Division of Administration & Finance
Office of the Vice President

Ph: 609.652.4381
Fax: 609.652.0275

THE RICHARD STOCKTON COLLEGE OF NEW JERSEY

July 18, 2006

Br. 2

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Licensing Assistant Section
Nuclear Materials Safety Branch 2
U.S. Nuclear Regulatory Commission, Region I
475 Allendale Road
King of Prussia, PA 19406

Ref: License No. 29-15222-02, Docket 030-14325

Dear Sir/Madam:

The Radiation Safety Officer of the College, Dr. Maria C. Moyer, Associate Dean and Director of the Academic Laboratories and Field Facilities, retired as of June 30, 2006. Therefore, we are requesting the appointment of Dr. Diane Smith, Assistant Dean and Director of the Academic Laboratories and Field Facilities as of August 1st 2006, as the new Radiation Safety Officer with the corresponding amendment of our license No. 29-15222-2 to incorporate this change.

Attached for your consideration is the resume of Dr. Smith as well as her certification of attendance in the Radiation Safety Officer Training Course provided by Radiation Safety & Control Services, Inc. in Portsmouth, NH on June 12-16, 2006. Also enclosed are the course schedule and outline and examination results.

Sincerely yours,

Charles E. Klein
Vice President

CK/dpm
Enclosures (5)

www.stockton.edu
PO Box 195 Jimmie Leeds Road Pomona NJ 08240

139225
NMSS/RGNI MATERIALS-002

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

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, 36, 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 the application dated November 5, 2003,
1. The Richard Stockton College of New Jersey	3. License number 29-15222-02 is amended in its entirety to read as follows:
2. Route 575 Pomona, New Jersey 08240-0195	4. Expiration date December 31, 2013
	5. Docket No. 030-14325 Reference No.

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. Hydrogen 3	A. Any	A. 20 millicuries
B. Carbon 14	B. Any	B. 20 millicuries
C. Phosphorus 33	C. Any	C. 10 millicuries
D. Sulfur 35	D. Any	D. 10 millicuries
E. Nickel 63	E. Foil or plated sources registered either with the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or with an Agreement State.	E. No single source to exceed the maximum activity specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission or an Agreement State
F. Strontium 90	F. Sealed Source	F. 1microcurie per source and 2 microcuries total
G. Cesium 137	G. Sealed Source	G. 5 microcuries per source and 20 microcuries total

License Number
29-15222-02

MATERIALS LICENSE
SUPPLEMENTARY SHEET

Docket or Reference Number
030-14325

Amendment No. 17

9. Authorized use:

A. through D. Research and development is defined in 10 CFR 30.4; teaching and training of students.

E. To be used for sample analysis in compatible gas chromatography devices that have been registered either with the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or with an Agreement State and have been distributed in accordance with a Commission or Agreement State specific license authorizing distribution to persons specifically authorized by a Commission or Agreement State license to receive, possess, and use the devices.

F. and G. Research and development is defined in 10 CFR 30.4; teaching and training of students.

CONDITIONS

10. Licensed material may be used only at the licensee's facilities located at the Science Laboratory, Route 575, Pomona, New Jersey.

11. A. Licensed material, except items 6.C., 6.G. and 6.G., shall be used by, or under the supervision of Richard H. Colby, Rosalind L. Herlands, Kelly Keenan, Matthew Landau, Maria C. Moyer, Brian James Rogerson, or Peter F. Straub.

    B. Material in Item 6.A. may also be used by or under the supervision of Linda C. Smith.

    C. Licensed material in item 6.C. shall be used by or under the supervision of Peter F. Straub.

    D. Licensed material in items 6.F. and 6.G. shall be used by or under the supervision of Fang Liu.

12. The Radiation Safety Officer for this license is Maria Moyer, Ph.D.

13. Licensed material shall not be used in or on human beings.

14. The licensee shall not use licensed material in field applications where activity is released except as provided otherwise by specific condition of this license.

15. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.

16. The licensee shall conduct a physical inventory every six months, or at other intervals approved by the U.S. Nuclear Regulatory Commission, to account for all sources and/or devices received and possessed under the license. Records of inventories shall be maintained for 5 years from the date of each inventory and shall include the radionuclides, quantities, manufacturer's name and model numbers, and the date of the inventory.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
29-15222-02

Docket or Reference Number
030-14325

Amendment No. 17

17. A. Sealed sources shall be tested for leakage and/or contamination at intervals not to exceed the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or under equivalent regulations of an Agreement State.

B. In the absence of a certificate from a transferor indicating that a leak test has been made within the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or under equivalent regulations of an Agreement State, prior to the transfer, a sealed source received from another person shall not be put into use until tested and the test results received.

C. Sealed sources need not be tested if they contain only hydrogen-3; or they contain only a radioactive gas; or the half-life of the isotope is 30 days or less; or they contain not more than 100 microcuries of beta- and/or gamma-emitting material or not more than 10 microcuries of alpha-emitting material.

D. Sealed sources need not be tested if they are in storage and are not being used; however, when they are removed from storage for use or transferred 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 shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

E. The leak test shall be capable of detecting the presence of 0.005 microcurie (185 becquerels) of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie (185 becquerels) or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 30.50(c)(2), and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations.

F. Tests for leakage and/or contamination, including leak test sample collection and analysis, shall be performed by the licensee or by other persons specifically licensed by the U.S. Nuclear Regulatory Commission or an Agreement State to perform such services.

G. Records of leak test results shall be kept in units of microcuries and shall be maintained for 5 years.

18. The licensee is authorized to hold radioactive material with a physical half-life of less than or equal to 120 days for decay-in-storage before disposal in ordinary trash, provided:

A. Waste to be disposed of in this manner shall be held for decay a minimum of ten half-lives.

B. Before disposal as ordinary trash, the waste shall be surveyed at the container surface with the appropriate survey instrument set on its most sensitive scale and with no interposed shielding to determine that its radioactivity cannot be distinguished from background. All radiation labels shall be removed or obliterated.

License Number
29-15222-02

MATERIALS LICENSE
SUPPLEMENTARY SHEET

Docket or Reference Number
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Amendment No. 17

C. A record of each such disposal permitted under this License Condition shall be retained for three years. The record must include the date of disposal, the date on which the byproduct material was placed in storage, the radionuclides disposed, the survey instrument used, the background dose rate, the dose rate measured at the surface of each waste container, and the name of the individual who performed the disposal.

19. The licensee is authorized to transport licensed material in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

20. 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 November 5, 2003

For the U.S. Nuclear Regulatory Commission

Date December 10, 2003

By *Original signed by Sattar Lodhi, Ph.D.*

Sattar Lodhi, Ph.D.
Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety
Region I
King of Prussia, Pennsylvania 19406

55838569

DIANE L. SMITH

[redacted] [redacted]
(607) 974-3861 (work)

OBJECTIVE Consideration for Assistant Dean/Director of Laboratory and Field Facilities Position

EDUCATION

Oregon State University, Corvallis, OR
Doctor of Philosophy, June 1994
Major: Analytical Chemistry GPA: 3.9/4.0

Iowa State University, Ames, Iowa
Master of Science, August, 1987
Major: Analytical Chemistry GPA: 3.5/4.0

Stockton State College, Pomona, New Jersey
Bachelor of Science, May 1983
Majors (2): Chemistry & Environmental Studies Chem. GPA: 3.8/4.0

CAREER RELATED EXPERIENCE

Corning Incorporated, Corning, New York
Development Associate, Optical Fiber Coating Development 2004-Present
Senior Development Scientist, Optical Fiber Coating Development 1999-2004
- Developed process and coordinated major toll compounding campaigns for new product development
- Established State-of-the-Art analytical laboratory and implemented quality program
- Design and conduct fundamental materials understanding studies
- Develop chromatographic, spectroscopic & wet chemical methods of analysis

Senior Research Scientist, Characterization Science & Service 1995-1999
- Supervised Separations Laboratory & Technical Lead-Competitive Analysis Program

International Experience – 3-month work assignment Avon, France 1998
- Strengthen collaboration between Corning facilities, integrate analytical methods

Wyeth-Ayerst Laboratories Inc., Saint Davids, Pennsylvania
Environmental Scientist, Environmental Control Group 1994-1995
- Coordinated and Oversaw all Environmental Fate and Effects Testing
- Prepared Environmental Assessments for FDA New Drug Applications

Oregon State University, Corvallis, Oregon
Research and Teaching Assistant, Chemistry Department 1991-1994
- Developed glow discharge/plasma gas chromatography detectors
- Studied relationships between instrument response and chemical structure
- Conducted multivariate statistical data analysis-Chemometrics

Mobil Oil Corporation, Princeton, New Jersey
Senior Environmental Chemist, Toxicology Division, 1988-1990
- Developed Analytical Methods using HPLC, GC, AA and FTIR
- Conducted Environmental/Chemical fate testing: EPA and EINECS methods
- Managed Chemical Repository Unit

Ames Laboratory/Iowa State University, Ames, Iowa
Research and Teaching Assistant, Chemistry Department, 1984-1987
- Developed new applications for ion chromatography
- Supervised undergraduate chemistry laboratories & classroom recitations

CAREER RELATED EXPERIENCE

Los Alamos National Laboratory, Los Alamos, New Mexico
Graduate Research Assistant, Summers of 1984 and 1985
Installed and operated air monitoring instrumentation, prepared SOP's
Surveyed soil characteristics, analyzed effects of chemical stabilizers

Cape May County Health Department, Cape May Court House, NJ
Consultant and Analyst for Water Quality Survey, 1982-1983
Conducted pesticide and heavy metal analysis

Stockton Environmental Laboratory, Pomona, New Jersey
Water and Refuse Analyst, 1981-1983
Performed wet chemistry methods: BOD/COD, kjeldahl N, TDS/TSS, NO_3^-

SPECIAL SKILLS

Multivariate Statistics/Chemometrics HCA and PCA Exploratory Techniques
Electronics and Computer Interfacing
HPLC with UV-VIS, RI and ELSD detection
Gel Permeation Chromatography-Relative Detection, PDA-UV
Ion Trap GCMS & Gas Chromatography with ECD, FPD, FID, PID
Ion Chromatography with post column detection
Atomic Absorption Spectroscopy (Flame and Graphite Furnace)
Fourier Transform Infrared Spectroscopy, FTIR and Near Infrared Spectroscopy, NIR
Air Monitoring Instrumentation: O_3, SO_2, CO, NO_x
Bomb Calorimetry & Wet Chemistry Techniques

PUBLICATIONS

Primary author on 29 Corning Inc. Internal, Proprietary Research Reports

S.M. Gasper, D.M. Schissel, L.S. Baker, D.L. Smith, R.E. Youngman, L.M. Wu, S.M. Sonner, R.R. Hancock, C.L. Hogue, S.R. Givens, Integrated Approach to Studying the Development and Final Network Properties of Urethane Acrylate Coatings, *Macromolecules,* Accepted 12/**2005**.

D.L. Smith and E.H. Piepmeier, A Multivariate Approach to Fingerprint Identification of Organic Compounds Using an Oscillating Glow Discharge Detector for Gas Chromatography, *Analytical Chemistry*, **1995**, 67, 1084-1091

D.L. Smith and E.H. Piepmeier, Fingerprint Identification of Organic Compounds Using an Oscillating-Plasma Glow Discharge Detector for Gas Chromatography, *Analytical Chemistry*, **1994**, 66, 1323-1329.

D.L. Smith and J.S. Fritz, Rapid Separation of Calcium and Magnesium by Ion Chromatography with Post Column Detection, *Analytica Chimica Acta*, **1988**, 201, 87-93.

PRESENTATIONS

8 Major Internal/Interdepartmental Proprietary Presentations at Corning Inc.

Oregon State University Graduate Congress 93, April 25, 1993
A Multivariate Approach to Using Electrical Plasma Oscillations in a Low Pressure GC Detector for Quantifying and Identifying Organic Compounds

ISU Analytical Chemistry Division - Formal Presentation of Literature
Topic: Displacement Chromatography, November 1985
Counter Current Chromatography, April 1986

SHORT COURSES

Six-Sigma DMAIC-certified green belt
Advanced Techniques of Ion Trap GCMS-Varian Inc. June 2005
Techniques of Ion Trap GCMS-Varian Inc. April 2002
Near Infrared Qualitative and Quantitative Analysis-Bruker Optics, May 2001
Consistent Mixing: The Key to Uniform Quality-U. Wisc. Madison, April 1999
Practical LC/MS and CE/MS-ACS Short Courses PittCon March, 1999
Improving Managerial Skills of the New or Prospective Manager-American Management Association, September 1996
Environmental Regulations-Executive Enterprises, Inc. October 1994
Risk Assessment for Ground Water Scientist; Environmental Site Assessments National Water Well Association, November 1989
Graphite Furnace Atomic Absorption-Perkin-Elmer Corp., 10/1990

SCHOLARSHIPS AND AWARDS

Corning Inc. Division Cash Awards: 1996, 1997, 1998, 2000, 2002, 2005
6 Formal Recognitions for contributions to Corning Inc. Internal Projects
N.L. Tartar Research Fellowship, Summers 1992 and 1993
Oregon State University Chemistry Department Fellowship
Iowa State University Industrial Scholarship
ISU Chemistry Department Outstanding Graduate Teaching Assistant
National Dean's List
American Institute of Chemists Senior Undergraduate Award

PROFESSIONAL MEMBERSHIPS

American Chemical Society, 1983-present
Society of Applied Spectroscopy
Twin Tiers NY-Local Section, Official & Unofficial Secretary 1996-2000

ACTIVITIES

Corning Inc. Optical Fiber Division climate Survey Response Team
OSU Graduate Student Recruitment Team
Mobil Oil Corporation
Supervisors Committee Member, Safety Committee
Chromatography Task Force
Stockton Chemistry Society: Secretary
Residence Assistants Selection Committee Member

REFERENCES

Available Upon Request

Radiation Safety & Control Services, Inc.

Awards this certificate to

Diane L. Smith

in recognition of satisfactory completion of our 40-hour

Radiation Safety Officer Training Course

Portsmouth, New Hampshire

June 12 - 16, 2006

Frederick P. Straccia, CHP

This course has been approved for 40, Category A, CE credits (reference number NHZ0183001) by the ASRT Dept. of Education.

NOTE: This class satisfies the Department of Transportation requirements listed in Title 49 CFR parts 172 subpart H and expires three years from the date listed above.

Radiation Safety Officer Training Course
COURSE SCHEDULE
Radiation Safety & Control Services, Inc.

Monday

8:00am	Introduction and Course Objectives
9:15am	Math Review
10:00am	*Break*
10:15am	Nuclear Physics Review
12:00pm	*Complimentary Lunch*
1:00pm	Radiation and Radioactive Material
2:30pm	*Break*
2:45pm	Interaction of Radiation With Matter
5:00pm	*Social Hour*

Tuesday

8:00am	Interaction of Radiation with Matter
10:00am	*Break*
10:15am	Radiation Exposure and Dose
12:00pm	*Lunch*
1:00pm	Biological Effects of Radiation
2:30pm	*Break*
2:45pm	Radiological Hazards
5:00pm	Break
7:00pm	**Optional** - Special Topics in Radiation Protection
9:00pm	*Class Ends*

Wednesday

8:00am	Radiological Hazards
10:00am	*Break*
10:15am	Radiological Hazards
12:00pm	*Lunch*
1:00pm	Principals of Radiation Detection
2:30pm	*Break*
2:45pm	Principals of Radiation Detection
5:00pm	*Class Ends*

Thursday

8:00am	Operational Radiation Safety Program
10:00am	*Break*
10:15am	Operational Radiation Safety Program
12:00pm	*Lunch*
1:00pm	Operational Radiation Safety Program
2:30pm	*Break*
2:45pm	Planning For Emergencies
5:00pm	Break
7:00pm	**Optional** - Special Topics in Radiation Protection
9:00pm	*Class Ends*

Friday

8:00am	Nuclear Regulatory Commission Regulations
10:00am	*Break*
10:15am	Transportation of Radioactive Material
12:00pm	*Class Commencement*

Radiation Safety & Control, Inc.

Radiation Safety Officer Training Course

Formal NRC Radiation Safety Training Equivalent Hours

	TRAINING CATEGORY	I	II	III	IV
Monday	Introduction and Course Objectives		0.75		
	Math Review			1.00	
	Nuclear Physics Review	1.00		0.75	
	Radiation and Radioactive Material	1.00		0.75	
	Interaction of Radiation With Matter	1.75		1.00	
Tuesday	Interaction of radiation with Matter (con't)	2.25			
	Radiation Exposure and Dose		1.00	0.75	
	Biological Effects of Radiation				1.75
	Radiological Hazards		1.00		1.25
	Special Topics in Radiation Protection		2.00		
Wednesday	Radiological Hazards		4.00		
	Principals of radiation Detection	4.00			
Thursday	Operational Radiation Safety Program		5.75		
	Planning For Emergencies		2.25		
	Special topics in Radiation Protection		2.00		
Friday	Nuclear Regulatory Commission Regulations		2.25		
	Transportation of Radioactive Material		1.75		
	Totals	10.00	22.75	4.25	3.00

Category I: Radiation Physics and Instrumentation
Category II: Principles and Practices of Radiation Protection
Category III: Mathematics Pertaining to the Use and Measurement of Radioactivity
Category IV: Biological Effects of Radiation

Radiation Safety Officer Training Course Outline: RSCS Inc.

- Math Review
  - Basic Definitions and Operations
  - Problem Solving
  - Graphical Analysis
  - Powers
  - Scientific Notation
  - Exponentials and Logarithms
- Nuclear Physics Review
  - Atomic Structure
  - Nucleus
  - Fundamental Properties
    - Mass, Charge, Energy, Force
    - Electrical & Chemical
  - Nuclear Force
- Radiation & Radioactivity
  - Radiation
    - Definition
    - Types of Radiation
  - Radioactivity
    - Definition
    - Units of Measure
    - Half Life & Decay Law
  - Interaction of Radiation with Matter
    - Penetrating Radiation
    - Non-Penetrating Radiation
      - Charged Particle Interactions
      - Coulomb Forces
      - Radiative Losses
    - Gamma & X-Ray Interactions
      - Photoelectric Effect
      - Compton Scattering
      - Pair Production
- Radiation Exposure and Dose
  - Fundamental Concepts
    - Exposure
    - Absorbed Dose
    - Dose Equivalent
    - Total Effective Dose Equivalent, TEDE
    - Committed Effective Dose Equivalent, CEDE
    - Deep Dose Equivalent, DDE

Radiation Safety Officer Training Course Outline: RSCS Inc.

- Background Radiation Exposure
  - Natural Sources
  - Technologically Enhanced Sources
- Biological Effects of Radiation
  - Background
  - Sequential Patterns of Biological Effects
  - Cellular Effects
  - Types of Exposure
    - Acute
    - Chronic
  - Types of Biological Effects
    - Short Term Effects
    - Long Term Effects
    - Genetic Effects
  - Federal Exposure Limits and Risk Estimates
- Radiological Hazards
  - External Radiation Dose
    - Penetrating (gamma)
    - Non-Penetrating (beta)
    - Rules of Thumb
    - Time, Distance, Shielding
  - Internal Radiation Dose
    - Units of Measure
    - Fixed vs Removable Contamination
    - Internal Hazards and Entry Routes
    - Airborne Radioactivity
    - Protection Methods
- Radiation Detection and Measurement
  - Basic Principles
    - Gas Filled Detectors
    - Scintillation Detectors
    - Solid State Detectors
  - Sample Analysis Applications
    - Detector Efficiency
    - Counting Statistics
    - Minimum Detectable Activity
  - Dose and Dose Rate Measurements
    - Dose Rate Meters
    - Dosimeters

- Contamination Measurements
  - Direct Methods (Friskers)
  - Indirect Methods
  - Swipes
  - Laboratory Instruments
- Operational Radiation Safety
  - Organization
  - Facility Design
  - Radiation Safety Program Goals
    - General Public
    - Radiation Workers
    - ALARA
  - Requirements
  - Annual Radiation Protection Program Audits
- Planning for Emergencies
  - Nature of Radiation Accidents
  - Planning for Radiation Accidents
    - Types of Accidents
    - Planning Criteria
  - Responding to Accidents
  - The Role of Federal, State, and Local Agencies
  - General Rules for Health Physicists and RSOs
- Regulations Pertaining to Radiation Protection
  - NRC/Agreement States - License Requirements
    - 10CFR20
    - 10CFR19
  - DOT - Transportation Requirements
  - EPA - Environmental/Effluent Considerations
- Transportation of Radioactive Material
  - Regulatory Agencies
  - Title 49 - Department of Transportation
    - 49 CFR 171: General Information
    - 49 CFR 172: Hazmat Tables
    - 49CFR 173: Reqts for shippers
    - 49 CFR 177: Public Highway
  - Title 10 - Nuclear Regulatory Commission
    - 10 CFR 71: Packaging of RAM
  - Title 39 - U.S. Postal Service
    - US Postal Service Publication #6

Radiation Safety Officer Training Course Outline:
RSCS Inc.

- 3 Considerations When Shipping
- The A(1) and A(2) System
- Quantity Limits
  - Radioactive Material
  - Limited Quantity
  - Type A Quantity
  - Type B Quantity
  - Highway Route Controlled Quantity:
  - Low Specific Activity (LSA)
  - Instruments or Articles: Solids
  - Three types of packaging
    - Container Type Determination
- Transport Index
- Warning Labels
  - White I
  - Yellow II
  - Yellow III
- Contamination Control
- Shipping Papers

Radiation Protection Program Assessments

- Purpose of Assessments
- Types of Assessments
- Preparations for Assessments
- Conducting Assessments
- Documentation
- Lessons Learned

Radiation Safety Officer Training Course

June 12-16, 2006

EXAMINATION 40/40 = 100%

Name (print): Diane L. Smith Signature: Diane L. Smith

Date: June 18, 2006

Instructions: You are allowed to use your Radiological Health Handbook, your RSCS RSO Handout (three-ring binder), and a scientific calculator. You are not allowed to use any answer sheets from practice problems provided during the class.

Please read all questions fully before answering. For multiple-choice questions, there is only one answer; choose the best response. For other problems, state your assumptions and show all work. Partial credit will be allowed where applicable. A grade of 80% is required to pass this examination. Good luck!

1. Express the following numbers in scientific notation:

   A. 423,000,000,000 4.32×10^{11} or 4.23E11

   B. 0.00000000015 1.5×10^{-10} or 1.5E-10

   C. 2344,567,465,873,567,234.2 $2.344567465873567234 2 \times 10^{18}$ or more practically 2.34×10^{18} or 2.34E18

2. Convert 1000 cubic inches to liters, given 1 l = 1000 cm^3, and 1 inch = 2.54 cm.

$$(1000\,in^3)\left(\frac{2.54\,cm}{1\,in}\right)^3\left(\frac{1\,L}{1000\,cm^3}\right) = 16.4\,L$$

3. Atoms are made up of the following components?

   (A.) Electrons orbiting around a nucleus of protons and neutrons
   B. Neutrons orbiting around a nucleus of electrons and protons
   C. Protons orbiting around a nucleus of electrons and neutrons
   D. None of the above

4. Given the following isotope, select the best choice:

protons + neutrons → 60

$^{60}_{27}\text{Co}$

protons — 27

A. There are 60 protons and 27 neutrons in the nucleus
B. There are 27 neutrons and 33 protons
C. There are 60 neutrons and 27 protons
(D) There are 33 neutrons and 27 protons
E. There are 60 neutrons and 33 protons

5. Define the term "radiation".

Radiation is energy in the form of particles (α and β) or waves (γ or X-

6. Which will travel farther in air, a 3 MeV alpha particle or a 3 MeV beta particle? Why?

The beta particle because it has less mass and charge. The beta particle will not interact as readily as an alpha particle.

7. How are X-rays and gamma rays similar? How are they different?

X-rays + γ rays are both electromagnetic waves and are indistinguishable from each other. The only difference is where they are produced. X-rays come from the electron cloud and γ-rays come from the nucleus.

8. Bremsstrahlung radiation may best be described as

A. Neutrons ejected when a photon interacts with a nucleus
B. Neutrons ejected when a proton interacts with a nucleus
(C.) Photon radiation produced when a beta particle loses energy after interaction with the electric field of a nucleus
D. The scattered photon produced via the Compton interaction.

9. Which energy photons are emitted after an annihilation event?

(A.) 0.511 MeV
B. 0.800 MeV
C. 1.02 MeV
D. 6.02 MeV

10. Calculate the Total Effective Dose Equivalent (TEDE) given the following information:

DDE = 30 **mrem**
CDE (thyroid) = 100 **rem**

$CEDE = \sum CDE * W_t = (100\,rem)(0.03) = 3\,rem$
↑ tissue weighting factor

$TEDE = CEDE + DDE = 3\,rem + (30\,mrem)\left(\frac{1\,rem}{1000\,mrem}\right) = 3.03\,rem$

11. The average annual radiation dose received from all background sources by individuals living in the United States is:

A. 200 mrem
B. 0.250 rem
C. 500 mrem
(D.) 0.360 rem

12. Our current radiation standards assume:

(A.) All radiation may be harmful
B. Most radiation is harmful
C. Sometimes radiation is harmful
D. Radiation is only harmful if you are not wearing a lead suit

13. Calculate the ***increase in risk*** of cancer death to an individual given the following information:

Lifetime risk = 0.04% per rem
Exposure = 50 rem
Initial risk of cancer (no exposure) = 20%

Increased risk $= (50\,rem)\left(\frac{0.04\%}{rem}\right) = 2\%$

14. How many half-value layers does it take to reduce the radiation exposure by a factor of 32?

$2^x = 32 \qquad x = 5$ It will take 5 half value layers to reduce the radiation exposure by a factor of 32.

15. The radiation interaction mechanisms responsible for gamma buildup in a shield are:

A. Photoelectric effects
(B) Compton effects
C. Pair Production events
D. Gamma Absorption effects

16. The three methods used to protect against external radiation are time, distance, and shielding.

17. An individual who inhaled an airborne concentration of radioactive material of 1.5 DAC for 8 hours would receive a CEDE dose of;

A. 12 mrem
B. 1.5 mrem
(C.) 30 mrem
D. 120 mrem

$(1.5\,DAC)(8\,hr) = 12\,DAC\text{-}hr$

$(12\,DAC\text{-}hr)\left(\frac{2.5\,mrem}{1\,DAC\text{-}hr}\right) = 30\,mrem$

18. With all parameters equal, the type of gas-filled detector that operates at the lowest operating voltage is the:

A. Recombination Detector
B. Smoke Detector
C. Ionization Detector
D. Proportional Detector

19. GM Detectors:

A. can operate an any voltage.
B. cannot electronically discriminate between different types of radiation.
C. must be turned off occasionally to allow the quench gas to re-charge.
D. none of the above.

20. A counter has a background of 200 counts for 10 minutes. A sample is counted for 5 minutes on this counter and yielded a gross count of 420 counts. Calculate the sample activity in dpm if the detection efficiency is 24%.

$R_b = \frac{200 \text{ counts}}{10 \text{ min}} = 20 \text{ cpm}$ $\quad$ R_{s+b} Sample $= \frac{420 \text{ counts}}{5 \text{ min}} = 84 \text{ cpm}$

$R_s = R_{s+b} - R_b = 84 \text{ cpm} - 20 \text{ cpm} = 64 \text{ cpm}$

$A = \frac{R_s (\text{cpm})}{\text{Eff} (c/d)} = \frac{64 \text{ cpm}}{0.24 \, c/d} = 267 \text{ dpm}$

21. Given a background count rate of 250 cpm, sample and background count times of 5 minutes, and a counting efficiency of 18%, calculate the system MDA in dpm and in uCi.

$L_d = 4.65\sqrt{C_b} \text{ (counts)} = (4.65)[(250 \text{ cpm})(5 \text{ min})]^{1/2} = 164 \text{ counts}$

$MDA(\text{dpm}) = \frac{L_d}{t_s * \text{Eff}} = \frac{164 \text{ counts}}{(5 \text{ min})(0.18 \, c/d)} = 183 \text{ dpm}$

$(183 \text{ dpm})\left(\frac{1 \mu Ci}{2.22\times10^{6} \text{ dpm}}\right) = 8.2\times10^{-5} \mu$

22. Scintillation detectors may be used for:

A. survey instruments.
B. beta particle spectroscopy instruments.
C. gamma ray spectroscopy instruments.
D. all of the above.

23. An instrument dead time:

A. can be ignored because this is the period of time that an instrument doesn't work.
B. may be an important consideration for some instruments at high count rates.
C. none of the above.
D. Both A and B.

24. Routine facility radiological surveys:

A. need only be documented when abnormal condition is found.
(B) should identify the individual performing the survey and the instrument used.
C. should be performed on the same day of the week.
D. all of the above.

25. Survey instrument calibrations are required:
A. when a malfunction occurs.
B. semi-annually.
(C) as specified in the radioactive materials license or specific regulation.
D. when the instrument is dropped.

26. 10CFR19 requires the following people to receive radiation protection training:

A. all individuals accessing the restricted area.
B. all individuals working with radioactive material.
C. all declared pregnant females.
(D.) all individuals likely to receive greater than 100 mrem in a year.

27. It is required by 10CFR20 to require documentation of each personnel access to the restricted area:

A. True
(B.) False

28. For a package arriving at your facility, an incoming radiological survey is required:

A. within 3 hours of package receipt during normal and off-hours.
B. if you suspect that it may contain radioactive material.
C. if it is damaged.
(D.) if it is "labeled" (white I, yellow II, or yellow III) or damaged and known to contain radioactive material.

29. Immediate response to a radiological incident should consider:

A. shutting down ventilation systems.
B. saving samples of blood, clothing, urine, etc. for later analysis.
C. evacuating and segregating personnel from the immediate area and controlling access.
(D.) all of the above.

30. A posting within your facility for emergency call-out telephone numbers should include

A. the RSO.
B. local fire department
C. local police
(D.) all of the above.

31. 10CFR20 Subpart M requires that the NRC be immediately notified if:

A. an individual receives an exposure in excess of the applicable limits.
(B.) an individual receives an intake in excess of 5 ALI. — Annual limit of intake
C. loss of any radioactive material.
D. none of the above.

32. The 10CFR20 annual dose limits for occupationally exposed adult workers are:

TEDE = 5 rem

SDE = 50 rem

LDE = 15 rem

SDE_{ME} = 50 rem

33. Licensees shall conduct operations so that the TEDE to individual members of the public from the licensed operation does not exceed _______ in a year.

A. 10 mrem
B. 50 mrem
C. 100 mrem
D. 500 mrem

34. Unless specific exemptions apply, containers of licensed material shall be labeled with the radiation symbol and the words:

A. "CAUTION RADIATION MATERIAL"
B. "CAUTION LICENSED MATERIAL"
C. "CAUTION CONTAMINATED MATERIAL"
D. "CAUTION RADIOACTIVE MATERIAL"

35. Each licensee shall post current copies of the following document(s) in accordance with 10CFR19:

A. 10CFR19 and 10CFR20
B. The license and license conditions
C. The licensees operating procedures applicable to licensed activities
D. All of the above

36. According to 10CFR20, Appendix B, the monthly average concentration limit for the release of Co-60 to the sewer is 3×10^{-5} μCi/mL.

37. TRUE or FALSE: Minors are not allowed to received occupational exposure under the provisions of 10CFR20.

38. Radioactive material that cannot meet SPECIAL FORM requirements is designated as:

A. USUAL FORM
B. NON-SPECIAL FORM
C. NORMAL MATERIAL
D. NORMAL FORM

39. The dimensionless number determined by expressing the maximum radiation level in millirem per hour at one meter from the external surface of a package is called the ______________ Index.

A. Transfer
B. Package
C. Transport
D. Total

40. TRUE or FALSE: The radiation level at any point on the external surface of Limited Quantity or White I labeled packages must be less than or equal to 0.5 mrem/hr.

This is to acknowledge the receipt of your letter/application dated

7/18/2006, and to inform you that the initial processing which includes an administrative review has been performed.

Amendment 29-15222-02

[X] There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information.

[ ] Please provide to this office within 30 days of your receipt of this card

____.

A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

Your action has been assigned **Mail Control Number** 139225.
When calling to inquire about this action, please refer to this control number.
You may call us on (610) 337-5398, or 337-5260.

NRC FORM 532 (RI)
(6-96)

Sincerely,
Licensing Assistance Team Leader