz, 15A supply. The supply is connected through a starter to a 1/2-hp drive motor. A step-down transformer connected across one phase of the supply provides the 115V, 3A control circuit.

1.3 WEIGHT

Crated        8,500 lb (3856 kg)  
Uncrated     8,300 lb (3765 kg)

1.4 HEAD (see Fig. 1-1)

The head (see Fig. 1-1) serves as a cylindrical shield for the source and as a guide for the moving drawer. It consists of a leak-proof shaped steel cylinder which contains approximately six thousand pounds of lead to provide ten-inch thick shielding. A stepped, circular hole running vertically through the centre of the head locates the inner head plug, the source cage assembly and the moving drawer.

1.5 COLLAR (see Fig. 1-4)

Mounted on top of the head is a 6-1/2 inch (16.51 cm) deep lead filled annular steel collar. The collar provides shielding for the transient beam occurring when the relatively unshielded volume of the sample chamber moves through the inner plug. The rear, semi-circular portion of the collar is attached to the head. The front portion opens as two doors, each hinged to the rear portion of collar. Pressure on a lever behind the handle on the right door raises a latch and permits the overlapping doors to be opened. The doors can be opened only when the drawer is raised, when access is required to the sample chamber.

1.6 INNER HEAD PLUG (see Fig. 1-2)

The inner head plug is a lead-filled stainless-steel cylinder which fits into the head above the source cage. It forms part of the shielding and also houses the upper drawer guides. The plug must not be removed except for source changing procedures supervised by AECL staff in a hot cell.

1.7 SOURCE CAGE ASSEMBLY (see Fig. 1-3)

The source cage is located in the centre of the head directly beneath the inner head plug. The stainless-steel cage contains forty-eight pencil positions. The source cage contains a minimum of eight double-sealed source pencils, each 8.31 in. (21.11 cm) long, set in an annular formation on an 8.32 in. (21.13 cm) pitch circle diameter (see Fig. 1-3). Each tubular pencil contains seven Cobalt-60 slugs completely sealed in by welded end caps.

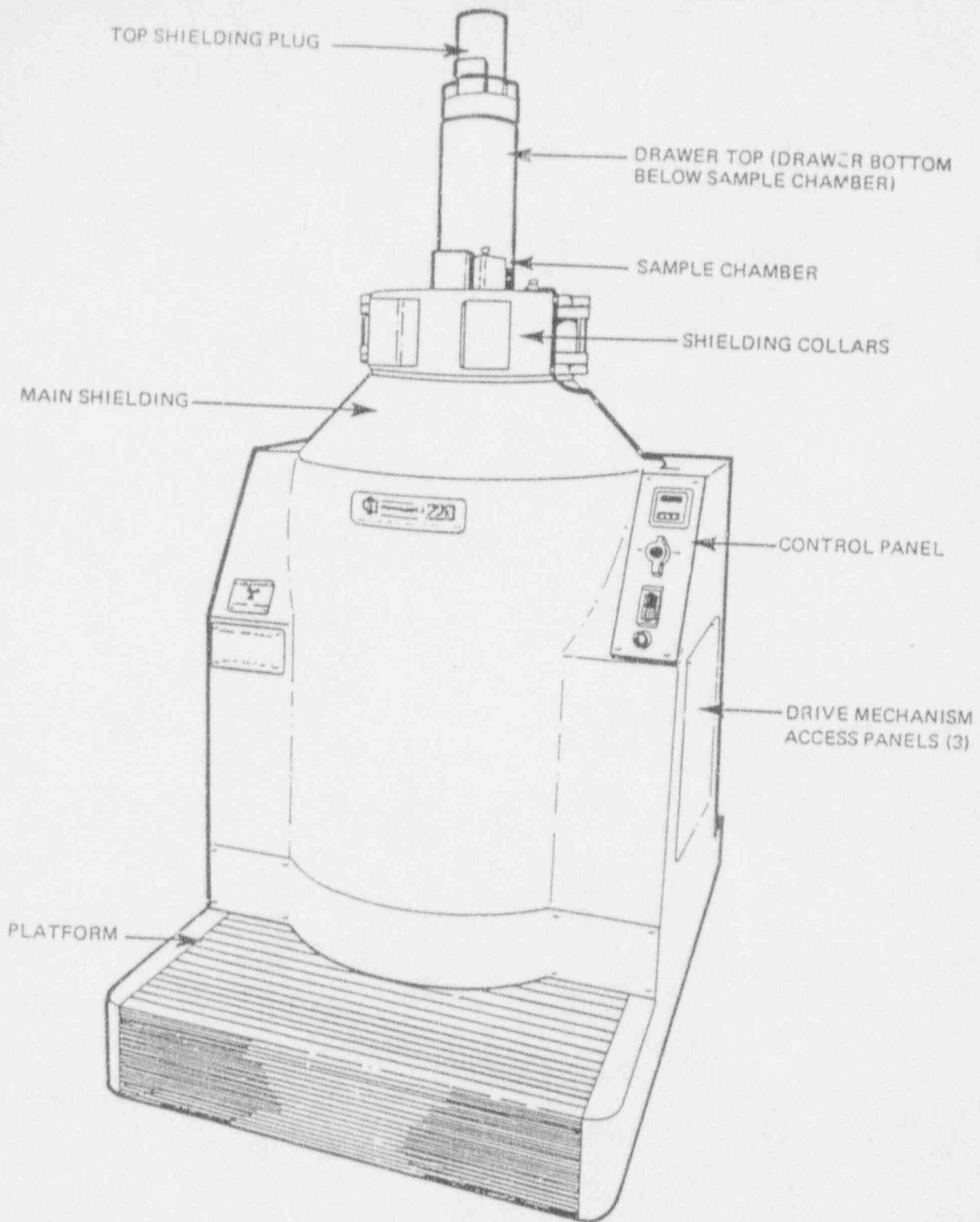


Fig. 1-1. Overall View of Gammacell 220

GC-220

1-3

NOV/84

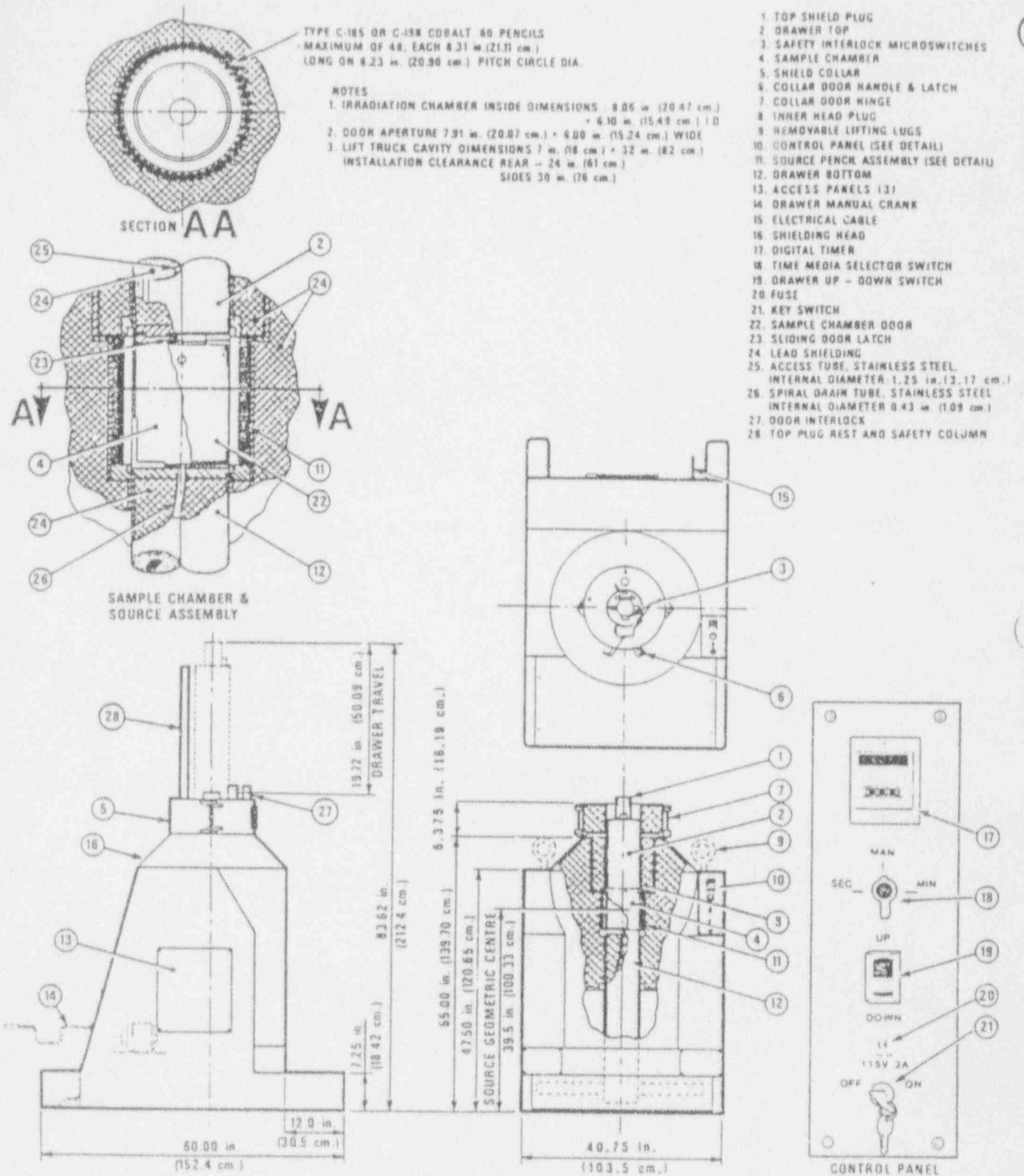


Fig. 1-2. General Dimensions

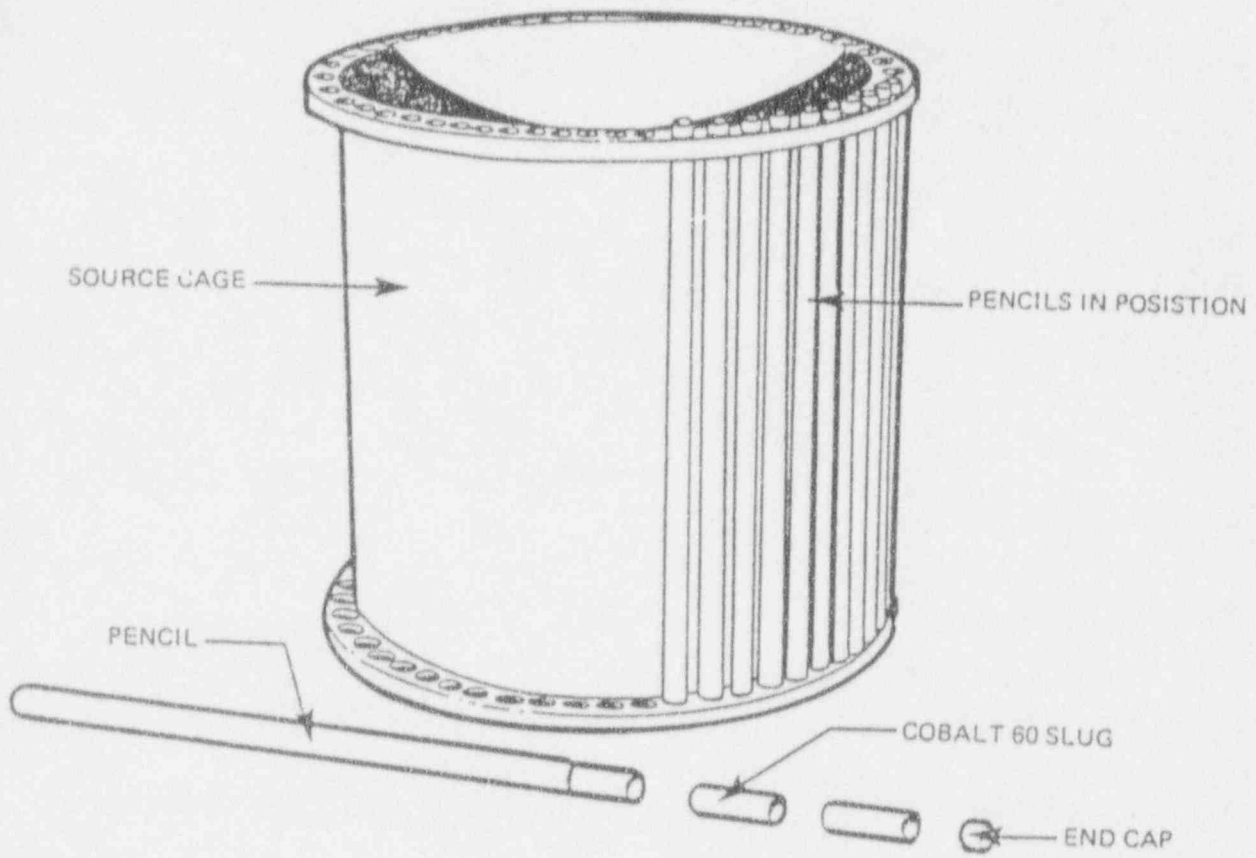


Fig. 1-3. Source Pencils and Cage

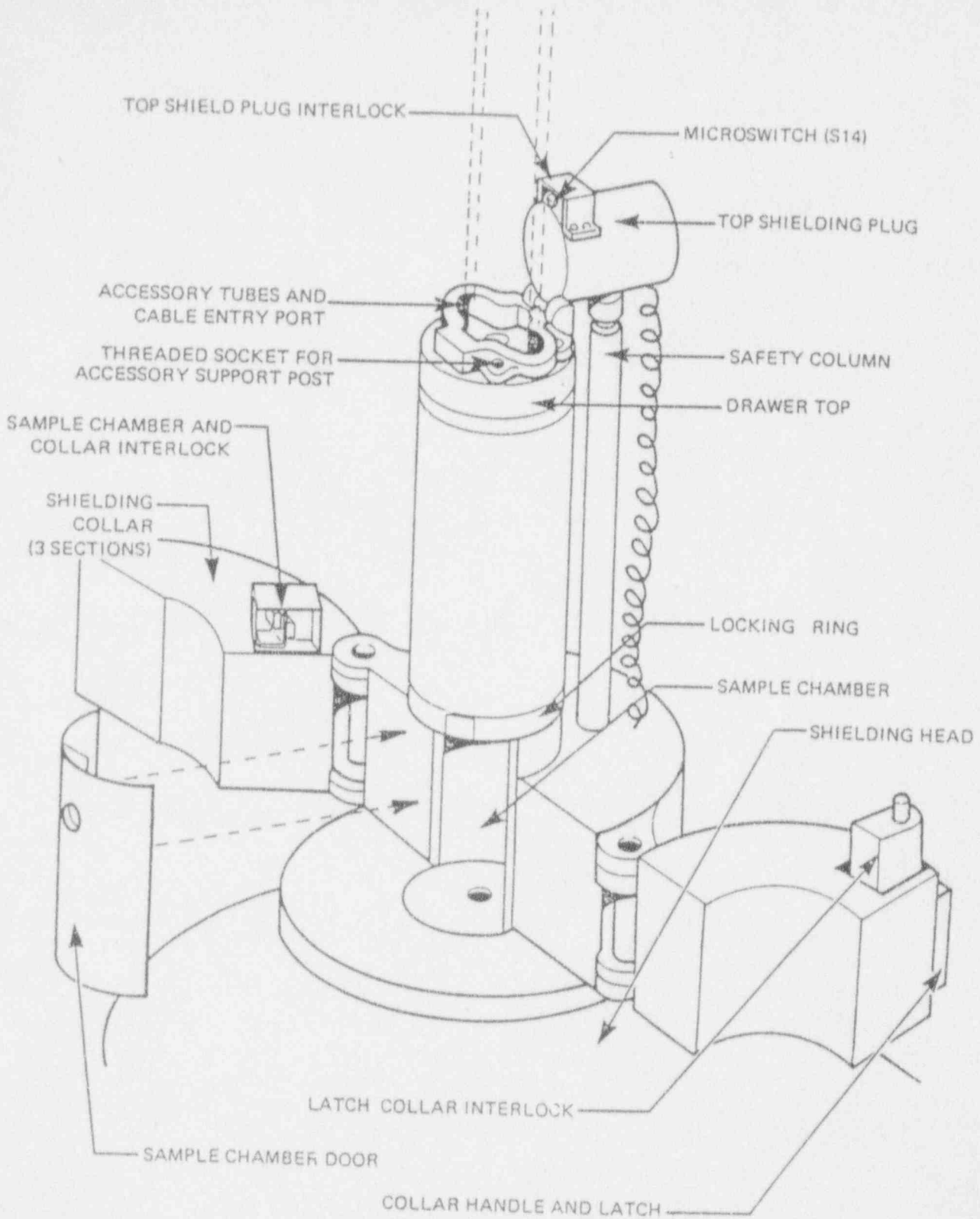


Fig. 1-4. Collar and Sample Chamber

1.8 DRAWER ASSEMBLY (see Fig. 1-2)

The drawer moves vertically through the centre of the head, inner plug and source cage assembly. It is 59.0 in. (149.86 cm) long and 6-1/2 in. (16.51 cm) in diameter, and is constructed from four distinct components; the top shielding plug, the drawer top, the sample chamber and the drawer bottom. The top shielding plug is hinged to the drawer top. The other three components are spigotted together and secured with screws. The drawer is guided in the head and inner head plug by four bronze bearings.

1.9 TOP SHIELDING PLUG (see Fig. 1-5)

The lead-filled closed steel cylindrical plug is 4 in. (10.16 cm) in diameter and 5-1/4 in. (13.34 cm) long. It is hinged to a steel casting on the drawer top and provides a radiation shield over the drawer top access tube. When the drawer is raised, the top plug may be tilted back to permit the introduction of accessories into the sample chamber (see Fig. 1-5). Electrical interlocks prevent the drawer being lowered with the plug in the open position. During a sample irradiation procedure the plug cannot be opened.

1.10 DRAWER TOP (see Fig. 1-4)

The 6-1/2 in. (16.51 cm) diameter, 14-3/8 in. (36.51 cm) long closed stainless-steel cylinder has a 1-1/4 in. (3.17 cm) inside diameter access tube through its centre. The space between the stainless-steel outer casing and the stainless-steel access tube is filled with lead. Welded to the drawer top is a steel casting onto which the top shielding plug is hinged. The casting is shaped to provide indirect entry to the access tube; it also provides two sockets tapped 1/2 - 20 UNF - 2B, 3/4 in. (1.91 cm) deep to accommodate accessory mounting posts. The access tube is designed to accept the tube insert accessory assembly.

1.11 SAMPLE CHAMBER (see Fig. 1-4)

The chamber is a thin wall closed, non-corrosive metal cylinder with a lift out full width door. The inside dimensions of the chamber are 6.10 in. (15.49 cm) diameter and 8.06 in.

(20.47 cm) high. The access port is 7.91 in. (20.07 cm) high and 6.00 in. (15.24 cm) wide. A step on the bottom of the door and a locking ring at the top of the chamber retain the door in place, see Fig. 1-4. An opening is provided in the top and bottom of the chamber for the access and drain tubes. Electrical interlocks prevent drawer movement when the door or door latch is improperly closed.

#### 1.12 DRAWER BOTTOM (see Fig. 1-2)

The drawer bottom is formed from a 6.5 in. (16.51 cm) diameter, 30.5 in. (77.47 cm) long stainless-steel tube, lead-filled, and closed at both ends. A spiral stainless-steel drain tube, 7/16 in. (1.11 cm) internal diameter, runs the length of the drawer bottom to facilitate drainage of liquid spills in the sample chamber. The drawer bottom is sufficiently long to provide irradiation shielding beneath the unit when the drawer is up.

A rectangular bracket on the base of the drawer provides a pin joint connection to the drive mechanism.

#### 1.13 DRIVE MECHANISM (see Fig. 1-6)

The drawer assembly is raised or lowered by a chain and sprocket system. The system motive power is provided by a 1/2 hp, 220V, 3 phase motor; the output speed of which is reduced initially through a V-belt and pulley connection to a worm and gear reducer. Further speed reduction is obtained through a chain and sprocket drive to a shaft. A sprocket at each end of the shaft transmits the shaft rotation to the smaller of double-head sprockets mounted each side of the head base. The head sprockets rotate less than one revolution each complete up or down movement of the drawer. Two roller chains are pinned at one end to each of the larger of the double-head sprockets and at the other end to each end of a full width lift-bar. The lift-bar is pin jointed to a bracket on the bottom of the drawer. With the partial rotation of the head sprockets on upward drawer movement the lift chains wrap around the sprockets and raise the lift-bar.



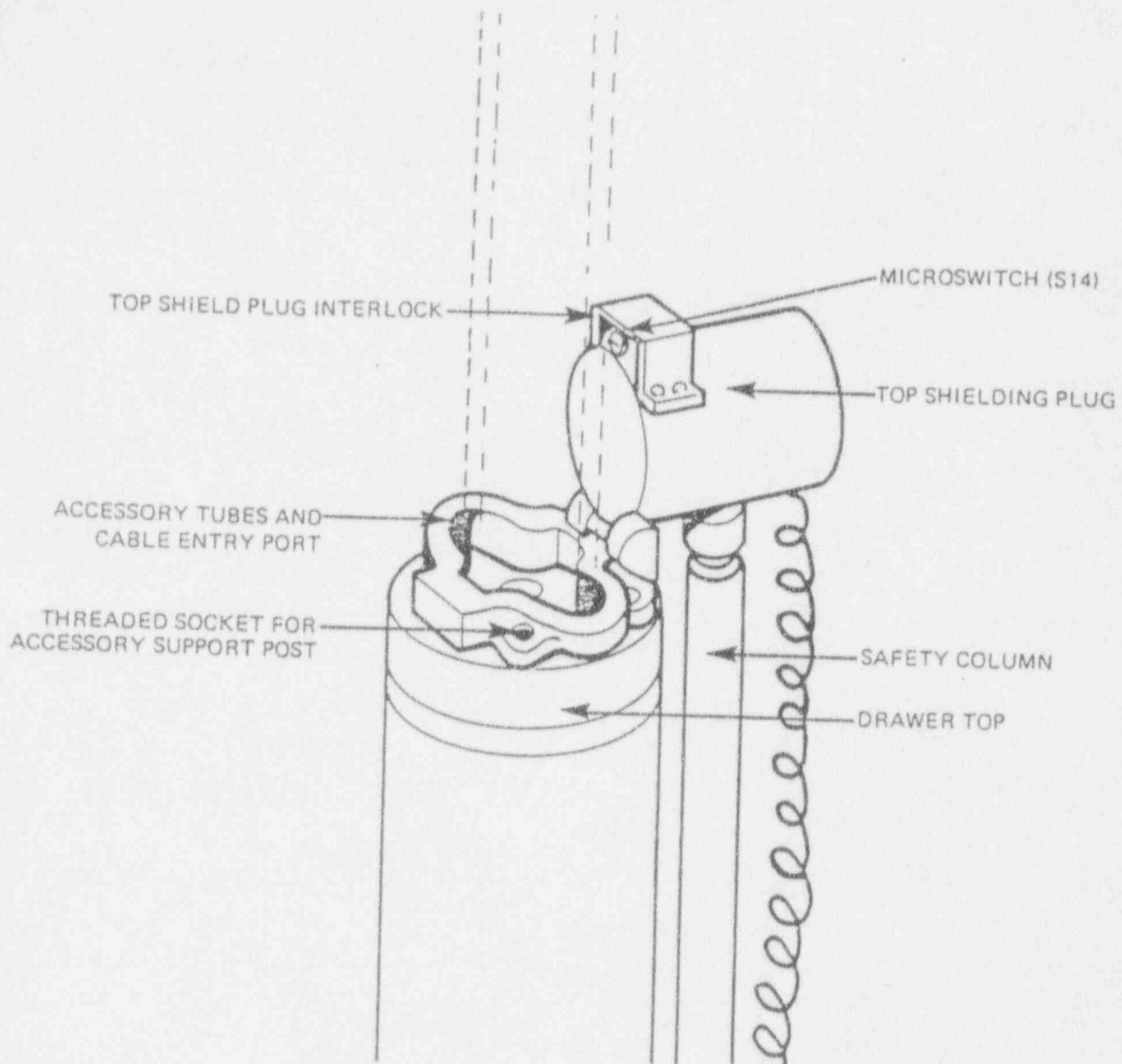


Fig. 1-5. Top Shielding Plug

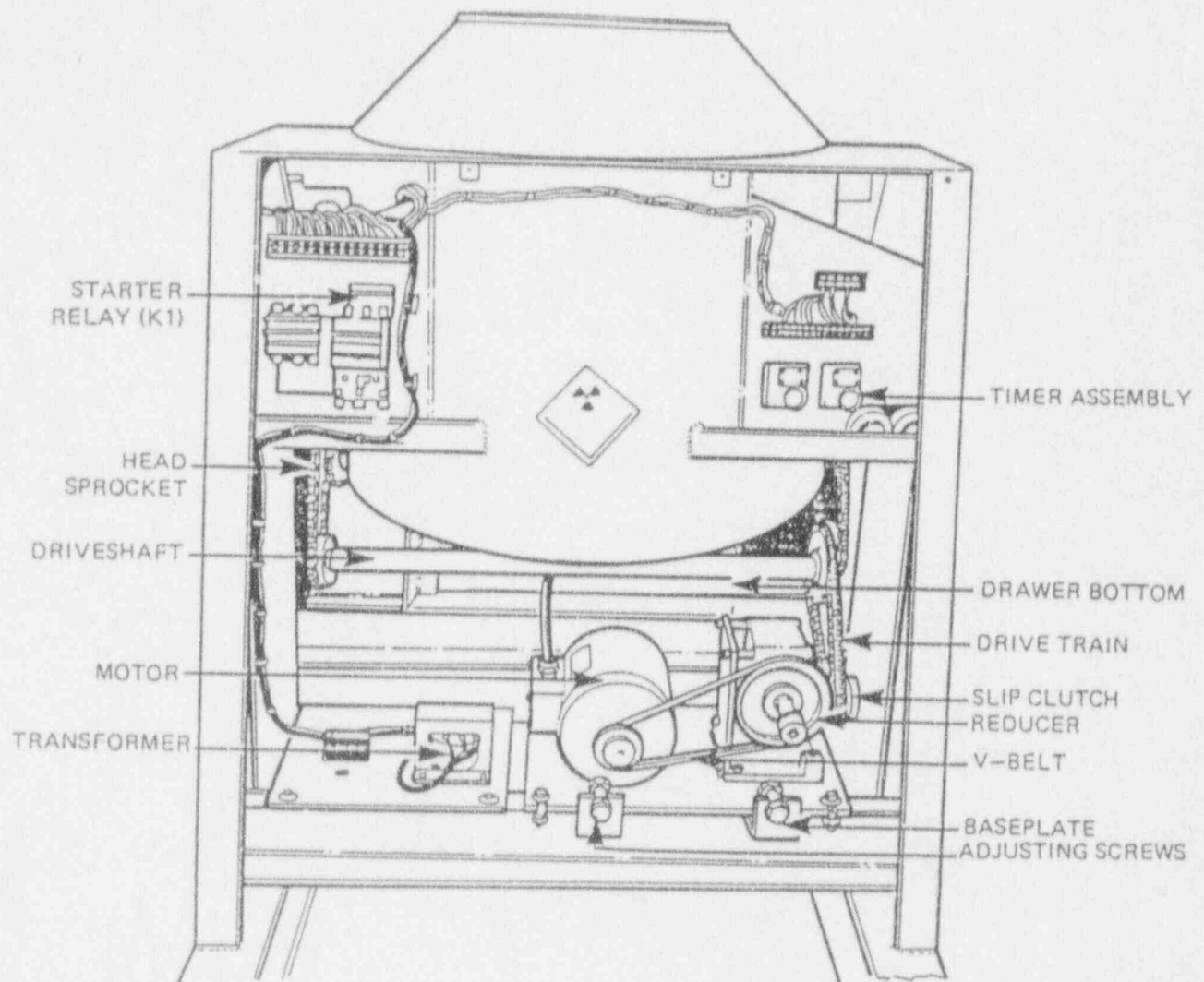


Fig. 1-6. Rear of Unit

#### 1.14 DRAWER MOVEMENT (see Fig. 1-7)

Drawer movement is electrically governed from the control panel. Microswitches mounted on the head sprockets are cam actuated at the end of drawer travel, disconnecting the electrical supply to the motor (see Fig. 1-7). The drawer travels 19.72 in. (50.02 cm) in approximately seven seconds. Microswitches S10 and S15 provide a back-up to these cam-operated microswitches.

Mechanical stops are provided at the limits of the drawer movement. The upper stop is formed from an adjustable bolt, mounted on the underside of the shield head, which stops against a nylon pad inserted in the top side of the lift-bar. The lower stop is formed from a nylon-tipped adjustable bolt, mounted on a fixed bracket (see Fig. 1-7), which stops against the underside of the drawer when it reaches the lowest point of its movement.

A hand crank is provided to enable the drawer to be operated manually in the event of a power supply failure. Hand crank operation is made easier if the V-belt is removed from the drive as the motor is equipped with a brake.

#### 1.15 CONTROL PANEL (see Fig. 1-8)

The unit controls are grouped on one panel situated at the top right of the head, as illustrated in Fig. 1-1. From the top of the panel the controls are:

- (1) Digital timer - to provide irradiation time settings between 1 and 9999 seconds or minutes. A reset button returns the timer to its original setting. The time setting is changed by holding in the reset button and pressing the individual digit buttons as required. The timer commences operation when the drawer reaches the irradiation position.
- (2) Selector switch - to provide for manual operation or selection of time settings in seconds or minutes.
- (3) Movement switch - to select up or down drawer movement.
- (4) Keyswitch - to control the electrical supply to the unit control circuit.

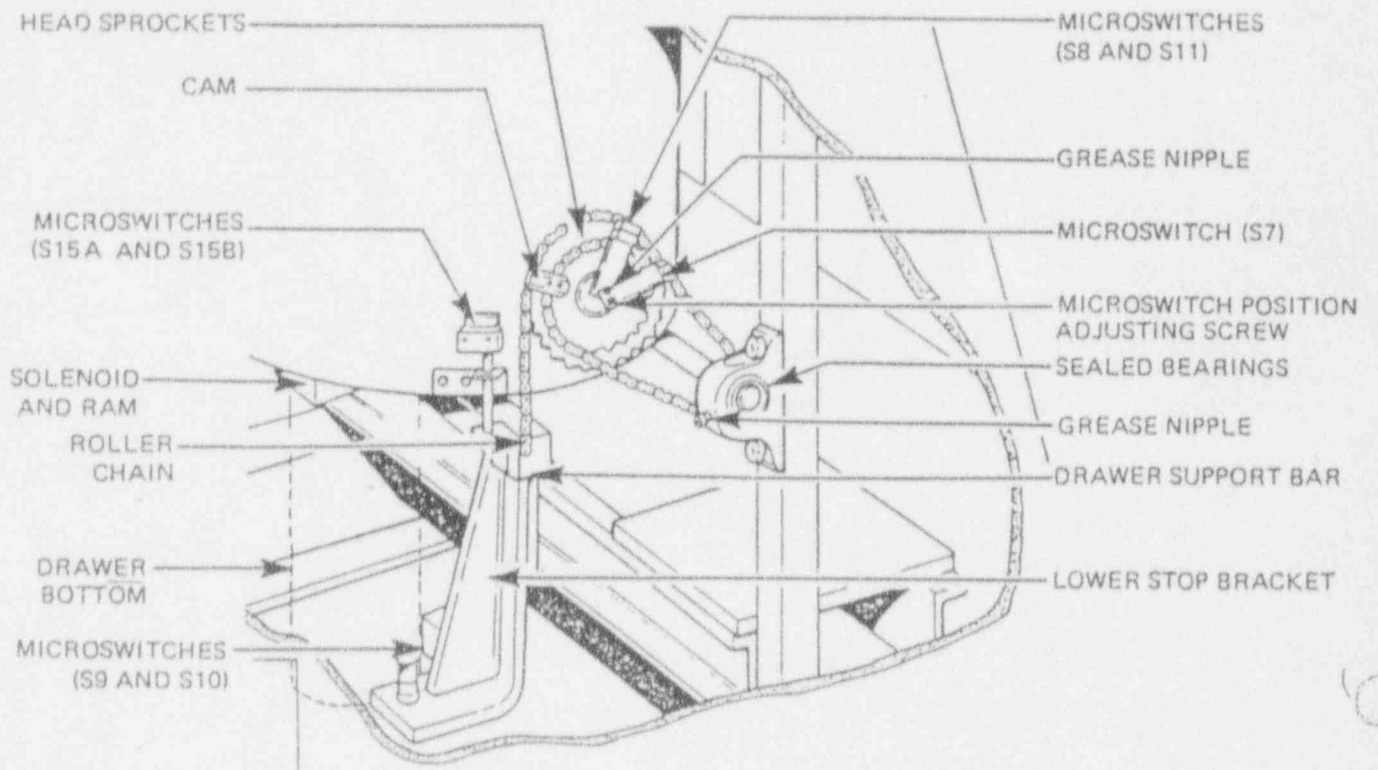


Fig. 1-7. Drive Mechanism

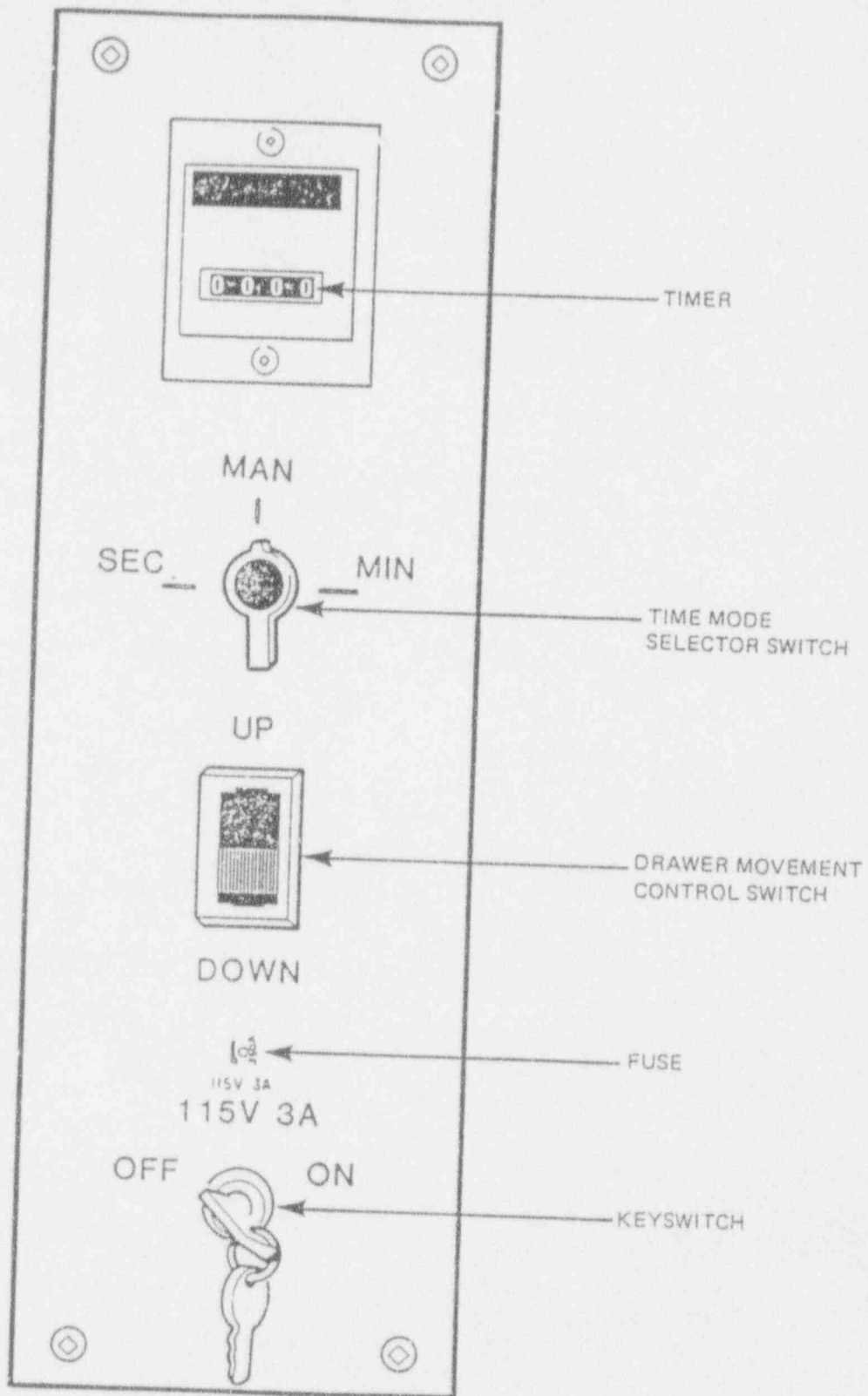


Fig. 1-8. Control Panel

## 1.16 SAFETY FEATURES

For the protection of the operator several safety features have been incorporated in the unit.

Three microswitches are mounted on the collar door (Fig. 3-1) to ensure that:

- (a) the sample chamber door is properly located.
- (b) the locking ring is in position.
- (c) both collar doors are closed.

A fourth microswitch is located on the top shielding plug to ensure that the plug is closed. Unless all four microswitches are actuated, the drive motor will not start.

The self-locking feature of the worm gear reducer prevents the drawer moving down under its own weight from rest.

A solenoid-operated bar, mounted on the underside of the head, actuates when the drawer stops in the raised position. The bar locates under the drawer bottom and prevents the drawer moving down in the event of a drive system mechanical failure.

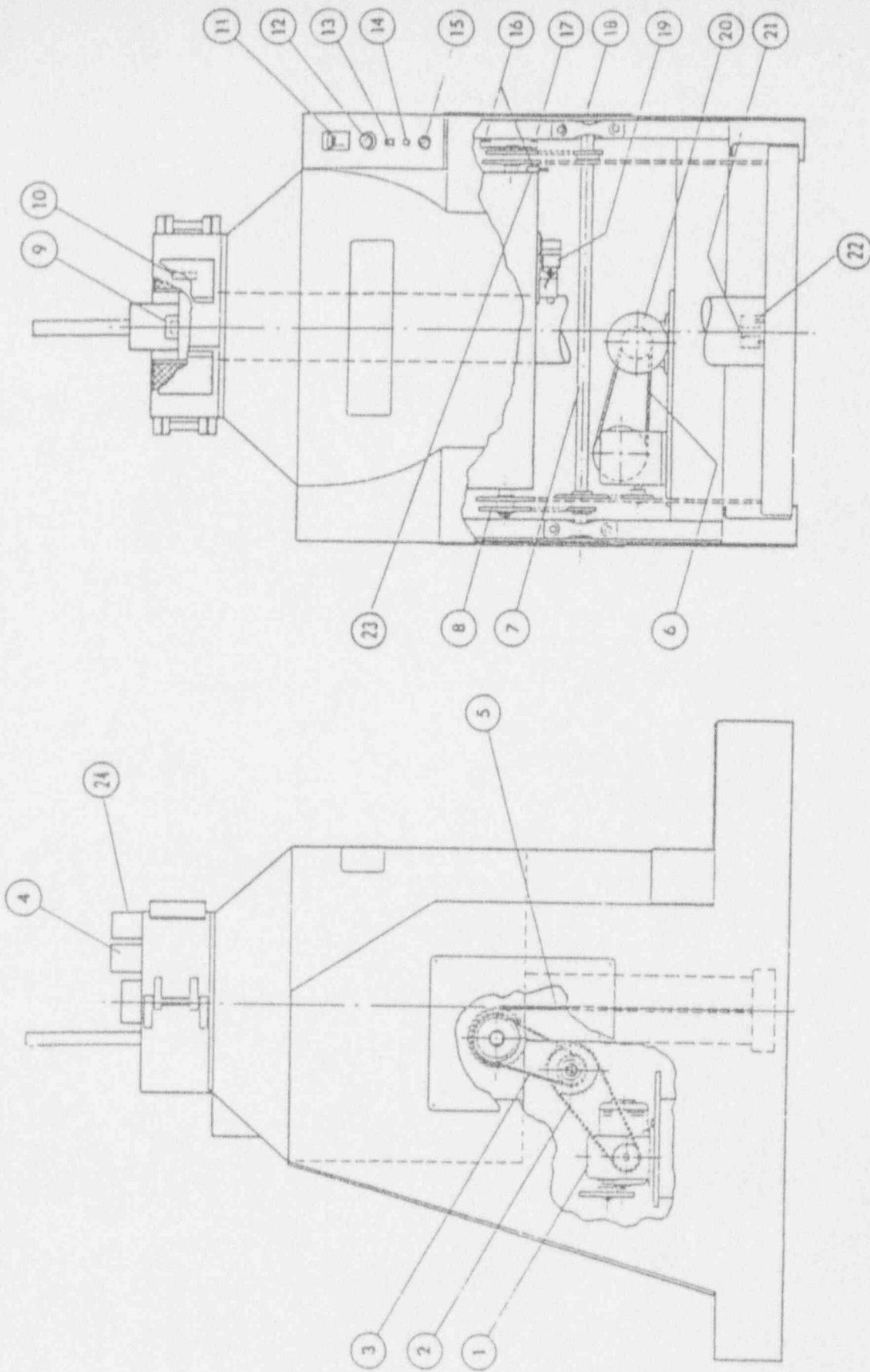
Drawer movement can be arrested by switching off the electrical supply keyswitch.

A solenoid-operated door interlock ensures that the collar doors can only be opened with the drawer in the fully up position.

The top plug rest and safety column ensures that the top plug can only be opened with the drawer in the fully up position.

Table 4-1. Component Locations

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1.	Worm Gear Reducer	13.	Rocker Switch - S2
2.	Reducer Output Chain	14.	3-amp Fuse - F1
3.	Head Sprocket Chain	15.	Keyswitch - S1
4.	Collar Microswitches - S4, S5, S6	16.	Up Coasting Microswitches - S8, S11, S15A
5.	Roller Chain	17.	Down Coasting Microswitches - S7
6.	V-Belt	18.	Sealed Bearing
7.	Shaft	19.	Solenoid and Ram - L1
8.	Head Sprocket	20.	Drive Motor - M1
9.	Shielding Plug Microswitch - S14	21.	Digital Timer Microswitch - S9
10.	Door Latch	22.	Bottom Stop Microswitches - S10
11.	Digital Timer	23.	Door Interlock Microswitch - S15B
12.	Rotary Selector Switch - S3	24.	Door Interlock



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Fig. 4-1. Component Location

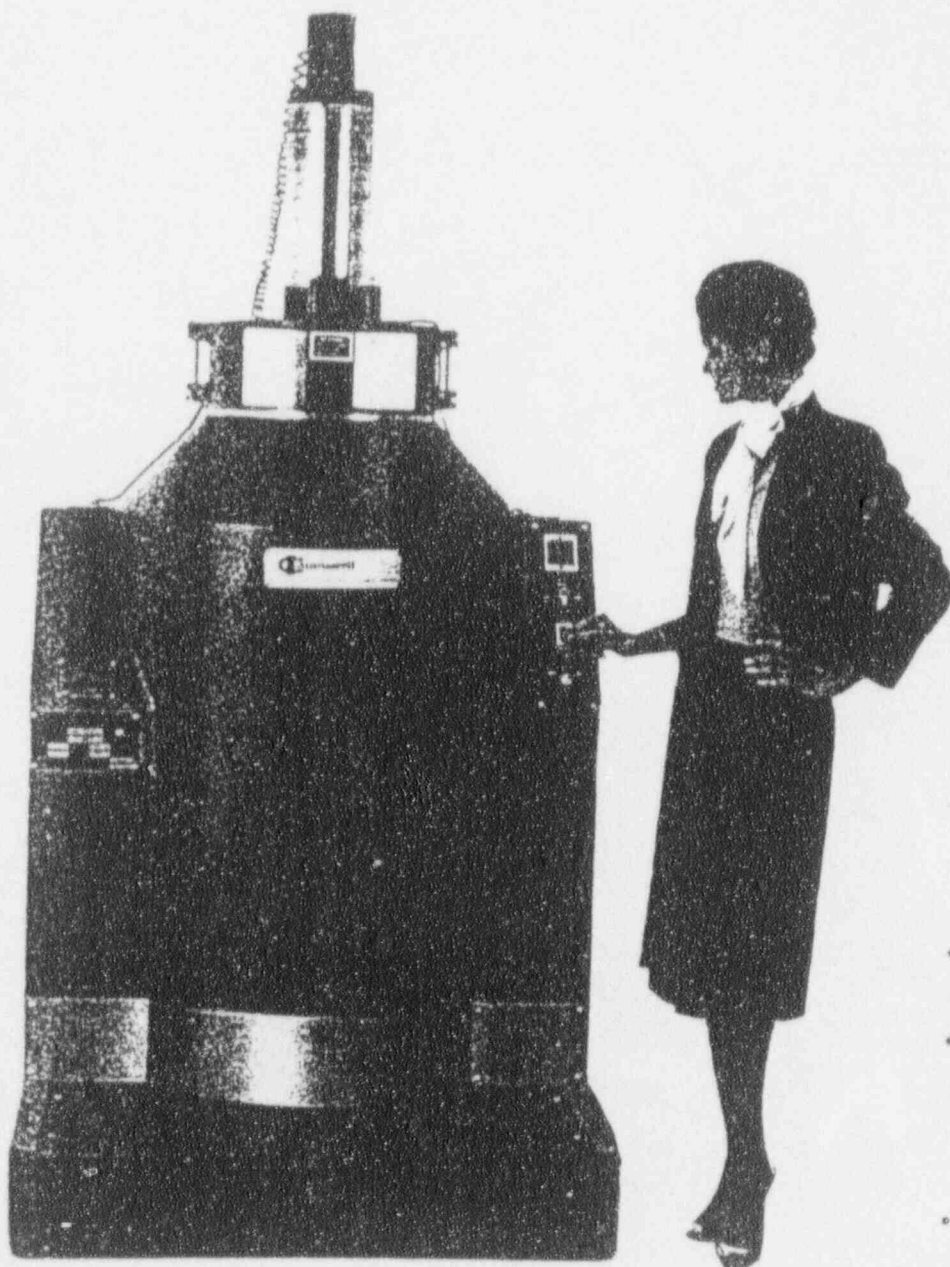




# AECL *Industrial Irradiators*

## Gammacell 220

### *High Dose Rate Research Irradiator*



THE GAMMACELL 220 is the most popular of the AECL line of high dose rate research irradiators. Over 200 have been installed in laboratories throughout the world. They are being used in a wide range of studies in the fields of medical product sterilization, biological and genetic effects, food preservation, growth stimulation, chemistry, pollution, radiation effects on materials, sterile male technique for insect control, and the irradiation of semi-conductors.

#### Features of the Gammacell 220

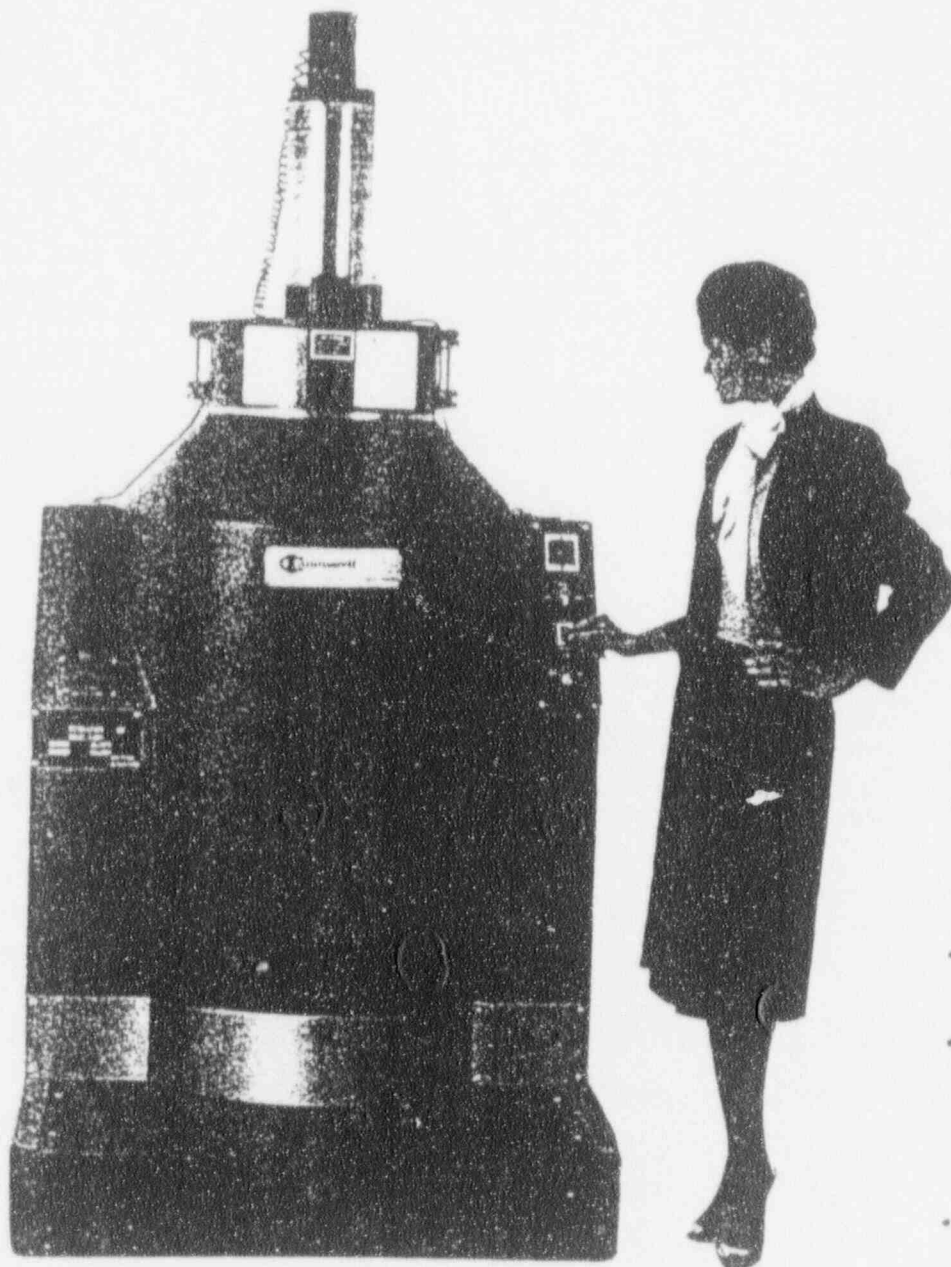
- **Self shielded** — can be placed right in the laboratory. No further shielding is necessary.
- **High dose rate** — up to  $2.0 \times 10^6$  Roentgens/hour when loaded with 24,000 curies of Cobalt 60. Dose rate and loading can be suited to customer requirements.
- **Safe** — source permanently fixed in shielded body. No possible malfunction can expose the operator to the source.
- **Simple to operate** — no special training required.
- **Reliable** — simplicity of design combined with AECL's long experience in irradiator design and construction assure years of trouble-free operation.
- **Large radiation chamber** — 15.2 cm (6.0 in) diameter x 20.6 cm (8.12 in) high. Volume: 3738 cm<sup>3</sup> (228 in<sup>3</sup>). The chamber is located in a vertical drawer which automatically positions the chamber in the centre of the radiation field.



# AECL Industrial Irradiators

## Gammacell 220

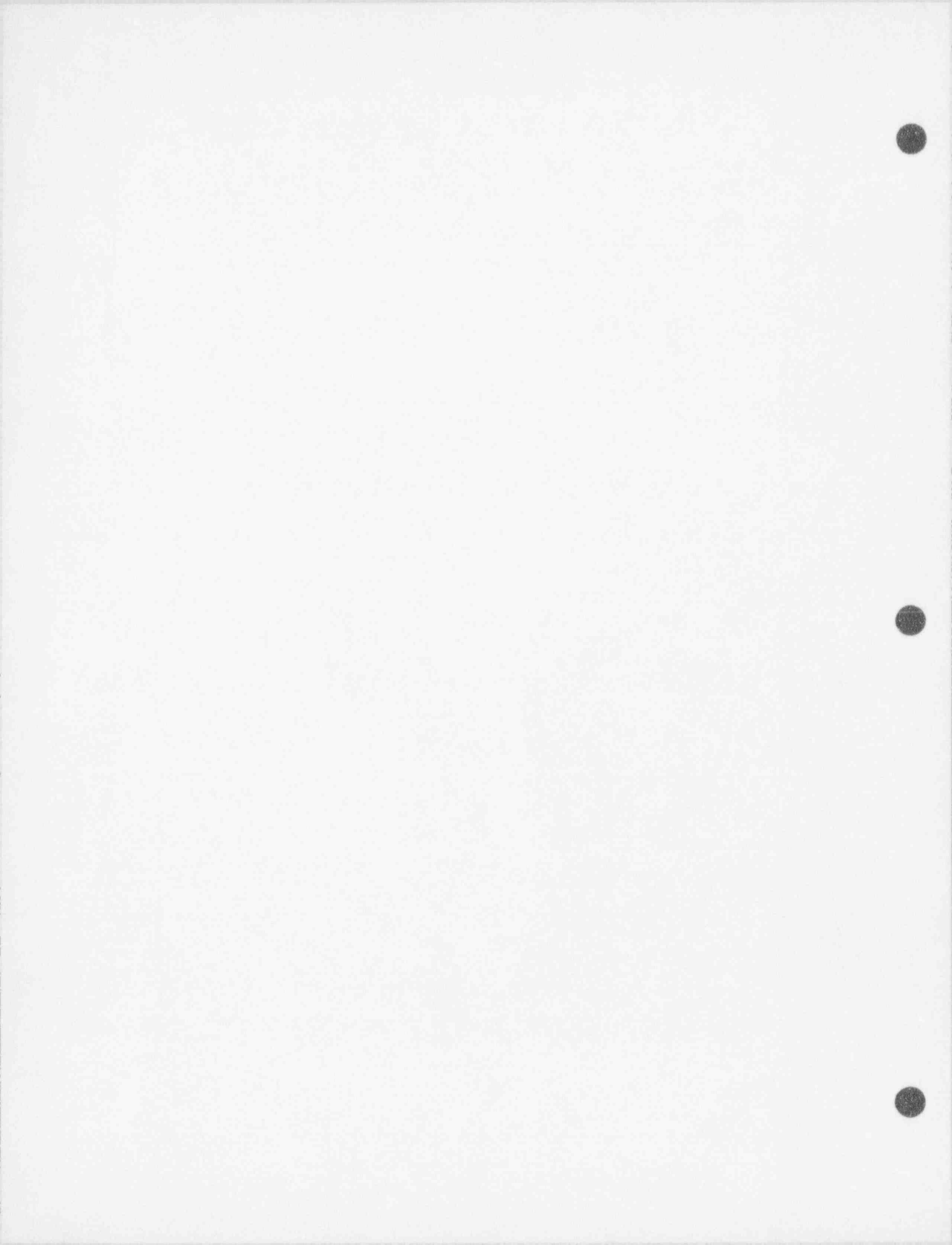
### High Dose Rate Research Irradiator

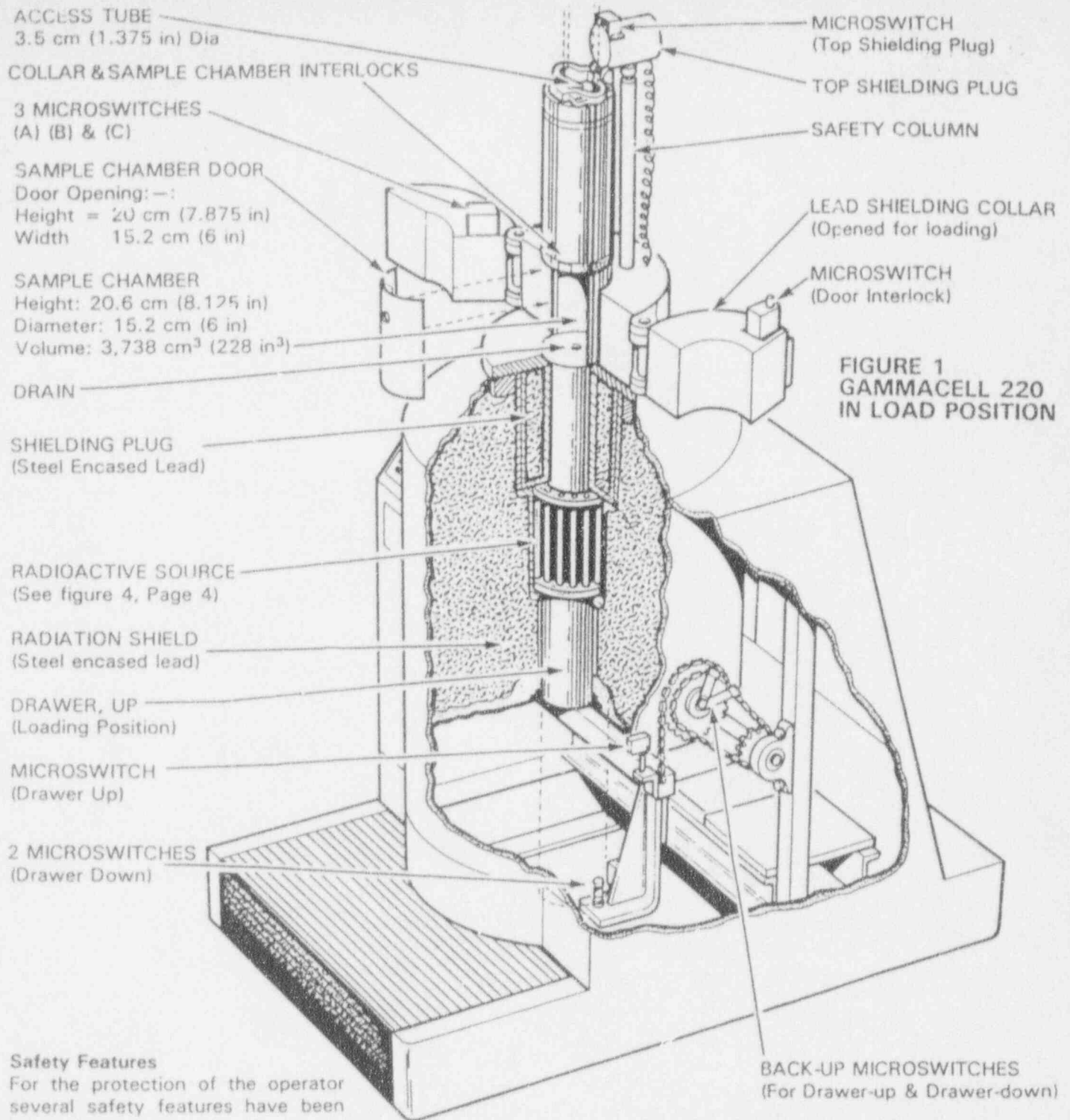


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**FIGURE 1  
GAMMACELL 220  
IN LOAD POSITION**

**Safety Features**

For the protection of the operator several safety features have been incorporated in the unit.

Three microswitches are mounted on the collar door to ensure that:

- A) the sample chamber door is properly located.
- B) the locking ring is in position.
- C) both collar doors are closed.

A fourth microswitch is located on the top shielding plug to ensure that the plug is closed. Unless all four microswitches are actuated the drive motor will not start.

A solenoid operated ram, mounted on the underside of the head, actuates when the drawer stops in the raised position. In this position the ram prevents the drawer from falling should any part of the drive mechanism fail.

A solenoid operated door interlock ensures the collar doors can only be opened with the drawer in the safe position.

Top plug rest and safety column ensure the top plug can only be opened with the drawer in the full up position.

## WEIGHTS & DIMENSIONS

Dimensions	Centimeters	Inches
Overall Width	103.5	40.75
Overall Length	152.4	60.0
Overall Height (drawer up)	212.4	83.6
Overall Height (drawer down)	157.8	62.2
Weight	4,005 kg	(8,830 lb)
Floor Loading	2,584 kg/m <sup>3</sup>	(519 lb/ft <sup>2</sup> )

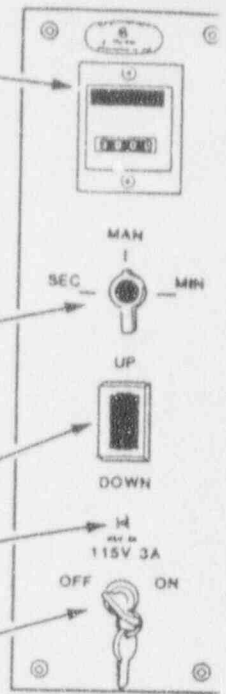
## ELECTRICAL POWER REQUIREMENTS

220 Volts — 3 phase — 50 or 60 Hz — 0.75 kVA (motor).

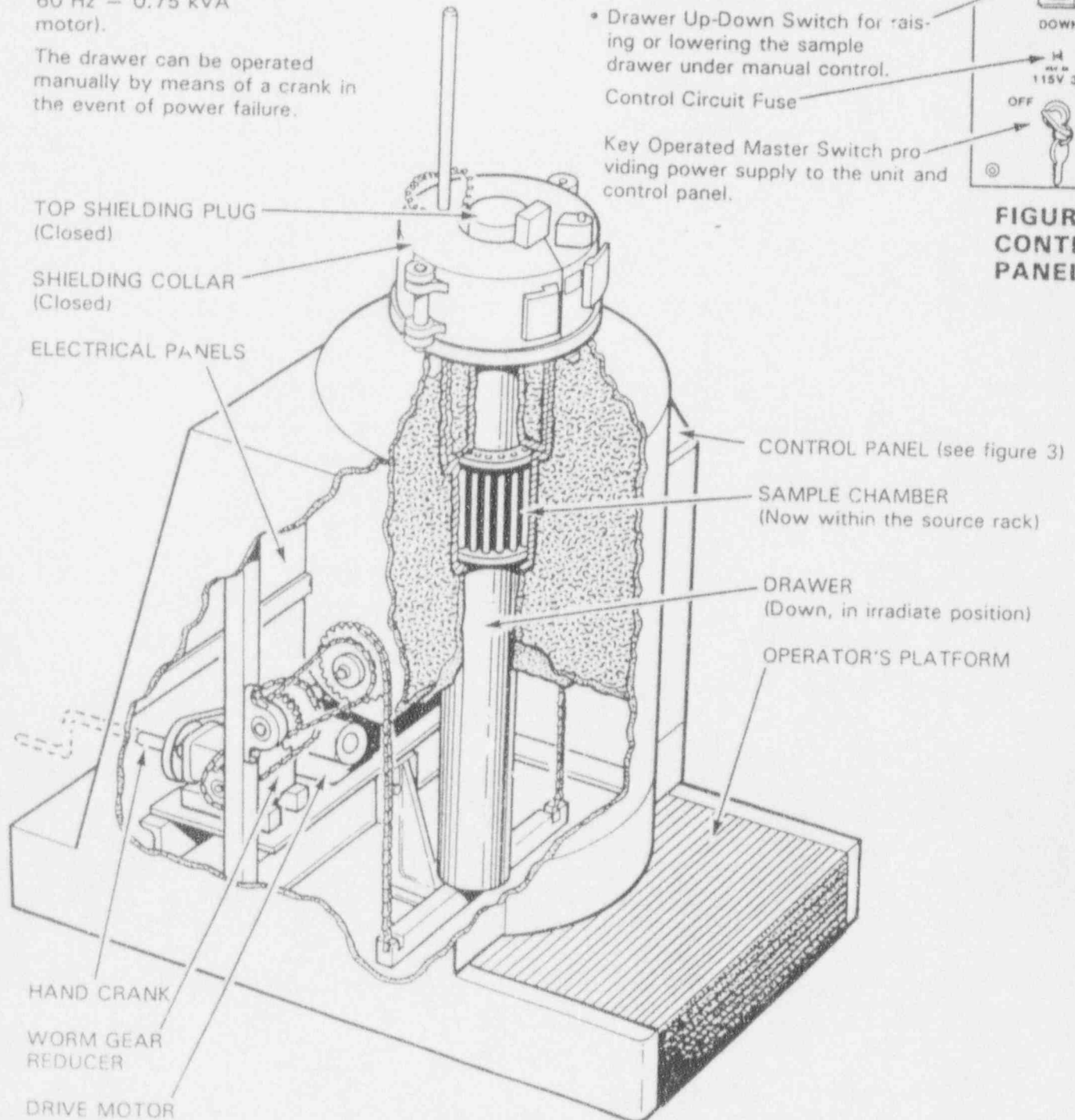
The drawer can be operated manually by means of a crank in the event of power failure.

## CONTROL PANEL

- Timer with a range of 0.1 — 999.9 calibrated in minutes and seconds. The timer is automatically repetitive permitting continuous experiments of the same time intervals to be completed by pressing the reset button.
- Mode Selector Switch which enables the operator to select time units desired, or manual control.
- Drawer Up-Down Switch for raising or lowering the sample drawer under manual control.
- Control Circuit Fuse
- Key Operated Master Switch providing power supply to the unit and control panel.



**FIGURE 3  
CONTROL  
PANEL**



**FIGURE 2 GAMMACELL 220 IN IRRADIATE POSITION.**

### A. RADIOACTIVE SOURCE —

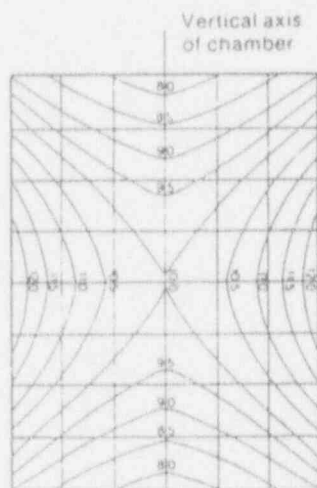
The Cobalt 60 source is doubly encapsulated in up to 48 stainless steel source pencils (Model C198). The pencils are equally spaced in an annular source rack which surrounds the irradiation chamber.

The active volume of each pencil is 196.3 mm (7.73 in) long x 6.35 mm (0.25 in) diameter. Cobalt 60 has a half-life of 5.3 years.

### B. EXTERNAL RADIATION LEVELS —

At 5 cm (2 in) from the surface of the unit the average exposure rate will not exceed 20 mR/h, and the maximum exposure rate will not exceed 100 mR/h.

At 100 cm (39.4 in) from the centre of the source the average exposure rate will not exceed 2 mR/h, and the maximum exposure rate will not exceed 10 mR/h.

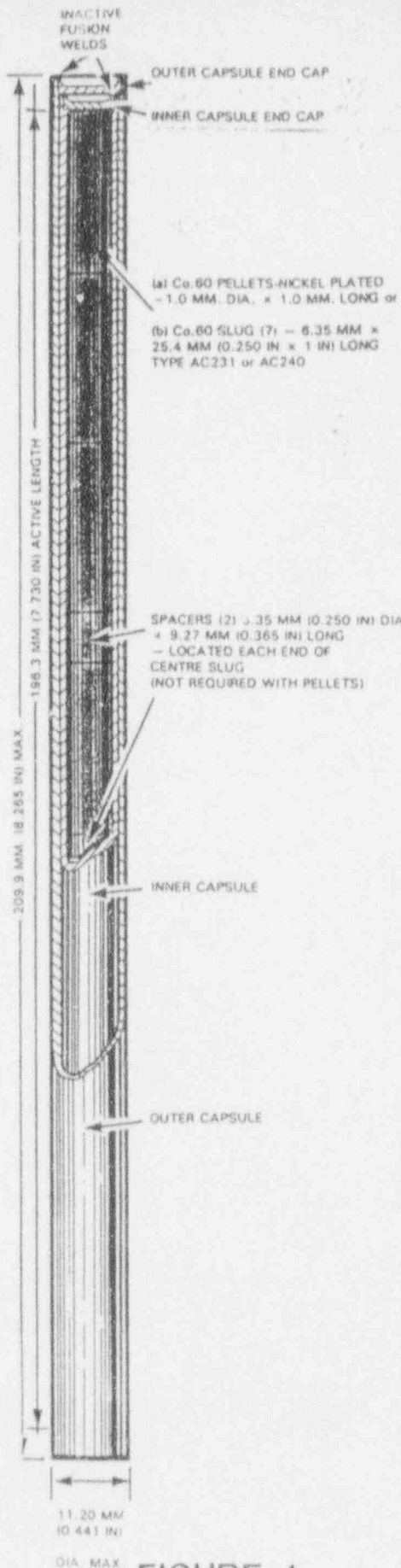


**FIGURE 5**  
Gammacell 220  
Sample Chamber Isodose Curves

### C. SHIPPING AND HANDLING

The Gammacell 220, complete with Cobalt 60 source, is shipped in one package without additional radiation shielding. The package can be handled by a standard forklift, or a platform truck, or an overhead hoisting device. It is licensed for shipment in the U.S.A. by the U.S. Dept. of Transport, and in Canada by the AECB.

The unit has been found acceptable for licensing in the USA by the USNRC, and in Canada by the AECB. When applying for a U.S. Radioactive Materials License, or a



**FIGURE 4**  
GAMMACELL 220 PENCIL  
(Pellet or Slug Type)

Canadian AECB License, the customer should apply for 10% more Cobalt 60 than ordered to allow for the  $\pm 10\%$  loading tolerance.

The customer should send a copy of the license to AECL-RCC at least 6 weeks prior to the estimated shipping date. Receipt of the licence by AECL-RCC will initiate the loading of the Cobalt-60 into the unit.

Prior to shipment of the unit AECL-RCC's installation branch will contact the customer to make arrangements for a smooth installation by AECL technicians. However, the following points are relevant:

- 1) Local riggers (movers of heavy equipment), with appropriate equipment, must be hired by the customer to move the unit from the customers unloading dock into the room where installation will be done. This move must be supervised by AECL Technicians.
- 2) In order to install the unit there is a requirement for the following minimum wall clearances (when facing the unit):
 

Rear Wall	36 cm (14 in)
Right Wall	36 cm (14 in)

Crated Weight: -- 4400 kg (9,700 lb)  
Crated Dimensions: --  
Height 170.1 cm (67 in)  
Width 108.4 cm (42.75 in)  
Length 156.2 cm (61.5 in)

### D. CERTIFICATION & DOCUMENTATION

A set of isodose curves is supplied with each unit showing the distribution of the dose rate in the sample chamber. See figure 5.

Actual dose rate values are normally within 5% of those indicated by the isodose chart.

The dose rate at the mid-point of the sample chamber is measured by ferrous chemical dosimetry, the accuracy being  $\pm 3.5\%$ . A Certificate of Measurement which certifies curie content and Central Dose Rate is supplied with each unit.

The Cobalt 60 pencils in the source are individually tested for leakage and contamination. A certificate describing the tests performed is supplied with each unit.

An Operation and Maintenance Manual is shipped with each unit.



U.S. Department  
of Transportation

Research and  
Special Programs  
Administration

Appendix 5

400 Seventh St., S.W.  
Washington, D.C. 20590

COMPETENT AUTHORITY CERTIFICATION  
FOR A TYPE B(U)  
RADIOACTIVE MATERIALS PACKAGE DESIGN  
CERTIFICATE USA/6125/B(U), REVISION 7

ENDORSEMENT OF CANADIAN COMPETENT AUTHORITY CERTIFICATE CDN/2013/B(U)

This certifies that the radioactive materials package design described below is hereby approved for use within the United States for import and export shipments only. Shipments must be made in accordance with the applicable International Atomic Energy Agency and USA<sup>2</sup> regulations.

1. Package Identification - Gammacell 220.
2. Packaging Description and Authorized Radioactive Contents - as described in Canadian Certificate of Competent Authority CDN/2013/B(U), Issue 7.
3. GENERAL CONDITIONS -
  - a. Each user of this certificate must have in his possession a copy of this certificate and all documents necessary to properly prepare the package for transportation in accordance with the endorsed certificate.
  - b. Each user of this certificate, other than the original petitioner, shall register his identity in writing to the Office of Hazardous Materials Regulation, Research and Special Programs Administration U.S. Department of Transportation, Washington D.C. 20590.
  - c. This certificate does not relieve any consignor or carrier from compliance with any requirement of the Government of any country through or into which the package is to be transported.

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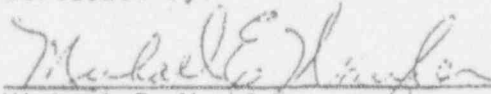
<sup>1</sup>"Safety Series No. 6, Regulations for the Safe Transport of Radioactive Materials, 1973 Revised Edition (As Amended)" published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

<sup>2</sup>"Title 49, Code of Federal Regulations, Parts 100 - 199, USA."

CERTIFICATE USA/6125/B(U), REVISION 7

- d. This certificate is issued only to authorize transport from point of entry to final destination within the United States and from point of origin in the United States to point of exit.
4. The package shall bear the marking USA/6125/B(U) in addition to other required markings and labeling.
5. This certificate, unless renewed, expires on October 31, 1991.

Certified by:

  
Michael E. Wangler  
Chief, Radioactive Materials Branch  
Office of Hazardous Materials Transportation

November 25, 1986

Revision 7 - issued to incorporate revision 7 of CDN/2013/B(U) and to extend the date of expiration.



# Certification



Atomic Energy  
Control Board

Commission de contrôle  
de l'énergie atomique

---

RADIOACTIVE MATERIAL TYPE B(U) PACKAGE DESIGN APPROVAL CERTIFICATE  
NO. CDN/2013/B(U), (REV. 7)

---

30-A2-93-0

October 10, 1986

The Atomic Energy Control Board hereby certifies that the package, as described below, has been demonstrated to meet the regulatory requirements prescribed for Type B(U) packages as described in the Canadian Transport Packaging of Radioactive Materials Regulations and in the IAEA Regulations\*, subject to the following provisions.

Each shipper under this certificate shall possess the necessary instructions for preparation of the package for shipment prior to the use of the package.

This certificate does not relieve the shipper from any requirement of the government of any country through or into which the package will be transported.

## PACKAGE IDENTIFICATION

Atomic Energy of Canada Limited Gammacell 220 Irradiator.

## PACKAGING DESCRIPTION

The Atomic Energy of Canada Limited (AECL) Gammacell 220 Irradiator, as shown on AECL Drawing No. A01885, (Revisions S and T), consists of a 760 mm diameter cylindrical steel-encased lead radiation shield which is welded to a support frame and is partially covered with sheet metal covers. A cavity in the radiation shield contains a cylindrical source cage, a drawer and a plug. A steel shipping cover, 57.1 mm thick with a 11.1 mm recess, registers on the plug and retains it in place. The drawer is retained on the top by the shipping cover and on the bottom by a shipping bracket. The radiation shield is wrapped in thermal insulation which is held in place by wire mesh on the front, the top and the back and by chicken wire on the sides and the bottom. The chicken wire on the sides and bottom is further protected by sheet metal panels. A steel energy absorber (impact limiter) is mounted on top of the radiation shield and the assembly is placed inside a plywood shipping crate. The crate dimensions are 1700 mm high by 1090 mm wide by 1560 mm long and the gross weight of the package is 4400 kg.

Page 1 of 2

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Canada

Page 31 of 33

The package shall bear the competent authority identification mark "CDN/2013/B(U)".

#### AUTHORIZED RADIOACTIVE CONTENTS

This package is authorized to contain not more than 963 TBq (26,000 Ci) of cobalt-60 in the form of metal pellets or slugs. Pellets and unsheathed slugs are doubly encapsulated in C198 stainless steel capsule assemblies. The aluminum-sheathed slugs are encapsulated in C185 stainless steel capsule assemblies. All capsules are mounted in a cylindrical source cage. The decay heat output for this material is not greater than 400 W.

The containment system consists of the capsule assemblies.

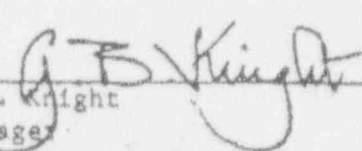
#### SHIPMENT

This package shall be prepared for shipment in accordance with AECL Engineering Spec. DS-0766, (Rev. B) "Preparation for Shipment, Gammacell 220", the Canadian Transport Packaging of Radioactive Materials Regulations and the IAEA Regulations\*.

The average surface heat flux of this package with 963 TBq (26,000 Ci) of cobalt-60 is  $32 \text{ W/m}^2$ . For heat fluxes exceeding  $15 \text{ W/m}^2$  supplementary arrangements must be made with the carrier to ensure adequate heat dissipation.

#### EXPIRY DATE

This certificate expires 31 October, 1991.

  
G.B. Knight  
Manager  
Radioisotopes and Transportation  
Division

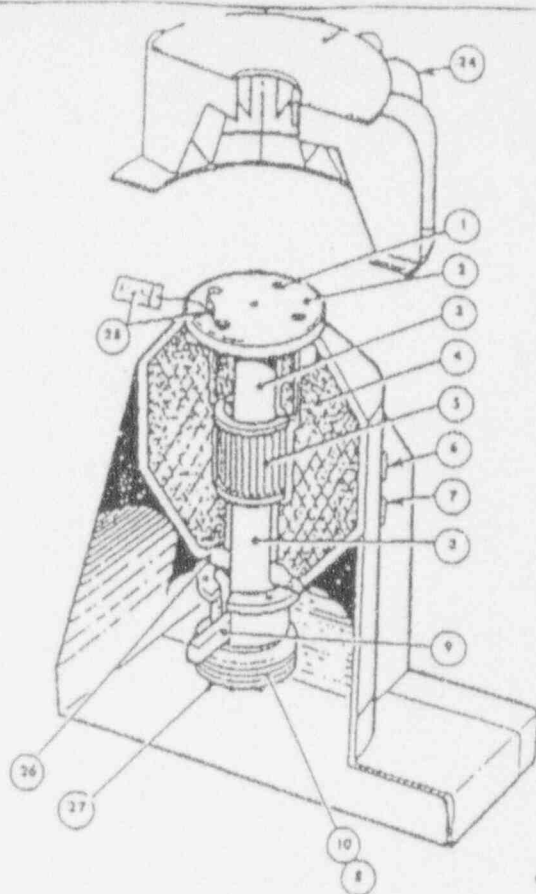
#### REFERENCE

- \* International Atomic Energy Agency safety Series No. 6, Regulations for the Safe Transport of Radioactive Materials, 1973 Revised Edition (as amended).

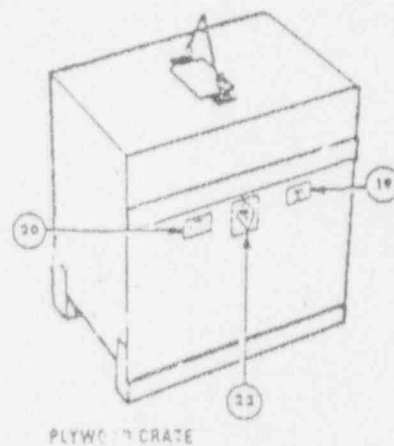
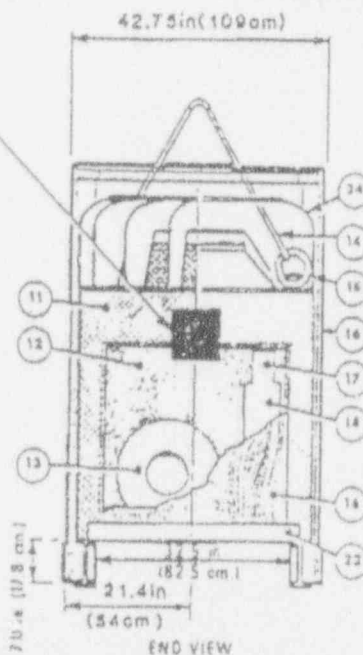
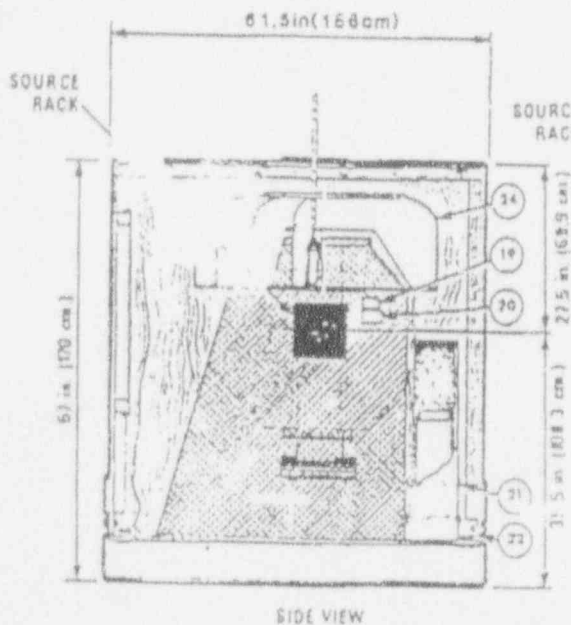
#### NOTES

1. AECL Drawing Nos. DS-0284, (Rev. H and J) attached.
2. Revision 0: February 3, 1976. Original certificate.
3. Revision 1: April 24, 1979. Certificate renewed.
4. Revision 2: May 27, 1980. Packaging Description and Shipment sections revised. Certificate renewed.
5. Revision 3: March 2, 1981. Packaging Description revised.
6. Revision 4: October 30, 1981. Certificate renewed.
7. Revision 5: September 23, 1982. Certificate renewed.
8. Revision 6: November 21, 1983. Certificate renewed.
9. Revision 7: October 10, 1986. Certificate renewed.

1. 3/4 In. -10 x 2-1/2 In. LG SOCKET HEAD SCREWS (4)
2. SHIPPING COVER — STEEL PLATE 1.75 In. (4.4 cm.) THICK
3. LOWER DRAWER
4. LEAD SHIELDING
5. STAINLESS STEEL SOURCE RACK 8.8 In. DIA (22.3 cm.) x 8.3 In. (21 cm.) WITH STAINLESS STEEL WELDED CAPSULES CONTAINING COBALT 60
6. RADIATION CAUTION PLATE WITH SPECIFIED CONTENT (1) AECL CP SPEC DG0005
7. AECL IDENTIFICATION PLATE(1)-AECL-CP SPEC DG0007
8. DRAWER BOTTOM BRACKET
9. ELEVATING BAR
10. SHIPPING BRACKET ASSEMBLY
11. KADWOOL — 0.5 In. (1.27 cm.) THICK. POLYETHELENE (4 MIL) WIRE MESH 1 In. (2.54 cm.) STANDARD STEEL PACKING STRAPS 0.5 In. (1.27 cm.) WIDE. AECL CP SPEC PO121
12. PACKING MATERIAL
13. SHIELD COLLAR (END USE ONLY)
14. HOIST SLING
15. SHOULDER EYELET (2)
16. 0.6 In. (1.27 cm.) THICK PLYWOOD CRATE
17. SHIELDING PLUG (END USE ONLY)
18. UPPER DRAWER (END USE ONLY)
19. RADIATION CAUTION PLATE (2) — AECL CP SPEC DG0008
20. AECL IDENTIFICATION PLATE(2) AECL-CP SPEC DG0007
21. 1/2 In. -13 x 9 In. LG SQ HD BOLTS (3)
22. SHIPPING BRACKET (2) WITH 5/8 In. x 11 x 1-1/4 In. LG HEX HD SCREWS (8)
23. RADIOACTIVE I or II or III LABEL (2)
24. CRUSH SHIELD ASSEMBLY
25. WIRE SEAL & TAG — 'DO NOT OPEN'
26. 3/4-10 x 2.0 In. LG. SOCKET HD. SCREWS (4)
27. 3/4-10x3 In LG SOCKET HD SCREWS(4)



NOTES  
 I.A.E.A. — TYPE B(u)  
 GROSS WEIGHT 9700 lb. (4400 kg.)  
 PROJECTED FLOOR LOADING 531 lb/sq ft. (0.26 kg/sq cm)  
 CAPACITY — 28,000 Ci 60 Co  
 AECB CERT CDN/2013/B (U) T



For unit numbers  
 195 and up

ATOMIC ENERGY OF CANADA LIMITED

412 MARCH ROAD, P.O. BOX 10800,  
 KANATA, ONTARIO, CANADA, K2K 1X8  
 Telex: 053-4982 CADINT MONTA  
 Tel. (613) 862-3790

TITLE

GAMMACELL 220  
 "LIVE" SOURCE HEAD  
 CRATING FOR SHIPMENT

REF. DWG. 401885		REVISED DECEMBER 1983	
DATE 31 JANUARY 1975		No.	REV.
DRAWN	CHECKED	APPROVED	DS-0284 J
AB	22	FL	
SHEET 1		OF 1	

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UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION I  
475 ALLENDALE ROAD  
KING OF PRUSSIA, PENNSYLVANIA 19406

MAR 22 1991

License No. 20-28072-02  
Docket No. 030-30125  
Control No. 114039

Biosurface Technology, Incorporated  
ATTN: J. D. Bernardy  
Director, Regulatory Affairs  
University Park  
64 Sidney Street  
One Kendall Square  
Cambridge, Massachusetts 02139

Gentlemen:

Please find enclosed an amendment to your NRC Material License.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the Region I Material Licensing Section, (215) 337-5093, so that we can provide appropriate corrections and answers.

Please be advised that you must conduct your program involving licensed radioactive materials in accordance with the conditions of your NRC license, representations made in your license application, and NRC regulations. In particular, please note the items in the enclosed, "Requirements for Materials Licensees."

Since serious consequences to employees and the public can result from failure to comply with NRC requirements, the NRC expects licensees to pay meticulous attention to detail and to achieve the high standard of compliance which the NRC expects of its licensees.

You will be periodically inspected by NRC. A fee may be charged for inspections in accordance with 10 CFR Part 170. Failure to conduct your program safely and in accordance with NRC regulations, license conditions, and representations made in your license application and supplemental correspondence with NRC will result in prompt and vigorous enforcement action against you. This could include issuance of a notice of violation, or in case of serious violations, an imposition of a civil penalty or an order suspending, modifying or revoking your license as specified in the General Policy and Procedures for NRC Enforcement Actions, 10 CFR Part 2, Appendix C.

9104080112

We wish you success in operating a safe and effective licensed program.

Sincerely,

*Francis M. Costello*

Francis M. Costello  
Nuclear Materials Safety Section C  
Division of Radiation Safety  
and Safeguards

Enclosures:

1. Amendment No. 02
2. Requirements for Materials Licensees

MATERIALS LICENSE

Amendment No. 02

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 39, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee		In accordance with letters dated December 13, 1990 and February 22, 1991,	
1. Biosurface Technology, Inc.  University Park 2. 64 Sidney Street One Kendall Square Cambridge, Massachusetts 02139	3. License number 20-28072-02 is amended in its entirety to read as follows:		
	4. Expiration date September 30, 1992		
	5. Docket or Reference No 030-30125		
6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license	
A. Cobalt 60	A. Sealed source (AECL Model C-166, C-167, C-185, or C-198)	A. 10,000 curies	
9. Authorized use			
A. For use in an AECL Model Gammacell 220, self-shielded irradiator for irradiating samples.			

CONDITIONS

10. Licensed material shall be used only at Building 200, One Kendall Square, Cambridge, Massachusetts or at University Park, 64 Sidney Street, One Kendall Square, Cambridge, Massachusetts.
11. A. Licensed material shall be used by Olaniyi Kehinde or individuals who have been trained as specified in application dated July 14, 1987. The licensee shall maintain records of each individual trained as a user.  
B. The Radiation Safety Officer is Olaniyi Kehinde.
12. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders or detector cells by the licensee.
13. A. Sealed sources and detector cells shall be tested for leakage and/or contamination at intervals not to exceed 6 months or at such other intervals as are specified by the certificate of registration referred to in 10 CFR 32.210, not to exceed 3 years.  
B. Notwithstanding Paragraph A of this Condition, sealed sources designed to emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed 3 months.

MATERIALS LICENSE  
SUPPLEMENTARY SHEET

License number	20-28072-02
Docket or Reference number	030-30125
Amendment No. 02	

(13. continued)

CONDITIONS

- C. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.
- D. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to any use or transfer as a sealed source.
- E. Sealed sources and detector cells need not be leak tested if:
- (i) they contain only hydrogen 3; or
  - (ii) they contain only a gas; or
  - (iii) the half-life of the isotope is 30 days or less; or
  - (iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or
  - (v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transfer to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.
- F. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. Records of leak test results shall be kept in units of microcuries and shall be maintained for inspection by the Commission. If the test reveals the presence of 0.005 microcurie or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission and the source shall be removed from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region I, ATTN: Chief, Nuclear Materials Safety Branch, 475 Allendale Road, King of Prussia, Pennsylvania 19406. The report shall specify the source involved, the test results, and corrective action taken.
- G. The licensee is authorized to collect leak test samples for analysis by Robert Johnson. Alternatively, tests for leakage and/or contamination may be performed by persons specifically licensed by the Commission or an Agreement State to perform such services.
14. The licensee shall not perform repairs or alterations of the irradiator involving removal of shielding or access to the licensed material. Removal, replacement, and disposal of sealed sources in the irradiator shall be performed by a person specifically licensed by the Commission or an Agreement State to perform such services.

MATERIALS LICENSE  
SUPPLEMENTARY SHEET

License number	20-28072-02
Docket or Reference number	030-30125
Amendment No. 02	

(Continued)

CONDITIONS

15. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.
- A. Application dated July 14, 1987
  - B. Letter dated August 19, 1987
  - C. Letter dated February 22, 1991



For the U.S. Nuclear Regulatory Commission

Date MAR 22 1991

By *James M. Costello*  
 Nuclear Materials Safety Branch  
 Region I  
 King of Prussia, Pennsylvania 19406