FINDLAY
THE UNIVERSITY OF FINDLAY
Nuclear Medicine Institute

Nuclear Regulatory Commission
King of Prussia, PA

J-6

March 30, 2006

Re: License # 37-30550-01
Docket # 03035303
Control # 138475

This correspondence is being sent at the request of G. Scott Truman to document his formal training in Dosimetry. Scott attended our one-year certificate program in nuclear medicine technology from 1993-94. During that time, Radiation Dosimetry was part of the Applied Technical Math module of which I was the instructor. I am providing to you a copy of the course description, syllabus, and objectives for the module taught in 1993-94 to document Scott's exposure to dosimetric theory and calculations. Specific objectives related to this topic are #122-143.

Sincerely,

Elaine M Markon

Elaine M. Markon, MS, RT(N), CNMT
Assistant Program Director - NMI
Assistant Professor - Physics

1000 North Main Street
Findlay, Ohio 45840-3695
1-800-472-9502
www.findlay.edu

138475

APPLIED TECHNICAL MATH

This course deals with the concepts needed to have a mathematical understanding of the field of nuclear medicine. Decay rate and its relationship to activity is discussed, with examples being cited and explained. The decay formula utilizing both pre- and post-decay, is discussed and its applicability to nuclear medicine is demonstrated. Examples of the proper manipulation of the formula are given. Mean life, effective half-life, physical half-life, and biological half-life are defined and calculated. Differences between these half-lives as well as their inter-relationships are discussed.

The dilution principle is discussed with particular attention given to dose calculations, volume determinations, concentration determinations, and performance of a dilution. The proper use of decay tables is demonstrated. Patient disposition records are reviewed and students practice recording doses and dilutions on these forms.

The inverse square law is defined showing the relationship between exposure rate and distance from a specific point source. Line and area sources are defined and their relationships given. The specific gamma constant is discussed and the relationship between activity, dose rate constant, and the exposure rate is stated. Numerous examples are cited. The shielding formula is discussed. Definitions for half-value layer, mass absorption coefficient, and linear attenuation coefficient are given. Appropriate tables and charts are utilized.

The following topics are dealt with during the statistics portion of the course: the different types of measurement errors, differentiation between accuracy and precision, concepts of central tendency, different ways to express variability, Poisson distribution, Gaussian distribution, the empirical rule dealing with confidence levels, standard deviation of the net count rate, and optimum counting times. Chi square is defined and the formula given. How to use the Chi square table is demonstrated and a lab is performed to show the applicability of the Chi square test.

The general radionuclide equilibrium equation is presented and discussed in relation to both secular and transient equilibrium. Calculations are demonstrated for both types of equilibrium. Emphasis is given to the calculations involving multiple elutions of a generator system

Dosimetric calculations utilizing the Marinelli equations and the short form of the MIRD equation are done. Theoretical concepts of both equations are presented. Definitions of all symbols are presented and students are instructed in the proper use of the applicable MIRD tables.

Applied Technical Math - Course Syllabus - 1993

Topic	
Decay Rate	
Decay Equation	
Pre-decay	
Mean Life	
Effective Half-life	
	Test 1
Doses and Decay	
	Test 2
Inverse Square Law	
Gamma Constant	
Shielding Formula	
	Test 3
Statistics	
	Test 4
Radionuclide Equilibrium	
Dosimetry	
	Test 5

The 5 exams will be averaged to determine your final grade for the course.

105. State the rationale behind the use of a radionuclide generator in nuclear medicine.
106. Demonstrate graphically the decay of the parent and the production of the daughter in a generator system.
107. Define radionuclide equilibrium.
108. State the general equilibrium equation and define all symbols used.
109. Explain what each of the two terms in the general equilibrium equation represents.
110. Name the two types of radionuclide equilibrium.
111. Define secular equilibrium.
112. Demonstrate graphically the decay of the parent and the production of the daughter in secular equilibrium.
113. Calculate the amount of daughter produced from the decay of the parent given the appropriate information.
114. Calculate the time at which secular equilibrium is reached under the proper conditions.
115. State the relationship between the daughter activity and parent activity at the time of equilibrium.
116. Define transient equilibrium.
117. Demonstrate graphically the decay of the parent and production of the daughter during transient equilibrium.
118. Designate on the graph the point of T_{max} and T_{eq} and state the changes seen on the graph when $K < 1$.
119. Calculate the amount of daughter obtained during successive elutions of a generator system representing transient equilibrium.
120. Calculate the amount of daughter produced from the decay of the parent during transient equilibrium.
121. State the conditions necessary for no radionuclide equilibrium to exist.
122. State the purpose of radiation dosimetry values.
123. State the one major problem associated with dosimetry.
124. List six factors which contribute to a patient's radiation dose.
125. Explain how each of the folowing factors affect the patient's radiation dose: gamma energy, percent absorption, effective half-life, particle energy, organ mass, percent uptake.
126. Name five radiations which are considered to be non-penetrating radiations.
127. State the Marinelli Equation for non-penetrating radiation, defining all symbols and stating the units of each term.
128. State the Marinelli Equation for penetrating radiation, defining all symbols and stating the units of each term.

129. Calculate the total radiation dose to a patient utilizing the Marinelli equations, given all necessary data.
130. State four problems or over-simplifications associated with the Marinelli equations.
131. State what "MIRD" represents.
132. Define the terms "target" and "source" in relation to the MIRD formula.
133. State the long version of the MIRD formula, defining each symbol and stating the units associated with each term.
134. List the radiations considered to be nonpenetrating radiation in relation to the MIRD equation.
135. List the radiations considered to be penetrating radiation in relation to the MIRD equation.
136. Determine the proper $\emptyset_i$ value given the radiation, its energy, and the proper data tables.
137. Determine the values of Δ_i given the proper data tables.
138. Calculate the radiation dose to a patient utilizing the MIRD formula, given all necessary data and tables.
139. Define the term "specific absorbed fraction" and state its relationship to the "absorbed fraction".
140. Define the term "cumulative activity".
141. State the short form of the MIRD equation, defining each symbol and stating the units associated with each term.
142. Determine the proper values from the "S" tables, given the proper data.
143. Calculate the radiation dose to the patient utilizing the "S" tables and given all necessary data.