

Appendix A

Hopewell G10-2-12 Gamma Irradiator

The following pictures show the unit in place along with the track system for positioning the instrument to be calibrated and the camera over the instrument face. Figure 1 taken behind the unit shows the Hopewell control unit and computer operation. Figure 2 shows the unit serial number plate. Figure 3 shows the serial number plate and the unit weight. As discussed on the pricing sheet, the unit was manufactured in 2005 and the source manufacture date is 9/23/2005. The original activity for the units 2 Cs-137 sources was 2.1 and 9.15 Ci. Decay corrected to 3/1/2020, the activity of the two is 8.42 Ci, well below the A2 (normal form) limit for Cs-137 of 16 Ci. The certificates for these sources are included with this appendix and show the certificates expiration date of 3/31/2022.

It is possible the manufacturer renews this certificate (normally every 5 years), but there's no guarantee. The current Source Calibration Certificate from 2005 recommend a working life of 15 years. The explanation of the "working life" is found on the back of the certificate and is shown in italics below.

Source working life

The 'recommended working life' is our recommendation of the period within which the source should be replaced or subjected to integrity testing to confirm the sources suitability for continued use. The period given has been assessed on the basis of such factors as, toxicity of nuclide, total initial activity, source construction (e.g., capsule design, source insert type, etc.), half-life of nuclide, typical application environments, operational experience, test performance data. etc.

Adverse environments could affect the appearance and integrity of a source. It is the user's responsibility to regularly inspect and test the source in order to assess at what point during the "recommended working life" the source should be replaced.

This irradiator has been housed in a specially shielded irradiation cell since 2005. The cell has never been flooded nor has the cell roof ever leaked. Further, the source has routinely been leak-tested every 3 months with no positive results ever. The irradiation cell for the G10-2-12 is the most "unadverse" environment imaginable. The only issue with the source is it is currently 70% of its original activity.

Should the certificates not be renewed the unit can still be used and be disposed at end of life in a Type A container. Currently, the unit can provide dose rates up to 6-6.5 R/hr.

MJWTS sees no reason why a new owner of the irradiator wouldn't be able to use it for any length of time even if the certificate isn't renewed as the sources would just be considered Normal Form, regardless. Normal form Cs-137 less than 16 Ci can be shipped as Type A, so this wouldn't be a problem for any future owner should they want to dispose of the sources in the future.

Figure 1 shows the upgraded collimation system for the G10-2-12. The original Attenuator -X had 4 shields to provide shielding of x10, x100, x1000 and x10,000 and only 4 choices. In 2017, MJWTS purchased the upgraded collimation system Model 0-X8000, shown on the front of the irradiator, which allows for 16 different shield configurations which include but are not limited to: (x2,x4,x8,x10,x20,x40,x80,x100,x200,x400,x800+) at a cost of \$11,200. MJWTS also purchased the Hopewell upgrade to replace the electronic controller with a computer controller for instrument positioning as described below:

MJWTS' irradiators were upgraded with Hopewell Design's 2-axis, Linear Positioning System. This upgrade added automation via the control computer, for faster, more accurate instrument positioning in the X and Z axis. This upgrade included:

- *The PLC controller upgrade to the existing control computer*
- *Upgraded Software to add automation to the existing Irradiator Software*
- *Upgraded the existing Manual Position Track with MDrive Plus microstepping Drive with Apex Dynamics Gearbox and associated hardware to drive the instrument table in both axes*

MJWTS's asking price for this complete system at \$29,900 is a small fraction of the original cost.

There are six attachments to this appendix which have self-explanatory titles, and which are listed below. Also included with these appendices are the engineering drawings for the unit and the source certificates mentioned earlier. The list of all of the equipment and parts that are included with the G10-2-12 irradiator are shown on page 4 and 5.

The attachments included with this Appendix are named:

- ATT_1_AEA 7020CM Cs-137_10Ci.pdf
- ATT_2_AEA 7753CM Cs-137_2 Ci.pdf
- ATT_3_Back Page of Calibrator Source Certificates.pdf
- ATT_4_G10 Irradiator Brochure
- ATT_5_USA-0363-S Special Form Certificate

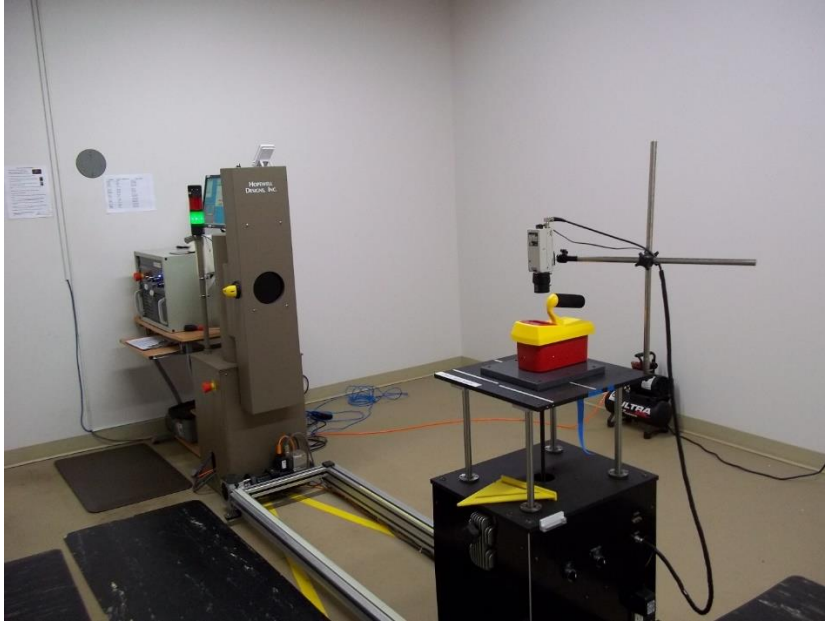


Figure 1. Hopewell G10-2-12 Irradiator System



Figure 2. Hopewell G10-2-12 Control Station



Figure 3. Serial Number Plate

G10-2-12 Parts List

- Gamma Beam Irradiator
- 2 Ci Cs-137 source
- 10 Ci Cs-137 source
- Electronic Controller
- Attenuator-X
 - 10,000 attenuator set with a x10, x100, x1000 and x10,000
 - With pneumatic operations and below gamma beam installation
 - Thomas commercial grade air compressor AIR-PAC Model T-614HDN
- Attenuator 0-X8000
 - 4 attenuator set with 16 shield configurations and computer control
- G-10 computer control upgrade
 - Replaced electronic controller with:
 - Computer controller
 - 17" LCD monitor
 - Opto DIO card for I/O
 - GPIB-USB cable for electrometer interface
 - Automated irradiation software
 - Exposure rate data
- Model T20-2-M two axis manual system

- Track movement is manual
- Locking tabs hold platform at desired position
- Hand crank for z-axis
- Track – Wiremold Raceway Model AL3300B-10
- Table
- Instrument Camera
 - JVC 1/3-inch color CCTV camera Model TK-X750U
- Area Monitor
 - Ludlum Digital Area Monitor Model 375/2
- Motor
 - MDrive Plus microstepping Drive with Apex Dynamics Gearbox Model PN 034

The upgrades to the above component list has been discussed above on page 2. The two original Attenuator-X attenuators as shown in Figure 4 below will be included at no charge.



Figure 4. Hopewell Attenuator-X Set