1.0 PURPOSE

To describe the method to estimate electron beam energy by using the B3WINdose B3110 and B3112 Energy Wedge Card Arrays and the WINdose for Excel Software Program provided by GEX Corporation.

2.0 SCOPE

2.1 The B3110 and B3112 products and their associated GEX *WINdose for Excel* software worksheet were specifically designed for use with the Risø aluminum wedge to estimate energies based on an extrapolated range technique for electron beam accelerator systems with approximate energies of 2 – 20 MeV. The product uses an array of B3WINdose dosimeters spaced at specific intervals on a card at die-cut positions with two die-cut alignment holes that fit snuggly over the posts on the Risø wedge.

2.2 The Risø HDRL two piece aluminum wedge is 12 cm wide by 14 cm long by 2.9 cm thick when assembled and has a nominal 16° angle.

2.3 The WINdose for Excel template permits a user to adjust the range of usable dosimeter measurements so the form can be manipulated for determination of energies in the allowable range of the Risø Wedge. Users should have a working knowledge of basic Microsoft Excel™ functions and charts in order to use the worksheets and manipulate the charts effectively. Detailed instructions are provided in the WINdose for Excel Installation & Operation Manual. The default energy estimating formulae in the WINdose for Excel workbook are set to the approximate energy of the facility. The data ranges may be reset to specific ranges as appropriate.

3.0 MATERIALS

3.1 GEX B3110 or B3112 Energy Wedge Card Array.

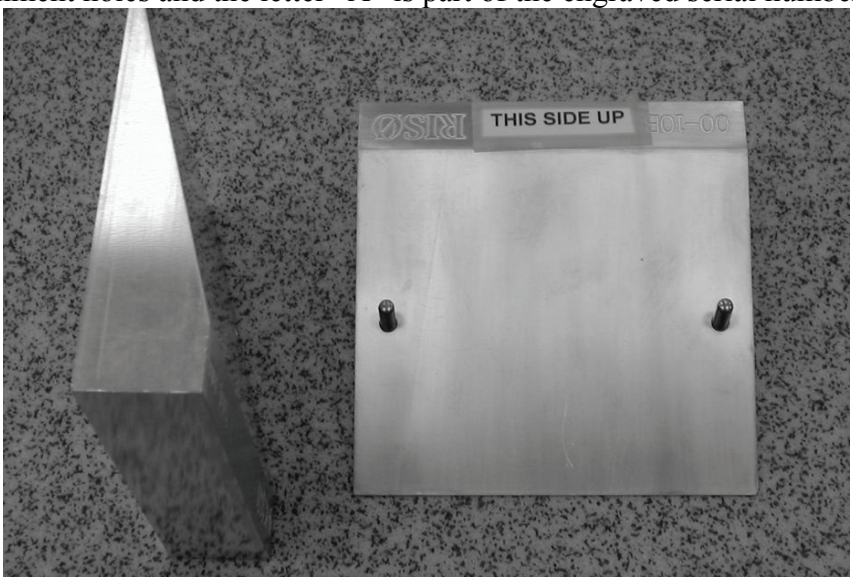
3.2 WINdose Dosimetry System

3.3 Risø Aluminum Wedge

4.0 PROCEDURE

4.1 Keep the package containing the dosimeter wedge card array sealed until just prior to use so that the environmental conditions are maintained.

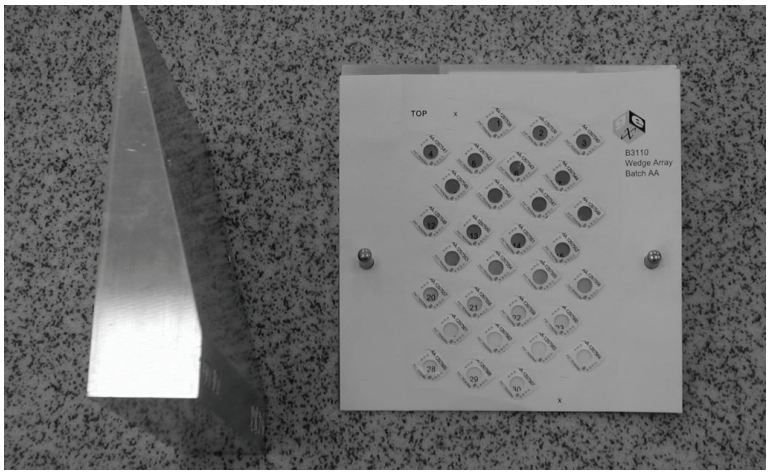
4.2 Separate the wedge pieces. The "bottom" part is fitted with two alignment pins and the letter "B" is part of the engraved serial number. The "top" part has two alignment holes and the letter "A" is part of the engraved serial number.



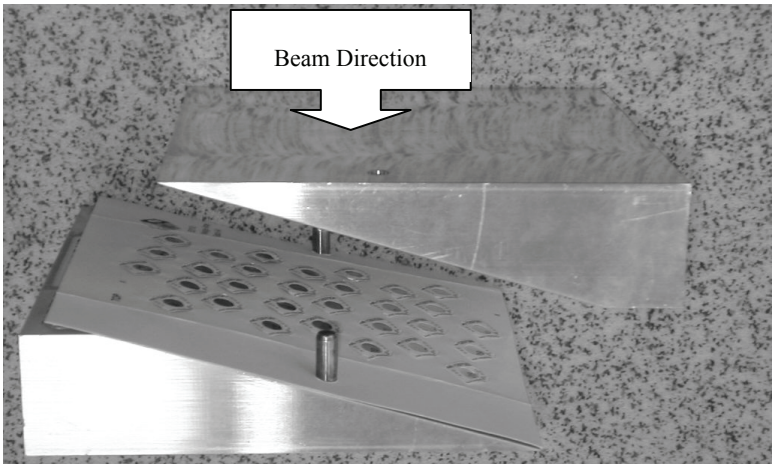
4.3 When ready to run the test, open the package and remove the card array. Unfold the card.

4.4 Orient the card so that the lowest numbered dosimeter will be over the thick end of the bottom part and align the card holes with the wedge pins. Press the card down against the metal. Align the front part with the wedge pins and press it down until snug.

4.4.1 The picture below depicts the correct orientation of the Wedge Card on the Risø aluminum wedge (irradiated dosimeters used for photographs to illustrate orientation; in actual use all dosimeters will be clear in this step).

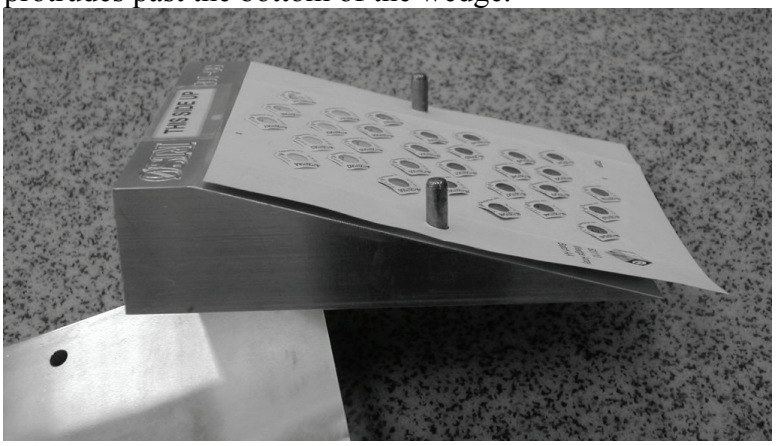


Top view



Side view

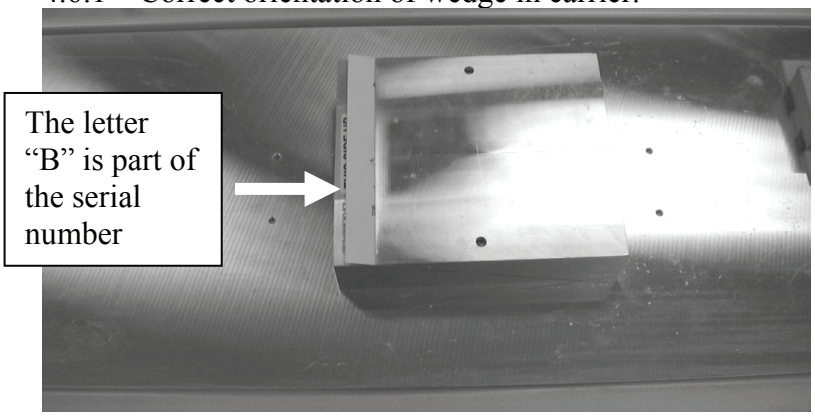
4.4.2 Incorrect orientation of B3110 card on aluminum wedge. Note that paper protrudes past the bottom of the wedge.



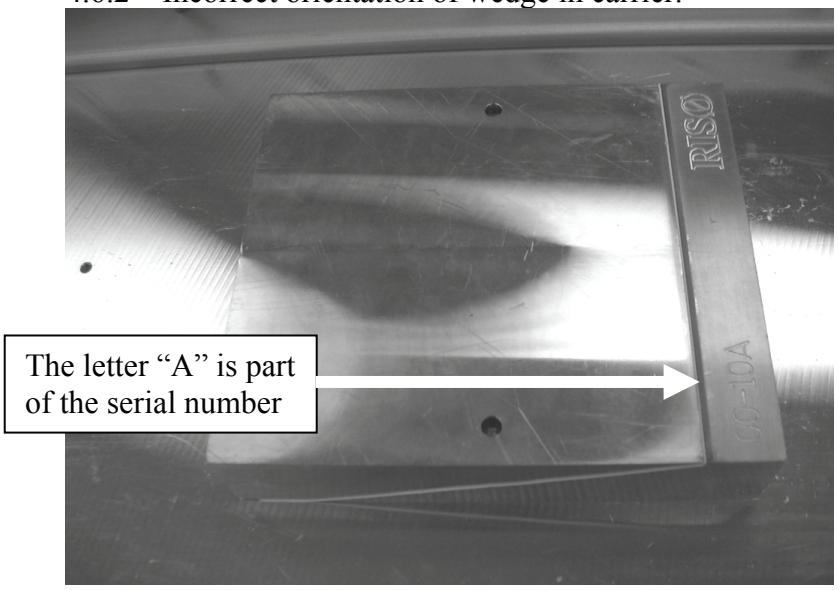
4.5 Wrap a single piece of tape around the entire wedge assembly to keep it together during irradiation.

4.6 A uniform density test fixture may be used to hold the wedge. Place the wedge in the fixture and secure it to prevent movement during irradiation. Orient the wedge in the material handling system such that the electron beam will enter through the front part.

4.6.1 Correct orientation of wedge in carrier.



4.6.2 Incorrect orientation of wedge in carrier.



4.6.3 If somehow the wedge is irradiated upside down, discard the B3110 card without making any measurements and perform another energy wedge test.

4.7 Perform only single-sided irradiation of the wedge. For best results, set the accelerator parameters to deliver a targeted maximum dose of 30 kGy.

4.8 Remove the wedge from the carrier as soon as possible after irradiation. Return it to the dosimetry laboratory. Carefully remove the front part of the wedge and pull the card array away from the back piece.

4.9 Follow the general methodology described in the procedure 100-258, Measuring GEX Dosimeters. NOTE: The wedge card array should be heat-treated if that is the facility practice and can be treated while the dosimeters remain in the array card.

4.10 Open the calibration specific workbook and select the appropriate worksheet from the tabs at the bottom of the screen. Complete the processing information in the top section of the worksheet.

4.11 The dosimeters on each card are provided in sequential order for user convenience. Enter the first dosimeter ID number into first cell on the report

4.12 It may not be necessary to measure all dosimeters on the card: the lower the energy, the less penetration and therefore fewer dosimeters receive a dose. Discontinue making measurements after obtaining two or three absorbance measurements that are approximately at dosimeter background.

4.13 Measure and record the absorbance values of the dosimeters in sequential order.

4.14 The energy is automatically estimated and displayed for Ea, average energy and Ep, practical energy.

4.14.1 The extrapolated range technique plots the dose values against the thickness of the aluminum. The Extrapolated Range formulae and the Estimated Energy formula default to only the depths and doses of a small range of cells in the table of doses. Depending on the system energy, the user may adjust the quantity and location of points that are used to define the slope that determines the intercept of the *x* axis. Some experimentation may be necessary to determine the "ideal" points used for the slope. See the WINdose for Excel Installation and Operations Manual for a more detailed description of how to adjust the ranges.

4.15 A depth-dose curve is automatically plotted to depict the energy estimate.

WARNING: The graph is not linked to the Extrapolated Range formulae and the Estimated Energy formula in step 4.14! Changes made to the formulae are not

automatically updated in the graph, and vice versa. See the WINdose for Excel Installation and Operations Manual for a detailed description of how to adjust the ranges and graph.

4.15.1 The extrapolated range technique plots the dose values against the thickness of the aluminum. The "Trendline" in the chart defaults to only the depths and doses of a small range of cells in the table of doses. Adjust the cell ranges in the chart to the same cell ranges used in the Extrapolated Range formulae. See the WINdose for Excel Installation and Operations Manual for a more detailed description of how to adjust the ranges.

4.15.2 To check that the refit "Trendline" is the same as the extrapolated range formula, compare the equation displayed on the chart to the Slope and Y-intercept values displayed above the chart on the main worksheet.

4.16 Establish and use a database of energy measurement values as appropriate for pass/fail acceptance criteria.

5.0 REVISION HISTORY

Date	Revision	Change Description
07/27/07	C	A few editorial changes and clarification of statements