APPLICATION FOR DISTRIBUTION OF EXEMPT QUANTITIES OF RADIOACTIVE MATERIALS

Cosmedico Light, Inc.

Weymouth MA

030-38187

Cosmedico

Cosmedico Light, Inc.
233 Libbey Pkwy., Unit 2
Weymouth, MA 02189-3101
781-331-0949 / phone
781-331-4766 / fax
www.cosmedico.com

November 5, 2009

Robert Lewis
US Nuclear Regulatory Commission
FSME/DMSSA
Two White Flint North
TWFN 8 E24
11545 Rockville Pike
Rockville, MD 20852-2738

RE: **Application for License to Distribute Exempt Quantities of Radioactive Materials**

Dear Mr. Lewis:

Enclosed please find an application to issue a radioactive materials license to Cosmedico Light, Inc., to distribute exempt quantities of Krypton-85 in electron tubes. Included herein is a signed original of our application form, along with the applicable information solicited in NUREG-1556, Volume 8, "Program-Specific Guidance About Exempt Distribution Licenses". Cosmedico Light, Inc., was issued a possession license by the Massachusetts Department of Public Health; a copy of the license is enclosed for your review.

If you have any questions or if we can provide you with additional information to expedite your review, please do not hesitate to call me at (781) 331-0949. Thank you very much and we look forward to timely approval of our application and receipt of our license.

Sincerely,

Steven Schlitt

Radiation Safety Officer

Enclosures

cc (w/enc.) B. York, Cosmedico Light, Inc.

B. Thomas, CHP – Integrated Environmental Management

022785

030-38187

NRC FORM 313 (3-2009) 10 CFR 30, 32, 33, 34, 35, 36, 39, and 40 **U.S. NUCLEAR REGULATORY COMMISSION**	**APPROVED BY OMB: NO. 3150-0120** **EXPIRES: 3/31/2012**
# APPLICATION FOR MATERIALS LICENSE	Estimated burden per response to comply with this mandatory collection request: 4.3 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

OFFICE OF FEDERAL & STATE MATERIALS AND
ENVIRONMENTAL MANAGEMENT PROGRAMS
DIVISION OF MATERIALS SAFETY AND STATE AGREEMENTS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

I CODE 23981

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
612 E. LAMAR BOULEVARD, SUITE 400
ARLINGTON, TX 76011-4125

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)* ☑ A. NEW LICENSE ☐ B. AMENDMENT TO LICENSE NUMBER ________ ☐ C. RENEWAL OF LICENSE NUMBER ________	2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)* **Cosmedico Light, Inc.** **233 Libbey Industrial Parkway** **Weymouth, MA 02189**
3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED **Cosmedico Light, Inc.** **233 Libbey Industrial Parkway** **Weymouth, MA 02189**	4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION **Steven Schlitt, Radiation Safety Officer** TELEPHONE NUMBER **(781) 331-0949**

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL a. Element and mass number; b. chemical and/or physical form; and c. maiximum amount which will be possessed at any one time.	6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.
7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.	8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.
9. FACILITIES AND EQUIPMENT.	10. RADIATION SAFETY PROGRAM.
11. WASTE MANAGEMENT.	12. LICENSE FEES *(See 10 CFR 170 and Section 170.31)* FEE CATEGORY **3. I** AMOUNT ENCLOSED $ **10,000.00**

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39, AND 40, AND THAT ALL INFORMATION CONTANED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER – TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
Steven Schlitt (Radiation Safety Officer)	Steven Schlitt	**11/06/2009**

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			$		
APPROVED BY				DATE	

022785

NUREG-1556, Vol. 8, Appendix J
Suggested Format for Providing Information Requested in Items 5 through 11 of NRC Form 313

(Cosmedico Light, Inc. response: ● = Confirmed/Yes/Included; ○ = Denied/No/Not Included)

Item No.		Suggested Response	Yes	Description Attached
5.	**RADIOACTIVE MATERIAL**			
	Unsealed and/or Sealed Sources			
	• For unsealed materials:			
	--	Provide element name with mass number, chemical and/or physical form, and maximum requested possession limit.	N/A	○
	--	For potentially volatile materials (e.g., I-125, I-131, H-3), specify whether the material will be free (volatile) or bound (non-volatile) and the requested possession limit for each form.	N/A	○
	• For sealed materials:			
	--	Identify each Radionuclide (element name and mass number) that will be used in each source.	●	● Attachment 1
	--	Provide the manufacturer's (distributor's) name and model number for each sealed source and device requested.	●	● Attachment 4
	--	Confirm that each sealed source, device, and source/device combination is registered as an approved sealed source or device by NRC or an Agreement State.	●	○
	--	Confirm that the activity per source and maximum activity in each device will not exceed the maximum activity listed on the approved certificate of registration issued by NRC or by an Agreement State.	●	○
	• Provide an Emergency Plan (if required).		N/A	○
	Financial Assurance and Recordkeeping for Decommissioning			
	No response is needed from most applicants. If F/A or a DFP is required, submit the required documents as described in Regulatory Guide 3.66.		N/A	○

Item No.	Suggested Response	Yes	Description Attached
6.	**PURPOSE FOR WHICH LICENSED MATERIAL WILL BE USED**		
	List the specific use or purpose of each radioisotope.	●	● Attachment 1
7.	**INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE**		
	RSO		
	Provide the name of the proposed RSO and information demonstrating that the proposed RSO is qualified by training and experience.	●	● Attachment 2
8.	**TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS (Occupationally Exposed Individuals and Ancillary Personnel)**		
	Submit a description of the radiation safety training program, including topics covered, groups of workers, assessment of training, qualifications of instructors, and the method and frequency of training.	●	● Attachment 3 (Section 5.2)
9.	**FACILITIES AND EQUIPMENT**		
	Describe the facilities and equipment to be made available at each location where radioactive material will be used. Include a description of the area(s) assigned for the receipt, storage, preparation and measurement of radioactive materials. Submit a diagram showing the locations of shielding, the proximity of radiation sources to unrestricted areas, and other items related to radiation safety. Diagrams should be drawn to a specified scale, or dimensions should be indicated.	●	● Attachment 3 (Section 5.3)
10.	**RADIATION SAFETY PROGRAM**		
	Material Receipt and Accountability		
	Develop and maintain procedures for ensuring material accountability,	●	● Attachment 3 (Section 5.11)
	Occupational Dose		
	Radiation exposures while handling electron tubes with less than 30 microcuries of Kr-85 represent radiation exposures less than 10 millirem per year to Cosmedico employees. Monitoring is not required.	○	● Attachment 3 (Section 5.5)

Item No.	Suggested Response	Yes	Description Attached
	Public Dose		
	No response is required from the applicant in a license application.	N/A	N/A
	Safe Use of Radionuclides and Emergency Procedures		
	Develop and maintain procedures for safe use and emergencies. State that such procedures have been developed.	●	● Attachment 3 (Section 5.13)
	If an emergency response plan is needed, submit it as a separate part of the application.	N/A	○
	Transportation		
	No response is needed from applicants during the licensing phase.	N/A	N/A
11.	**WASTE MANAGEMENT**	N/A	N/A
A	**NUREG 1556, Volume 8, Appendix J,** ***10 CFR 30.33 General Requirements***		
	(2) The applicant's proposed equipment and facilities are adequate to protect health and minimize danger to life or property.	●	● Attachment 3 (Section 5.3)
	(3) The applicant is qualified by training and experience to use the material for the purpose requested in such manner as to protect health and minimize danger to life or property.	●	● Attachment 2, Attachment 3, (Section 5.1)
B	**NUREG 1556, Volume 8, Appendix J,** ***10 CFR 32.14 Requirements for License***		
B1	Chemical and physical form and maximum quantity of byproduct material in each product	●	● Attachment 4
B2	Details of construction and design of product	●	● Attachment 4
B3	Method of containment or binding of byproduct material in product	●	● Attachment 4
B4	Procedures for prototype testing to demonstrate that the material will not become detached from the product or that byproduct Material will not be released under severe conditions	●	● Attachment 4
B5	Results of prototype testing	●	● Attachment 4

Item No.	Suggested Response	Yes	Description Attached
B6	Quality control procedures to be followed in the fabrication, and the quality control standards the product will be required to meet 10 CFR 32.15	●	● Attachment 5
B7	Proposed method of labeling or marking each unit, except for timepieces or hands or dials containing H-3 or PM-147, and its container with the identification of the manufacturer or initial transferor and the byproduct material.	●	● Attachment 6
B8	For products with limits specified in §30.15, 30 microcuries of Kr-85, the radiation level and method of measurement	●	● Attachment 4 (Section 4.**)
B9	Any additional information, studies, and tests regarding product safety	●	● Attachment ** (Section **)
C	Each product will contain no more than 30 microcuries of Kr-85, as specified in §30.15.	●	○

Attachment 1 - Application Items 5 and 6
Radioactive Material (Type, Form and Use)

Radionuclide	Chemical/Physical Form	Site Limit (millicurie)	Item Limit (millicurie)	Intended Use
Krypton - 85	Gas	300	0.03	For use and/or possession incident to the receipt, storage and distribution of electron tubes.

In the design and construction of the high pressure UV lamps to be marketed and distributed by Cosmedico, a trace amount of Krypton-85 is added to the major fill gas of the lamps. Kr85 functions as an ignition aid, lowering the required starting voltage, by providing a small degree of pre-ionization in the lamp envelope before ignition voltage is applied.

Attachment 2 - Application Item 7
Individual Responsible for Radiation Safety Program

Mr. Steven Schlitt, Director of Engineering and Quality Assurance, will serve as the Radiation Safety Officer for this license. His duties and responsibilities are stated in the Radiation Protection Plan, Section 5a (included herein as Section 10). His experience and training is provided below.

Education: Bachelor of Science degree, Electrical Engineering, College of Engineering, Worcester Polytechnic Institute, 1977.

Experience and Background:
Cosmedico Light, Inc. (Dec, 2008 - Present). Director of Engineering and Quality Assurance. Responsibilities include:

- In collaboration with suppliers, direct all new product programs for Cosmedico Light, Inc. (Cosmedico);
- Develop and administer product specifications for all Cosmedico purchased products;
- Evaluate all quality defects and develop preventative action programs;
- Approve all Cosmedico compatibility claims and submit necessary paperwork to the FDA;
- Prepare and administer training programs for technical departments of bed manufacturers; and
- Manage submittal and renewal of test agency (i.e. UL) approvals on all required products.

GTE Sylvania / OSRAM Sylvania (1977-2008). A total of 31 years of experience in the design, development and manufacturing of low pressure Hg discharge lamps. Breadth of responsibilities and knowledge included:

- test and measurements of lamps and associated control gear;
- interfacing between R&D and marketing and customers on new product development;
- new product development management, bringing new products to market from concept to the shop floor as an individual contributor and as a team leader;
- product/process improvement and cost reduction program management;
- document administration and author of Quality documents for ISO 9001;
- knowledge and practice of Six Sigma concepts and tools;
- implementation of Advanced Product Quality Planning procedures; and
- managing director of a team of R&D engineers at the OSI manufacturing plant in Drummondville, Canada.

Radiation Safety Training

The training class was completed on April 27, 2009. Training topics included:

- Principles and practices of radiation protection;
- Radioactivity measurements, monitoring techniques, and the use of instruments;
- Mathematics and calculations basic to the use and measurement of radioactivity;
- Biological effects of radiation applicable to the types and forms of radioactive material at Cosmedico;
- Safety practices applicable to protection from the radiation, chemical toxicity, and other properties of the radioactive materials in use at Cosmedico facilities; and
- Conducting radiological surveys and evaluating results.

The training also reviewed applicable Massachusetts Department of Public Health (MDPH), USNRC, USEPA, and OSHA regulations, as well as the terms and conditions of the radiation-related licenses and permits issued to Cosmedico by these agencies.

ISO 9001:2000
Integrated Environmental Management, Inc.
Certificate No. 03.0021

IEM
Integrated Environmental Management, Inc

3124 Sandlebrook Drive, Suite 1508 • Findlay OH 45840
Phone (419) 423-4701 • Fax (419) 423-7462

www.IEM-Inc.com

May 20, 2009

Steven Schlitt
Cosmedico Light, Inc.
233 Libbey Industrial Parkway
Weymouth, MA 02189

Re: Radiation Safety Officer Training

Dear Mr. Schlitt:

A radiation safety class was completed on April 22, 2009 to cover the requirements of the radioactive materials license and the safe handling of the electron tubes containing krypton 85. Enclosed is an outline of the topics that were covered during the class, a resume documenting my training and experience and a certificate documenting the training class.

Thank you very much for the opportunity of providing this training to you. In the meantime, if you have any questions, please do not hesitate to call me at (419) 423-4701.

Sincerely,

INTEGRATED ENVIRONMENTAL MANAGEMENT, INC.

BR Thomas

Bill Thomas, CHP, CIH
Vice President, Consulting

Cc: Carol Berger, IEM Maryland
File 2009005.01

exposure to hazardous materials, both chemical and radiation exposures. OHM employees encountered hot environments in Building X700 where chromic acid and uranium were present.

Health and Safety Manager during the remediation of mixed waste that was buried in several burial pits at the Ames Laboratory in Ames, Iowa. Mr. Thomas participated in the planning and execution of the project, including presentations at the public hearings that were provided by the DOE to the public. The waste in the burial pits contained a variety of hazardous materials, including radioactive uranium, thorium, and asbestos as well as volatile organics including methyl ethyl ketone and trichloroethylene. Mr. Thomas prepared the health and safety plan for the project which described the industrial hygiene practice, the construction safety requirements, and the elements of the health physics program. Mr. Thomas evaluated the controls that were implemented and verified that employee exposures were reduced to as low as reasonably achievable.

1990-1993 *Health and Safety Manager, IT Corporation, St. Louis, Missouri.* Provided direction day-to-day for laboratory operations in the areas of health physics, industrial hygiene, hazardous waste management, and laboratory safety. Served as the Radiation Safety Officer for the USNRC Broad Scope license for the use of by-product and source material at the laboratory.

Collateral assignment as Department Manager of a radiochemistry laboratory to analyze samples from a variety of commercial and government facilities, including facilities operated by the DOE. Services were provided to a variety of DOE facilities including Fernald, Idaho National Energy Laboratory, Lawrence Livermore National Laboratory, Nevada Test Site, Oak Ridge National Laboratory, Paducah Gaseous Diffusion Plant, Rocky Flats, WSSRAP, and the Y12 Production Facility. Supervised the analysis of various environmental media to be analyzed for specific radioactive isotopes including uranium, plutonium, thorium, and radium. Other analyses were performed for fission products and gross methods including alpha and beta analysis. Served as the RSO for the broad-scope license issued to the laboratory by the NRC.

Performed waste management assessment for four different DOE facilities. Principal investigator for hazardous and mixed waste policies, procedures and practices. Recommended program changes and upgrades. Worked at the following facilities, including: Portsmouth Gaseous Diffusion Plant, Piketon, Ohio; K25 Gaseous Diffusion Plant, Oak Ridge, Tennessee; Paducah Gaseous Diffusion Plant, Paducah, Kentucky; and Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Served as project manager for the Industrial Hygiene department at Los Alamos National Laboratory (HSE-5). Responsibilities included reviewing and making recommendations for several of the programs being implemented by HSE-5for the National Laboratory. These programs included asbestos controls, carcinogen control, sampling strategies and hazardous waste site characterization. Mr. Thomas also developed a sampling strategy to evaluate personnel exposures to hazardous materials. Mr. Thomas evaluated the asbestos management program at Los Alamos Laboratory. He reviewed the work performed by the IH department, including project oversight and air monitoring. He inspected work sites established by contractors including Pan American Services to assess compliance with LANL procedures and OSHA regulations.

Served as project manager to prepare mixed waste and radiative waste management plans and programs for waste generated during the remedial investigation at the Nevada Test Site. The programs required coordination between the Remedial Investigation contractor, the DOE Operations Area office and the facility receiving the waste for disposal.

1988-1990 *Director of Corporate Health and Safety, Burlington Environmental, Columbia, Illinois.* Responsible for designing and implementing health and safety programs to limit exposures to hazardous chemicals and radioactive material during sampling and remediation activities. Developed procedures and conducted training classes for field service personnel to correctly use personal protective equipment and perform air monitoring to evaluate personnel exposures.

Mr. Thomas also served on several audit teams to review the health physics programs at DOE site, including Rocky Flats, Los Alamos and the Nevada Test Site. The criteria for the audits were based on the DOE Technical Safety Appraisal objectives. Mr. Thomas worked with the program personnel to correct deficiencies and measure the effectiveness of the programs.

Member of Technical Advisory Group for Martin-Marietta Energy Systems. The Advisory Group provided oversight of the Federal Facility Agreement regarding the operation of the Low Level Radioactive Waste Tank Systems implemented for Oak Ridge National Laboratory. Made recommendations to implement standard industry practices for the purposes of reducing personnel exposures to hazardous and radioactive materials. Reviewed the elements of the industrial hygiene relating to the engineering controls and administrative controls implemented to reduce exposures to hazardous materials. Evaluated the effectiveness of the health physics programs for the purposes of reducing personnel exposures to radiation to as low as reasonably achievable.

Mr. Thomas reviewed the industrial hygiene and health physics programs being implemented at each facility. Used the Technical Safety Appraisal guidelines developed by DOE to critique the effectiveness of the programs begin implemented. Worked with each respective program managers, responsible for the H&S program, to develop an action plan to upgrade the program and track the progress of the changes.

Member of the Management Advisory Team for Martin Marietta Energy Systems Gaseous Diffusion Plants. The Advisory team reviewed the effectiveness of the Health and safety programs being implemented including the health physics and industrial hygiene programs. The Advisory Group was responsible for reviewing each of the health and safety programs and making recommendations for areas of improvement.

1983-1988 *Senior Health Physicist, IT Corporation, Oak Ridge, Tennessee.* Provided health physics and industrial hygiene consulting to government and commercial clients. Served as the project manager for several remedial decontamination projects involving hazardous and radioactive materials. His experience included:

Project CIH, Fernald Feed Materials Production Center, US Department of Energy Cincinnati, Ohio. May, 1987 - June, 1988. Performed health-and-safety review of engineering improvements at DOE uranium metals production facility. Improvements included new ventilation systems, radioactive materials handling systems, and decontamination of the facility. Recommended health physics and industrial hygiene controls to minimize worker's exposure, and updated air monitoring programs for both workplace exposures and effluent sampling.

Task Manager, Fernald Feed Materials Production Center, US Department of Energy Cincinnati, Ohio. August, 1985 - June, 1986. Mr. Thomas developed and implemented the collection and analysis of radiation measurement to assess the concentration of uranium in the soil surrounding the manufacturing facility. This work was performed as part of the site wide Remedial Investigation/ Feasibility study.

Health Physics Supervisor, Joliet, Illinois, Commonwealth Edison, September, 1984 - December, 1985. Provided support for the chemical cleaning of the primary cooling system at Dresden Nuclear Power Station, Unit 1. Mr. Thomas was responsible for assessment of engineering controls to reduce personnel exposures to radiation. The techniques were successful to remove more than 750 curies of cobalt-60 and other activation corrosion products. Personnel exposures were less than 7 man-Rems for the total project.

Health Physics Supervisor, Confidential Client, August 1983 - July, 1984. Provided support to decommission a facility that manufactured neutron sources (Am-Be) for nuclear power plants and radiography applications. The hot cells and glove boxes were segmented and packages in Type B shipping containers; the TRU waste shipped to Idaho Falls for storage and ultimate disposal by the USDOE. Drums of remote handled TRU were repackaged and characterized in order to satisfy the waste acceptance criteria for the USDOE. All work was performed in containments designed to minimize the spread of radioactive contamination, both airborne and surface contamination. Exposures to remediation workers was maintained below 1,000 millirem per person for the 15 month project; external exposures to gamma and neutron radiation were minimized. Internal exposures to

TRU. including plutonium and americium were evaluated and verified to satisfy the requirements of the USNRC.

1976-1983 *Senior Research Industrial Hygienist, Dow Chemical, Midland, Michigan and Tulsa, Oklahoma.* Provided health and safety support for employees in manufacturing facilities, including plastic and other intermediate chemical production. Assigned as lead health physicist for decontamination projects at several nuclear power plants. From 1977 to 1980, Mr. Thomas served as the radiation safety officer for a NRC broad scope license to authorize the use of mixed fission products and special nuclear material used in manufacturing and research applications at Dow Chemical. The program included a TRIGA reactor, two small accelerators, sealed radioactive sources and tracers for a variety of research programs. Mr. Thomas directed all elements of the health physics program including training, standard operating procedures, exposure assessment and documentation. Mr. Thomas later (1981 - 1983) served as the radiation safety officer for the field services division where sealed sources and mixed fission products were used in treatment systems. This assignment had responsibilities in 22 states for approximately 3,000 employees. Mr. Thomas directed the use of radioactive materials licenses in 16 different states and a NRC license for the use of these radioactive materials.

Professional Society Membership

Health Physics Society (Plenary member)

American Academy of Health Physics

American Industrial Hygiene Association

American Academy of Industrial Hygiene

Bibliography

Mr. Thomas has authored/coauthored many papers and technical reports. In addition, he has developed/presented training courses in the field of health physics, industrial hygiene and safety.

Other Appointments/Awards

Ohio Radiation Advisory Council. Appointed by Governor Taft in 2002. Elected Chair of the Council each year from 2004 through 2008. Appointment expires in 2010.

Ohio Utility Radiological Safety Board, Citizen's Advisory Council. Elected Chair in 2001 and 2002.

Member of the Working Group for the ANSI/HPS N43.8 Standard. *Classification of Industrial Ionizing Radiation Gauging Devices*, 2006-2008.

Director of the State of Ohio Low Level Radioactive Waste Facility Development Authority Board. Appointment by the Speaker of the Ohio State Legislature in 1997.

Chairman's Award for Safety Excellence, OHM Remediation Services. 1996, 1997

Senior Technical Associate, International Technology Corporation. 1991.

Member of the People to People Ambassador Delegation visiting the People's Republic of China, 1987. Invited speaker to review health physics practices.

Attachment 1
Radiation Safety Training Topics

Authorized User Training

The type and form of radioactive material present at Cosmedico
The location of MDPH and Cosmedico radiation protection policies and procedures
Applicable hazardous materials and Department of Labor requirements
Employee, management and contractor responsibilities for radiation safety
Identification of radiation postings, labels and barriers
Radiation Safety Procedures (RSPs)
Documentation and record keeping requirements
Cosmedico Emergency Preparedness Plan

Radiation Worker Training

Radioactivity and radioactive decay
Characteristics of ionizing radiation
Man-made radiation sources
Acute effects of exposure to radiation
Risks associated with occupational radiation exposures
Special considerations in the exposure of women of reproductive age
Dose-equivalent limits
Modes of exposure - internal and external
Dose-equivalent determinations
Basic protective measures - time, distance, shielding
Specific procedures for maintaining exposures as low as reasonably achievable
Radiation survey instrumentation - calibration, use and limitations
Radiation monitoring programs and procedures
Emergency procedures
Warning signs, labels, barriers and alarms

ATTACHMENT 2

Qualifications for Billy R. Thomas

Professional Qualifications

Mr. Thomas has over 29 years of senior-level experience in radiological and industrial hygiene activities with emphasis on systems to minimize personnel exposures to radioactive and hazardous materials, compliance with federal and state regulations, site and facility audits. Mr. Thomas has developed and implemented comprehensive programs for radiation and chemical protection programs. Mr. Thomas is actively involved in all aspects of health and safety including regulatory compliance, site decommissioning, program evaluation, applied health physics, occupational safety, training and project management.

Education

M.S., Environmental Health, University of Oklahoma, 1981

B.S., Health Physics, Oklahoma State University, 1976

Certifications

Certified Health Physicist (Comprehensive Practice), American Board of Health Physics, 1988. Recertified: 2008.

Certified Industrial Hygienist (Comprehensive Practice), American Board of Industrial Hygiene, 1984. Recertified : 2007.

OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) Training. Initial training 1987 and updated each year.

Lead Abatement Training for Supervisors, University of Cincinnati, 1996.

Asbestos Abatement Supervisor Course, Asbestos Consulting and Training Systems, 1997.

Authorized User - Maryland Department of the Environment Radioactive Materials License No. MD-31-281-01.

Experience and Background

2002-Present — *Vice President, Consulting Division, Integrated Environmental Management, Inc. Findlay, Ohio.* As the director of the company's consulting division, Mr. Thomas is responsible for selecting and coordinating the services of senior-level consultants in the areas of radiation safety and industrial hygiene. In addition, he maintains and ensures all members of the division maintain a track record of technical excellence, cost and schedule control, and innovation in solving environmental and health/safety problems for both government and commercial clients.

2008-Present — *Adjunct Instructor, College of Science, University of Findlay, Findlay, Ohio.* Serves as instructor for Environmental, Safety and Occupational Health Management program in the College of Science. Presents classes for both the graduate and undergraduate in topics related to safety management and industrial hygiene.

1999-2002 — *Senior Health Physicist, Integrated Environmental Management, Inc. Findlay, Ohio.* Provides high-quality radiation protection services to commercial and government clients. As a member of the client's response team, works with clients to promote an understanding of what is required to achieve and/or maintain compliance in the eyes of all pertinent regulatory agencies, individually or jointly; develop and overall strategy for achieving compliance and reduce liabilities in a technically-sound, legally defensible, and fiscally-conservative business manner; recommend specific solutions that are compatible with the client's operating philosophy; and provide insights into future regulatory issues and their impact as input to the client's long-range business planning and cost forecasting process.

Mr. Thomas served as the task manager to develop a baseline human heath risk assessment for a confidential client who previously processed enriched uranium and manufactured fuel pellets. The risk assessment was developed for potential exposures both hazardous chemicals and radioactive materials found in soil and groundwater. The assessment incorporated the requirements of the USEPA

Risk Assessment Guidance for Superfund (RAGS) as well as requirements established by the State authorities.

Mr. Thomas developed a Emergency Response and Preparedness Manual for a Canadian client who manufactured uranium pellets for nuclear power reactors. The manual was prepared in accordance with the guidance provided by the Canadian Nuclear Safety Commission (CNSC) and the U.S. Nuclear Regulatory Commission (USNRC). The manual addressed the resources to mobilize to an emergency, involving both hazardous chemicals and radioactive uranium in several different chemical forms. The manual was implemented by the client and approved by the CNSC.

A commercial client, licensed by the Nuclear Regulatory Commission, required an evaluation of their internal dosimetry program. Mr. Thomas prepared a procedure to measure both internal and external exposure. The procedure satisfied the recommendations established by the NCRP and ANSI as well as requirements established by the USNRC.

Mr. Thomas worked as part of a project team to develop decommissioning plans for six (6) different facilities licensed to process radioactive materials. The decommissioning plans established the derived concentration guidelines levels for a variety of radioactive isotopes, including enriched uranium, thorium and byproduct radioactive materials. The potential exposures to future residents were limited to less than twenty-five millirem per year and evaluated over a period of 1,000 years. The plans were compliant with the requirements established by the USNRC and NUREG 1757. Each plan was approved by the USNRC and implemented by the client in order to decommission the facility and terminate the license.

A commercial client required a plan to survey, remediate and ultimately release the building surfaces for unrestricted use. Mr. Thomas established the release criteria using and developed a procedure to complete the radiation survey. The procedure was consistent with the requirements established by the USNRC and NUREG 1575, MARSSIM.

Mr. Thomas completed radiation surveys to evaluate potential exposures to electromagnetic frequency (EMF) radiation in commercial manufacturing facilities. The evaluation of personal exposures were compared to recommendations published by the ACGIH and OSHA. Recommendations were provided to the clients to limit personnel radiation exposures and verify that exposures were acceptable.

1993-1999 *Director of Health and Safety, The IT Group, Findlay, Ohio.* Originally joined OHM Remediation Services in 1993. The IT Group purchased OHM in 1998. Duties including conducting site and facility health and safety audits, determination of personal protective equipment and respiratory protection equipment, supervising the development and implementation of site specific health and safety plans, and providing industrial hygiene training and services. He had direct accountability for health and safety compliance, including regulatory compliance with federal, state and local agencies. He implemented a comprehensive health and safety program for demolition and remediation activities by the Midwest region, which accumulated 2.3 million man-hours from March, 1994 to July, 1997 without a single lost time injury.

Safety and Health Manager, Kansas City PRAC II, Kansas City District. Duties on this HTRW contract included the development of safety and health plans as well as procedures to be implemented at each of the KC PRAC projects. Developed SSHP for specific KC PRAC projects including, Ottawa, Illinois, Galena, Kansas, Mead Nebraska, and Fort Riley, Kansas. Mr. Thomas provided specific support on the KC PRAC projects including:

Project CIH, Project CHP, Ottawa Radiation Sites, Ottawa, Illinois September 1994 – August 1997. Developed the site specific health and safety plan and radiation protection plan to excavate soil contained radioactive radium generated by a luminous processing company. This project involved the excavation of radioactive contamination from nearby residences and selected sites in the city. Worked with State of Illinois and the EPA to implement an effective contamination control program, including air sampling and personnel monitoring for radium. Provided radiation worker training for the work crew and directed the on-site health physics and industrial hygiene program for the initial phases of the project. Conducted site inspections and project audits on a periodic basis.

Safety and Health Manager, USACE, Omaha District Rapid Response II. Duties on this HTRW contract included the development of program procedures and policies to work on multiple USACE projects. Developed SSHP for specific Rapid projects, including work at Joliet, Illinois, Ames, Iowa and Des Moines, Iowa. Mr. Thomas conducted site inspections and provided technical support for the implementation of the site safety and health program for RR/IR task orders. Mr. Thomas provided support on each Rapid project, including:

Project CIH, Project CHP: Ames Laboratory Chemical Disposal Site, Ames, Iowa. July 1994 – November 1994. Developed the site specific health and safety plan for the excavation and disposal of approximately 1,000 cubic yards of radioactive uranium wastes and contaminated soils. Developed the radiation protection program to be implemented by project employees to reduce exposures to ionizing radiation to as low as reasonable achievable. Contaminated materials were packaged and shipped for disposal in Clive, Utah.

Safety and Health Manager, USACE, TERC Number 1. Duties on this contract included the development of SSHP for work at Ellsworth AFB in Rapid City SD and KI Sawyer AFB in Michigan. Mr. Thomas provided support for some of the TERC projects including:

Project CIH, Ellsworth AFB, OU2 and OU7, Rapid City South Dakota, November 1996 – September 1997. Developed the site specific health and safety plan to excavate radioactive materials from disposal trenches at OU2 and OU 7. Developed radiation protection plan as well as the release criteria to be implemented to document that the site was free of contamination. Worked with the USAF Radiation Safety Committee to establish protocols to identify plutonium in soil and verify that debris was handled correctly.

Project CIH, Tarracorp Industries, Granite City, Illinois April, 1993 – May, 1997. USACE Omaha PRAC II. Developed the site specific safety and health plan for this project to excavate and treat lead-contaminated soil from smelter emissions. Treatment was completed by stabilizing the soil using a pugmill. This process delists the soils to a "special waste" classification, resulting in key cost savings in disposal. To date, over 300 residential sites have been remediated, and over 100,000 tons of soil have been processed. Excavation, transportation, and disposal of wastes containing battery chips have also taken place. Developed the elements of the air monitoring program. The air monitoring program was sufficient to evaluate the personnel exposures to airborne lead dust, as well as the fugitive emission from the exclusion zone. Performed periodic site visits to review results of the air sampling program and confirm that exposures were acceptable.

Health and Safety Manager, Department of Energy, Weldon Spring Site Remedial Action Program (WSSRAP), April 1993 – July, 1995. OHM was contracted to excavate contaminated construction debris from the WSSRAP quarry. Materials in the quarry were accumulated from a munitions manufacturing facility at Weldon Spring, as well as the demolition of buildings from the Mallinckrodt site used during the Manhattan project. Personnel exposures to uranium and thorium were documented, as well as nitroaromatics and asbestos. Mr. Thomas completed site inspections to evaluate the effectiveness of the health and safety plan and review the results of employee exposure monitoring.

Health and Safety Manager during the demolition of selected manufacturing buildings at the WSSRAP. The demolition projects involved the controlled demolition of nine buildings. Employees encountered radioactive uranium as well as asbestos containing materials and cadmium based paints. Mr. Thomas evaluated the construction safety program as well as industrial hygiene program during the demolition tasks.

Health and Safety Manager during the remediation of facilities at the Piketon Gaseous Diffusion Plant in Portsmouth, Ohio. OHM was contracted to remediate a chromic acid tank, including the removal of the lead liner in Building X700. OHM also demolished the incinerator in Building X705A. Mr. Thomas prepared the health and safety plan to document the methods necessary to reduce employee

Attachment 3 - Application Items 8, 10 and 11

Radiation Protection Program Plan

High Pressure Lamp Storage Area

Cosmedico Light, Inc.

Weymouth MA

No. RSP-001
Rev. No. 02

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

Date: *11/5/09*

TABLE OF CONTENTS

No. RSP-001
Rev. No. 02

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

Date: *11/5/09*

1. PURPOSE

The goals of the Cosmedico Light, Inc., (Cosmedico) policy on radiological protection are to minimize the total risk of harm or injury experienced by employees, contractors, or visitors as a result of work-related activities, and to demonstrate compliance with applicable laws and regulations on their control. This Radiation Protection Program Plan has been developed to guide generation and implementation of Cosmedico operational procedures as they pertain to licensing, permitting and radiation protection issues.

2. SCOPE

This Radiation Safety Procedure (RSP) applies to all Cosmedico facilities, equipment and operations that involve the use of radioactive materials. Facilities, equipment and operations that do not involve radioactivity are exempt from the requirements of this Radiation Safety Procedure.

3. REFERENCES

3.1 105 CMR 120.001, "General Provisions".

3.2 105 CMR 120.100, "Licensing of Radioactive Material".

3.3 105 CMR 120.200, "Standards for Protection Against Radiation".

3.4 105 CMR 120.750, "Notices, Instructions, and Reports to Workers: Inspections" describes training information.

3.5 105 CMR 120.770, "Packaging and Transportation of Radioactive".

3.6 Massachusetts Department of Public Health, Radiation Control Program, Radioactive Materials License issued to Cosmedico.

3.7 Regulatory Guide 3.0 - Massachusetts Department of Public Health, Radiation Control Program, "Guide for the Preparation of Applications for Licenses for Non-medical Use of Radioactive Material", Regulatory Guide No. 3.0, Revision 1.0, May 1995.

4. DEFINITIONS

4.1 Agreement State - Any state with which the U. S. Nuclear Regulatory Commission has entered into an effective agreement under the Atomic Energy Act for regulation of byproduct, source or special nuclear material.

4.2 ALARA (acronym for "as low as is reasonably achievable") - Making every reasonable effort to maintain exposures to radiation as far below the regulatory dose limits as is practical consistent with the purpose for which the licensed activity is undertaken, and taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and in relation to the utilization of licensed materials in the public interest.

4.3 Approval - An act of endorsing or adding positive authorization or both.

4.4 Authorized User - Employees who supervise the use of radioactive material and who supervise individuals who work with radioactive material. Authorized users are qualified, by training and experience, to assure radioactive material is used for its intended purpose in a manner that protects health and minimizes danger to life or property.

4.5 Calendar Quarter - A time period of three (3) months beginning in January, April, July, or October. For demonstration of compliance, a calendar quarter shall not exceed four (4) months.

4.6 Calendar Year - A time period of 12 months that begins in January. For demonstration of compliance, a calendar year shall not exceed 15 months.

4.7 Calibration - Determining the response of an instrument relative to a series of reference values over the range of the instrument; or the strength of a source of radiation relative to a reference standard.

4.8 Dosimeter - A device used to measure an individual's exposure to a radiation environment when the hazard is cumulative over long intervals of time, typically in excess of 30 days. Workers who are exposed to ionizing radiation may be required to wear dosimeters so that their employers are able to maintain a record and demonstrate that exposures are below regulatory limits. Common types of wearable dosimeters for ionizing radiation include quartz fiber dosimeters, film badge dosimeters, thermoluminescent dosimeters (or TLD), reflecting optical dosimeters, or solid state (MOSFET or silicon diode) dosimeters.

4.9 Extremity - The arms below the elbow and the legs below the knee.

4.10 Eye Dose Equivalent (HE) - The dose equivalent to the lens of the eye from external whole body exposure at a tissue depth of 0.3 centimeter.

4.11 General Employee - Any employee, visitor, or contractor who is permitted unescorted access to the controlled area.

4.12 Health Physics Technician (HP Technician) - Personnel who perform work at Cosmedico involving radioactive materials, such as inventory/management, receiving activities, shipping/receiving activities, release surveys, area surveys, radiation survey records maintenance, and quality assurance activities as they pertain to radiation surveys.

4.13 License - A radioactive materials license issued by the MDPH, USNRC or an Agreement State in accordance with the regulations adopted by the USNRC or the Agreement State.

4.14 Licensed Material - Radioactive material used in sufficient quantity, type or concentration to require licensing by a state or federal regulatory agency.

4.15 May - The word may is used to denote permission.

4.16 MDPH - An acronym for the "Massachusetts Department of Public Health", a state regulatory agency.

4.17 Milliroentgen per hour (mR/hr) - A unit of gamma exposure rate. One mR/hr shall be equivalent to 1000 μR/hr.

4.18 Minor change - Refers to changes to RSPs. A minor change is one that does not substantively affect the actions required in the procedure. Typographical changes, formatting changes and changes that do not affect radiation safety are considered to be minor changes.

4.19 Monitored Employee or Personnel - An individual who performs work with radioactive materials and has the potential to receive greater than 500 millirem total effective dose equivalent in one calendar year.

4.20 Optical Dosimeter - A device used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words optical dosimeter and dosimeter may be used interchangeably in this RSP.

4.21 Posting - Signs, labels, placards or other devices used to indicate the presence of radiological conditions.

4.22 President - Senior official of the corporation and a designated senior manager of Cosmedico with the authority to commit Cosmedico resources for health and safety purposes, and with administrative influence over all participants in radiation protection activities.

4.23 Radiation - Ionizing radiation: alpha particles, beta particles, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in this RSP, does not include non-ionizing radiation, such as radio- or micro-waves, or visible, infrared, or ultraviolet light.

4.24 Radiation Detection Instrument - A device, consisting of a detector and a ratemeter, that detects and records certain characteristics of ionizing radiation.

4.25 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Radiation Protection Program Plan for Cosmedico. The RSO is qualified to direct the use of radioactive material for their intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.26 Radiation Safety Procedure (RSP) - A document that specifies or describes how an activity is to be performed. It may include methods to be employed, equipment or materials to be used and sequence of operations.

4.27 Radiation Survey Instrument - A hand-held radiation survey instrument capable of detecting ionizing radiation.

4.28 Radiation Worker - An occupational worker who may enter radiological areas and/or who has the potential to receive greater than 100 millirem TEDE in a calendar year.

4.29 Radioactive Material - Any solid, liquid or gaseous substance which emits radiation spontaneously.

4.30 Radioactive Material Storage Area - An area where radioactive materials are secured from unauthorized removal or access, or where constant surveillance over the materials is maintained.

4.31 Records - A completed document that furnishes evidence regarding various radiological activities. Examples include radiological survey, sample count, calibration, quality assurance, and stop work records.

4.32 RSP - see Radiation Safety Procedure

4.33 Semi-annual - A time period that consists of six (6) months. For compliance purposes, semi-annual shall not exceed eight (8) months.

4.34 Shall - The word shall is to be understood as a requirement.

4.35 Shallow Dose Equivalent (HS) - The dose equivalent from external whole body exposure at a tissue depth of 0.007 centimeter, averaged over an area of one (1) square centimeter.

4.36 Should - The word should is to be understood as a recommendation.

4.37 Stop Work Order - The authority delegated to responsible individuals to shut down or prevent a job from starting if the job may violate regulatory (or other) requirements for radiological protection or if unsafe working conditions are present.

4.38 Total Effective Dose Equivalent (TEDE) - The sum of the deep dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). Using the terminology in 105 CMR 120.200, the TEDE is equivalent to the sum of the deep dose equivalent (external) and the committed effective dose equivalent (internal).

4.39 Unrestricted Area - Any area to which access is neither limited nor controlled.

4.40 Unrestricted Use - Equipment, components, materials, land areas (property), and other items that may be used, transferred, sold, or disposed of without regard for their radiological constituents.

4.41 Visitor - A company individual who is not assigned to the Cosmedico facility or non-company personnel such as vendors, contractors, inspectors, auditors or observers.

5. PROCEDURE

5.1 Radiation Protection Program and Administration

5.1.1 President

5.1.1.1 Overall control and authority for radiation protection shall rest with the President.

5.1.1.2 The responsibility of the President includes, but is not limited to, the following:

5.1.1.2.1 Establish the Cosmedico policy and prepare/amend this RSP accordingly; and

5.1.2.2 Assure that Cosmedico radiation protection services are sufficient to meet the requirements of this Plan and MDPH license requirements.

5.1.1.3 The President may designate the authority for implementing the radiation protection program described herein to the Radiation Safety Officer.

No. RSP-001
Rev. No. 02
Date: 11/5/09

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

5.1.2 Radiation Safety Officer (RSO)

5.1.2.1 The RSO shall be responsible for recommending the type and number of staff and resources necessary for full implementation of this RSP.

5.1.2.2 The RSO shall have the responsibility and authority to terminate any work activities that do or may violate regulatory or Cosmedico requirements for radiological protection, including:

5.1.2.2.1 Specific work activities shall be permitted to proceed to a safe condition after issuance of the stop-work order.

5.1.2.2.2 Stop-work orders shall be lifted only after the initiating conditions have been alleviated.

5.1.2.3 Other duties and responsibilities of the RSO shall include the following:

5.1.2.3.1 Assessment of radiological hazards and ensure the implementation of appropriate radiation safety precautions;

5.1.2.3.2 Ensuring that the use of licensed material is by or under the direct supervision of Authorized Users;

5.1.2.3.3 Ensuring all personnel trained in the necessary radiation safety aspects of their job;

5.1.2.3.4 Ensuring that all users participate in the necessary exposure monitoring;

5.1.2.3.5 Ensuring licensed materials are accounted for, secured against unauthorized removal at all times when not in use, and disposed of properly;

5.1.2.3.6 Investigating incidents and events;

5.1.2.3.7 Performing routine inspections of all applicable storage areas and annual program audits; and

5.1.2.3.8 Ensuring that the terms and conditions of MDPH license are met, and that all required records are maintained.

No. RSP-001
Rev. No. 02
Date: 11/5/09

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

5.1.3 The minimum qualifications of the RSO shall include the following:

5.1.3.3.1.1 Bachelor's degree (or equivalent);

5.1.3.3.1.2 Hands-on experience with radioactive material;

5.1.3.3.1.3 Course work and/or experience with the following:

5.1.2.4.3.1 Principles and practices of radiation protection;

5.1.2.4.3.2 Biological effects of radiation applicable to the types and forms of radioactive material at Cosmedico;

5.1.2.4.3.3 Safety practices applicable to protection from the radiation, chemical toxicity, and other properties of the radioactive materials in use at Cosmedico facilities;

5.1.2.4.3.4 Conducting radiological surveys and evaluating results; and

5.1.2.4.3.5 Familiarity with applicable MDPH, USNRC, USEPA,and OSHA regulations, as well as the terms and conditions of any radiation-related licenses and permits issued to Cosmedico by these agencies.

5.1.2.5 The RSO shall be an employee of Cosmedico.

5.1.2.6 If the RSO is absent for more than 60 calendar days:

5.1.2.6.1 A new RSO shall be named.

5.1.2.6.2 Notification of such, including the name, qualifications and authority of the new RSO, shall be submitted to the MDPH.

5.1.2.6.3 The new RSO shall be designated "Acting RSO" until such time as the MDPH has concurred with his/her qualifications.

5.1.3 Authorized Users

5.1.3.3 The RSO may designate authority for implementing certain aspects of the radiation protection program to Authorized Users.

5.1.3.2 There shall be at least one (1) Authorized User at Cosmedico whenever licensed radioactivity is in use and for the duration of the MDPH license.

5.1.3.3 Authorized Users shall have the following minimum qualifications prior to assuming this position:

5.1.3.3.1 Hands-on experience with the type of radioactivity to be used under his/her supervision, including the following;

5.1.3.3.1.1 Characteristics of ionizing radiation;

5.1.3.3.1.2 Basic radiation protection principles, quantities and units;

5.1.3.3.1.3 Biological effects of radiation applicable to the types and forms of radioactive material at Cosmedico;

5.1.3.3.1.4 An understanding of the type, form, and authorized uses of radioactive materials at Cosmedico;

5.1.3.3.1.5 An understanding of the provisions of this RSP; and

5.1.3.3.1.6 Training in the topics shown in Attachment 8.1.

5.1.3.4 The responsibilities and authority of Authorized Users may include the following:

5.1.3.4.1 Determining the type, amount and use of radioactive material;

5.1.3.4.2 Monitoring and maintaining equipment associated with the use, storage and disposal of licensed radioactive material under their control;

5.1.3.4.3 Serving as custodian opf sealed sources

5.1.3.4.4 Ensuring service personnel are not permitted to work on equipment, storage cabinets, etc, in restricted areas without RSO approval

5.1.3.4.5 Informing the RSO of personnel changes and procedure or equipment alterations;

5.1.3.4.6 Complying with procedures for terminating the use of radioactive materials in storage areas;

5.1.3.4.7 Supervising the use of radioactive material by employees, visitors or contractors; and

5.1.3.4.8 Ensuring that personnel working under their supervision:

5.1.3.4.8.1 Are trained in the safe use of the radioactive material;

5.1.3.4.8.2 Secure radioactive materials against tampering, loss, theft or unauthorized removal; and

5.1.3.4.8.3 Comply with the requirements of this RSP.

5.1.4 Employees

5.1.4.1 Individual users of radioactive material shall perform all work under the direction of an Authorized User.

5.1.4.2 Employee shall report unusual conditions or circumstances involving radioactive material that may lead to hazardous work conditions or a violation of license requirements to the Authorized User or RSO.

5.2 Training in Radiation Protection

5.2.1 All Cosmedico employees, visitors and contractors shall receive initial training in radiation protection prior to unescorted access being granted, and refresher training annually thereafter.

5.2.2 Training may consist of General Employee Training (GET), Visitor Training and/or special briefings, as determined by the RSO.

5.2.3 GET shall be required for all employees with the potential to exceed 100 millirem TEDE per calendar year.

Note: General employee training is not required at Cosmedico because the potential radiation exposure is less than 10 mrem per year.

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

5.2.4 All personnel permitted unescorted access to the warehouse in order to do work, shall receive Visitor Training prior to the start of work and annually thereafter.

Note: Examples of applicable personnel are office workers, cleaning crews and facility maintenance personnel.

5.2.5 Personnel who enter the warehouse infrequently or for reasons other than to do work may, at the discretion of the RSO, receive Visitor Training.

Note: An example of these personnel are visiting researchers, consultants or observers who are not assigned to work in the area, but who enter the area in order to meet with an Authorized User.

5.2.6 GET, Radiation Worker Training, and Visitor Training programs shall:

5.2.6.1 Address the pertinent requirements of 105 CMR 120.200, as applicable.

5.2.6.2 Include, as a minimum, the topics shown in Attachment 8.1.

5.3 Facilities and Equipment

5.3.1 Radioactive materials shall be used/stored in the warehouse described in Attachment 8.2.

5.4 Instrumentation

5.4.1 No radiation survey instrument will be maintained by Cosmedico.

Note: The electron tubes used by Cosmedico contain an exempt quantity of Kr-85 such that the potential external radiation dose to a person handling the tube is less than 0.1 mrem per hour on contact. Routine monitoring and surveys are not required by the MDPH.

5.5 Exposure Control

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

5.5.1.2 The President shall ensure that sufficient trained personnel are available to perform each operation such that administrative exposure goals of 50% of the applicable regulatory limit are not reached.

5.5.2 Persons under 18 years of age shall not be permitted unescorted access to radiologically-restricted areas at Cosmedico facilities.

5.5.3 Individual monitoring of personnel working with the electron tubes and their shipping containers for external exposure is not required.

Note: In general, routine work in the warehouse and handling electron tubes with less than 30 microcuries of Kr-85 represent a potential for external exposure of less than 100 microR per hour on contact and less than five (5) microR per hour at a distance of 30 cm. Assuming constant and continuous presence at 30 cm for a full (2,000-hour) working year, the annual dose potential is less than 10 millirem. Therefore, routine monitoring for external exposures is not required.

5.5.4 Individual monitoring for internal radiation exposure is not required for personnel working with the electron tubes and their shipping containers.

Note: The electron tubes contain Kr-85, which is biologically inert (i.e., is not taken up by the body). Therefore, in the event of a breach of a tube, no uptake will occur and routine internal exposure monitoring is not required.

5.6 Control of Work

5.6.1 Routine working conditions at Cosmedico that may cause an individual to incur a radiation dose of less than 100 millirem TEDE per calendar year shall require no specific controls.

Note: The electron tubes contain less than 30 microcuries of Kr-85. In the event of a breach of one or more tubes, resulting in the release of radioactivity, the dose potential is less than one millirem TEDE (see Attachments 8.5 and 8.6).

5.6.2 Distribution of devices to non-licensees shall be performed pursuant to USNRC License issued to Cosmedico, for exempt distribution.

5.7 ALARA Program

5.7.1 While occupational radiation exposures incurred by employees or visitors of Cosmedico historically are low, for radiation protection purposes, all exposures shall be assumed to entail some risk to the employee.

5.7.2 The following principles shall govern all work activities with the potential for exposure to radiation or radioactive materials:

5.7.2.1 Activities and operations shall produce a positive net benefit.

5.7.2.2 All radiation exposures shall be kept as low as reasonable achievable (ALARA) in light of economic and societal costs.

5.7.2.3 Radiation exposures received by individuals shall not exceed the radiation dose limits described above

5.7.3 ALARA activities shall include the following:

5.7.3.1 A corporate program shall be established that integrates management philosophy and regulatory requirements, with specific goals and objectives for implementation included.

5.7.3.2 The RSO shall establish applicable and appropriate radiological goals to direct all levels of management and workers at Cosmedico toward improvement in radiological performance.

5.8 Receipt and Control of Radioactive Materials

5.8.1 Purchase of radioactive materials shall require the written approval of the RSO.

Note: RSO approval serves as an indication that Cosmedico is licensed/permitted to possess the materials solicited, and that the materials, once received, will be incorporated into the routine surveillance and accountability program

5.8.2 Packages shall be received as described in Attachment 8.3 of this RSP.

5.8.3 Incoming packages, known or suspected to contain radioactivity at levels significantly higher than background, shall be monitored for exposure rate, pursuant to 105 CMR 120.200 and as described in Attachment 8.4 of this RSP.

5.8.4 Radioactive material shall be marked as such to ensure proper handling and storage.

Note: Markings may include tags or stickers indicating "Radioactive Materials."

5.8.5 Items identified as radioactive materials shall be maintained in a radioactive material storage area established for this purpose within a restricted area.

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

5.9 Surveillance

5.9.1 Routine exposure rate surveys and other surveillance activities as described in 105 CMR 120.200, are not required to handle and store exempt quantities of Kr-85. No surveys will be performed at the Cosmedico facilities.

Note: Surveys, required by the MDPH, are performed in order to ensure licensed material is used, transported and stored in such a way that doses to members of the public do not exceed the limits shown above, that the exposure rate in any unrestricted area does not exceed two (2) mR per hour from licensed operations.

5.9.2 Non-routine surveys may be performed at the discretion of the RSO or any time there is reason to suspect that radiation may exceed pre-determined action levels.

5.10 Posting and Labeling

Posting/labeling shall be performed pursuant to 105 CMR 120.200.

5.11 Radioactive Material Accountability

5.11.1 The amount of radioactive material received by or shipped from Cosmedico shall be added to or debited from a radioactive material inventory log maintained for that purpose.

5.11.2 The log shall be maintained to assure compliance with maximum possession limits established in MDPH license issued to Cosmedico.

5.11.3 The amount of radioactive material on hand shall be summarized using inventory records at least once per quarter.

5.11.4 A physical inventory of tubes on hand and the associated radioactive material shall be reconciled once per year.

5.12 Packaging and Transportation of Radioactive Material

5.12.1 Shipment of radioactive materials shall require the written approval of the RSO.

5.12.2 Material deemed radioactive by the Department of Transportation (DOT) shipped from Cosmedico shall be packaged, surveyed, labeled, and shipped in accordance with 105 CMR 120.770.

Note: The DOT defines radioactive materials as those that contain a total of 2,000 pCi of radioactivity per gram.

5.12.3 Prior to shipment of specifically-licensed materials, the RSO shall obtain confirmation that the receiver is licensed to receive the type, quantity and form of radioactive material present in the shipment.

Note: Securing a copy of the recipient's radioactive materials license is the recommended method of confirmation.

5.13 Emergency Response and Notifications

5.13.1 For emergencies where radioactive materials may be involved, consideration shall be given to exposure to radioactive materials and ionizing radiation in addition to the other hazards present.

5.13.2 If it is known or suspected that an internal or external dose limit has been exceeded:

5.13.2.1 The RSO shall be notified immediately.

5.13.2.2 The RSO shall evaluate the likelihood and magnitude of the radiation exposure, and shall implement appropriate follow-up actions as soon as possible after notification.

5.13.3 The RSO and the President shall notify the MDPH of events as required by 105 CMR 120.200.

Note: Attachment 8.5 of this RSP contains a radiation dose analysis associated with the breach of a single Kr-85-bearing tube. Attachment 8.6 contains the dose analysis associated with the breach of all of the tubes in a 100- unit box.

5.14 Control of Radioactive Waste

Note: Under routine working conditions, no radioactive waste is generated at Cosmedico.

5.14.1 Radioactive waste materials shall be controlled by the following:

5.14.1.1 Preventing materials from becoming unnecessarily and/or excessively contaminated;

5.14.1.2 Decontaminating and reusing radioactive materials such as tools and equipment;

5.14.1.3 Monitoring materials for radioactivity and removing non-radioactive materials prior to disposal; and

5.14.1.4 Using waste volume reduction techniques if practical.

5.14.2 Radioactive waste shall be stored on site or disposed of by one of the following means:

5.14.2.1 Transfer to an authorized recipient as provided in 105 CMR 120.200 (or other applicable state or federal requirement); and

5.14.2.2 Any other means specifically approved in advance by the MDPH.

5.14.3 Manifests, Certificates of Disposal or other documentation to confirm transfer and disposal shall be maintained by the RSO.

5.15 Radiation Protection Records

5.15.1 The RSO shall maintain records sufficient to:

5.15.1.1 Document implementation of this RSP;

5.15.1.2 Demonstrate compliance with applicable MDPH license and permit requirements; and

5.15.1.3 Identify all areas where licensed materials is used as input to site decommissioning

5.15.2 The following records shall be preserved and maintained until license termination, at which time the records shall be transferred to the MDPH:

5.15.2.1 Individual employee records and analyses performed using employee exposure records.

5.15.2.2 Records of radiation dose incurred by members of the general public.

5.15.2.3 Records of waste disposal.

5.15.2.4 Records of Radiation Safety Training.

5.15.3 All other records shall be maintained pursuant to Appendix A of Regulatory Guide 3.0, Cosmedico corporate policy and the advice of legal counsel.

5.16 Radiation Safety Procedures

5.16.1 Radiation Safety Procedures (RSPs) may be generated to guide the implementation of this RSP.

5.16.2 The preparation, distribution and use of RSPs shall be controlled.

5.16.3 All RSPs shall be signed by the President and the RSO prior to their implementation.

5.16.4 Approval signatures shall signify the RSP is adequate for its intended use, that it meets the requirements of this RSP, and that all provisions of the MDPH license are met.

5.16.5 RSPs shall be reviewed by the RSO and the Authorized Users for continued applicability, effectiveness and compliance with this RSP at least once per year.

5.16.6 This RSP (RSP-001, "Radiation Protection Program Plan") shall require amendment to the MDPH license issued to Cosmedico, prior to revision or discontinuation.

5.17 Periodic Program Review

5.17.1 All activities conducted as part of this RSP shall be subject to quality assurance provisions and an annual review per 105 CMR 120.200.

5.17.2 Limited-scope audits/assessments of the radiation protection program should be conducted by the RSO (or designee) to determine compliance with applicable federal/state regulations, applicable license requirements, and this RSP.

5.17.3 The following programmatic elements shall be audited for compliance and continued applicability at a frequency of at least once per year:

5.17.3.1 Radiation safety training

5.17.3.2 Training of radiation protection personnel

5.17.3.3 Documentation and records

5.17.3.4 Radioactive materials accountability

5.17.3.5 ALARA

5.17.3.6 Shipping/receiving radioactive material

EXEMPTION PROVISIONS

6.1 Minor changes to this RSP shall be permitted pursuant to the written authorization of the RSO.

6.2 Other variances and exceptions to the requirements of this RSP shall be permitted pursuant to the written authorization of the RSO, the President, and after amendment of the MDPH license.

7 DOCUMENTATION

None

8 ATTACHMENTS

8.1 Required Training Topics

8.2 Locations Where Licensed Materials May be Used/Stored

8.3 Procedure for Ordering and Receiving Radioactive Materials

8.4 Procedure for Receiving Radioactive Materials

8.5 Potential radiation exposure when a single glass tube breaks

8.6 Potential radiation exposure when a box of tubes breaks

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

ATTACHMENT 8.1
REQUIRED TRAINING TOPICS

Visitor Training and Hazard Communication Training
Identification of radiation postings, labels and barriers.
Location of electron tubes stored in the warehouse.
How to contact and interact with the radiation safety staff.

General Employee Training
The type and form of radioactive material present at Cosmedico.
The location of MDPH and Cosmedico radiation protection policies and procedures.
Employee, management and contractor responsibilities for radiation safety.
Identification of radiation postings, labels and barriers.
Cosmedico Emergency Preparedness Plan
How to contact and interact with the radiation safety staff.

Radiation Worker Training
Radioactivity and radioactive decay.
Characteristics of ionizing radiation.
Man-made radiation sources.
Acute effects of exposure to radiation.
Risks associated with occupational radiation exposures.
Special considerations in the exposure of women of reproductive age.
Dose-equivalent limits.
Modes of exposure - internal and external.
Dose-equivalent determinations.
Basic protective measures - time, distance, shielding.
Specific procedures for maintaining exposures as low as reasonably achievable.
Radiation survey instrumentation - calibration, use and limitations.
Radiation monitoring programs and procedures.
Emergency procedures.
Warning signs, labels, barriers and alarms.
The type and form of radioactive material present at Cosmedico.
The location of MDPH and Cosmedico radiation protection policies and procedures.
Applicable hazardous materials and Department of Labor requirements/procedures.
Employee, management and contractor responsibilities for radiation safety.
Cosmedico Emergency Preparedness Plan
Responsibilities of employees and management.
How to contact the radiation safety staff.

Authorized User Training
Radiation Worker Training
Regulations and license requirements
Radiation Safety Procedures (RSPs)
Documentation and record keeping requirements

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

ATTACHMENT 8.2

LOCATIONS WHERE LICENSED MATERIALS MAY BE USED/STORED

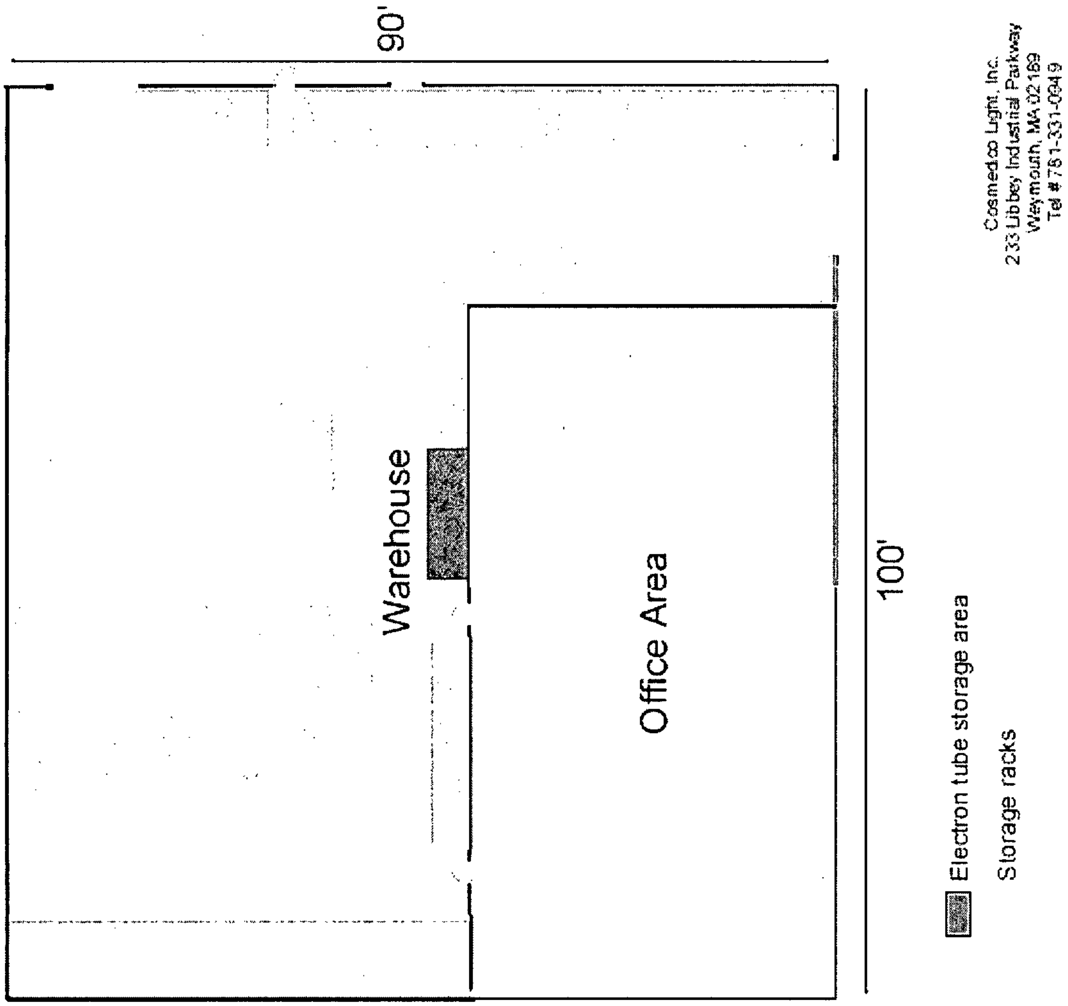
Room*,*	**Activity Performed**	**Equipment Used**
Warehouse	Store shipping packages containing electron tubes.	No equipment is used in the warehouse.
Shipping/ Receiving	Inspect packages being received and fill packages being shipped offsite.	Visual inspection when receiving electron tubes. Verification before shipping offsite.

* See attached floor plans
** Specific room designations are current as of the date of this RSP.

No. RSP-001
Rev. No. 02

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

Date: *11/5/09*

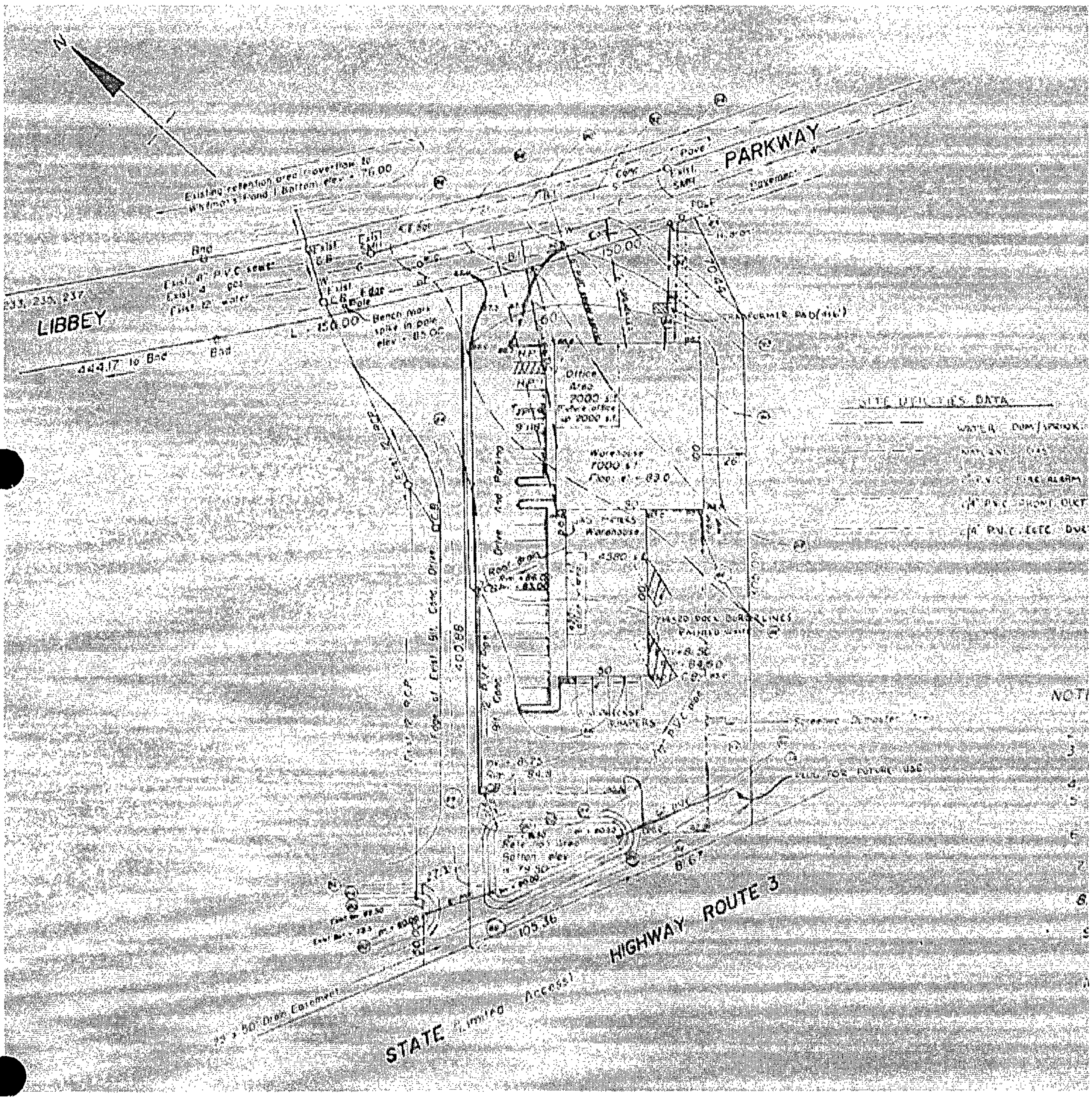


Approx. Dimensions of Electron Tube Storage Area
24' Wide X 26' High x 4' Deep

No. RSP-001
Rev. No. 02

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

Date: *11/5/09*



No. RSP-001
Rev. No. 02
Date: *11/5/09*

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

ATTACHMENT 8.3

PROCEDURE FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL

This procedure was originally developed by the MDPH and modified for work with Cosmedico and the receipt of electron tubes containing Kr-85.[1] It is equivalent to Appendix H of the MDPH Application Guide.

For packages received under the specific license, authorized individuals shall implement procedures for opening each package as follows:

1. The Radiation Safety Officer (RSO) must ensure that the requested material and quantities are authorized by the license and that possession limits are not exceeded.

2. During normal working hours, carriers must be instructed to deliver radioactive packages directly to the Receiving Department.

3. During off-duty hours, security personnel must accept delivery of radioactive packages as described below.

a. If the package is wet or appears to be damaged, immediately contact the facility's RSO.

b. Any packages containing radioactive material that arrive between 5:00 P.M. and 7:00 A.M. or on Sundays shall be signed for by a Cosmedico employee and taken immediately to the Receiving Department.

c. Place the package in the designated storage area and lock the door.

d. Contact phone numbers:

RADIATION SAFETY OFFICER (RSO): Mr. Steve Schlitt

OFFICE PHONE: (781) 331-0949

HOME PHONE: (978) 346-8541

Massachusetts Radiation Control Program 24-hour Phone: (617) 242-3453

Massachusetts Radiation Control Program Ordinary Business Phone: (617) 242-3035

---

[1]Massachusetts Department of Public Health, Radiation Control Program, *Guide for the Preparation of Applications for Licenses for Non-medical Use of Radioactive Material*, Appendix H, Regulatory Guide No. 3.0, Revision 1.0, May 1995.

No. RSP-001
Rev. No. 02

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

Date: *11/5/09*

ATTACHMENT 8.4

PROCEDURE FOR SAFELY OPENING RADIOACTIVE MATERIAL PACKAGES

This procedure was originally developed by the MDPH and modified for work with Cosmedico and the receipt of electron tubes containing Kr-85.[2] It is equivalent to Appendix I of the MDPH Application Guide.

For packages received under the specific license, authorized individuals shall implement procedures for opening each package as follows:

1. Visually inspect the package for any sign of damage (e.g., wetness, crushed). If damage is noted, stop and notify the Radiation Safety Officer (RSO).

2. Monitor all packages for the presence of radiation levels if there is evidence of degradation of package integrity, such as packages that are crushed, wet, or otherwise damaged.

Note: Monitoring the external surfaces of a labeled package for radioactive contamination is not required for electron tubes containing gaseous Kr-85. The gas will escape to the ambient atmosphere and does not create contamination on the packaging materials.

3. Package inspection shall be performed as soon as practical after receipt of the package, but not later than three (3) hours after the package is received at Cosmedico's facility if it is received during normal working hours. If a package is received after working hours, and has no evidence of degradation of package integrity, the package shall be inspected no later than three (3) hours from the beginning of the next working day.

4. Open the outer package (following supplier's directions if provided) and remove packing slip. Open inner package to verify contents (compare requisition, packing slip, and label on electron tubes). Check integrity of the electron tube containers, visually inspecting for breakage of tubes. If anything is other than expected, stop and notify the RSO.

5. Obliterate any radiation labels on shipping container prior to discarding in regular trash.

6. The final carrier and the Agency shall be immediately notified by telephone and shall confirm the initial contact within 24 hours by overnight letter or telefax to the Agency, when external radiation levels exceed the limits of 105 CMR 120.785(I) and(J).

---

[2]Massachusetts Department of Public Health, Radiation Control Program, *Guide for the Preparation of Applications for Licenses for Non-medical Use of Radioactive Material*, Appendix I, Regulatory Guide No. 3.0, Revision 1.0, May 1995.

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

ATTACHMENT 8.5

POTENTIAL RADIATION EXPOSURE WHEN A SINGLE GLASS TUBE BREAKS

Exposure Scenario

The potential for radiation exposure was evaluated for a single employee handling an electron tube containing 30 microcuries of gaseous Kr-85. It is assumed that the glass tube breaks and 100% of the radioactive gas is allowed to escape, including in the breathing zone of the employee. The employee is assumed to leave the room within the 30 minutes after the tube breaks and is more likely to leave in less than 5 minutes. It is assumed that the room where the employee is working is the Shipping and Receiving area, or a room that has a floor area of approximately 1,100 square feet (100 square meters, m^2) and a ceiling height of 10 feet (3 m). This room has an air volume of approximately 3,300 ft^3 ($300m^3$) and minimum ventilation equipment in to exchange the air volume four (4) times per hour.

Source Term

It is assumed that 100% of the Kr-85, 30 microcuries, escapes from the glass tube and is immediately diluted in the volume of the room, including in the breathing zone of the employee. The exposure rate was estimated by the USNRC to be $2.4x10^{-9}$ rem/microcurie.[3] The dose conversion factor for a smaller room, 18 m^3, with one (1) air volume exchanged each hour was reported to be $7.3x10^{-8}$ rem/microcurie.[4]

Exposure Potential

The potential radiation exposure to the exposed employee in the larger room, $300m^3$, was estimated to be less than $7.2x10^{-5}$ millirem. In the smaller room, 18 m^3, the radiation exposure was estimated to be less than $2.2x10^{-3}$ millirem. Both evaluations indicate that the potential for radiation exposure under accident conditions are significantly less than 1 millirem per event.

---

[3] U.S. Nuclear Regulatory Commission, *Systematic Radiological Assessment of Exemptions for Source and Byproduct Materials*, NUREG 1717, Table A.1.9, June, 2001.

[4] NUREG 1717, Table A.1.9.

No. RSP-001
Rev. No. 02

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

Date: *11/5/09*

ATTACHMENT 8.6

POTENTIAL RADIATION EXPOSURE WHEN A BOX OF TUBES BREAKS

Exposure Scenario

The potential for radiation exposure was evaluated for a single employee handling a box of electron tubes, containing 100 electron tubes, each containing 30 microcuries of gaseous Kr-85. It is assumed that all of the glass tube break and 100% of the radioactive gas is allowed to escape, including in the breathing zone of the employee . The employee is assumed to leave the room within the 30 minutes after the box is dropped and the tubes break. It is more likely that the employee(s) will leave the room in less than 5 minutes and that not all 100 tubes will break. It is assumed that the room where the employee is working is the Shipping and Receiving area, or a room that has a floor area of approximately 1,100 square feet (100 square meters, m^2) and a ceiling height of 10 feet (3 m). This room has an air volume of approximately 3,300 ft^3 ($300m^3$) and minimum ventilation equipment in to exchange the air volume four (4) times per hour.

Source Term

It is assumed that 100% of the Kr-85, 3,000 microcuries, escapes from the 100 glass tubes and is immediately diluted in the volume of the room, including in the breathing zone of the employee. The exposure rate was estimated by the USNRC to be $2.4x10^{-9}$ rem/microcurie.[5] The dose conversion factor for a smaller room, 18 m^3, with one air volume exchanged each hour was reported to be $7.3x10^{-8}$ rem/microcurie.[6]

Exposure Potential

The potential radiation exposure to the exposed employee in the larger room, $300m^3$, was estimated to be less than $7.2x10^{-3}$ millirem. In the smaller room, 18 m^3, the radiation exposure was estimated to be less than $2.2x10^{-1}$ millirem. Both evaluations indicate that the potential for radiation exposure under accident conditions are significantly less than 1 millirem in the event that a box of 100 tubes was dropped and all of the tubes were broken.

---

[5] U.S. Nuclear Regulatory Commission, *Systematic Radiological Assessment of Exemptions for Source and Byproduct Materials*, NUREG 1717, Table A.1.9, June, 2001.

[6] NUREG 1717, Table A.1.9.

No. RSP-001
Rev. No. 02

RADIATION PROTECTION PROGRAM PLAN
Cosmedico Light Inc.
Weymouth, MA.

Date: *11/5/09*

Revision Level To:	By	Date	Reason	What was revised
00	S. Schlitt	4-21-09	Initial issue	-
01	S. Schlitt	8-10-09	Update Mass Telephone numbers	Attachment 8.3: Telephone numbers changed to 617-242-3453 and 617-242-3035
02	S. Schlitt	10-14-09	Clarification of dimensions of the storage area	Added dimensions to Page 21 showing the warehouse layout.

Note: Revisions are shown in Bold Blue Color until a new revision supersedes a given Rev Level.

Attachment 4 - NUREG 1556, Vol 8, Appendix J, Requirement B
Description of Exempt Products

Cosmedico Light Inc.
High Pressure Electron Tubes with Kr85

ATTACHMENT 4 (B1)

Cosmedico Branded lamps

Item Part Number	Description	Mfr	Bq	Microcurie (uCi)
21082	Cosmedico ME 630 Pin	Radium	1018	0.0275
21084	Cosmedico 500K R7s	Radium	960	0.0259
21106	Cosmedico ME 1530 Pin	Radium	1018	0.0275
21107	Cosmedico ME 1400 Wire Leads	Radium	1018	0.0275
21111	Cosmedico E 400 SE	Radium	960	0.0259
21112	Cosmedico ME 650 SE	Radium	1018	0.0275
21113	Cosmedico ME 650w LS	Radium	1018	0.0275
21114	Cosmedico ME 630 B	Radium	1018	0.0275
21115	Cosmedico ME 1510 B	Radium	1018	0.0275
23049	CosmoTech L 400w R7s	BLV	2120	0.0572
24003	Cosmedico E 400w R7s	BLV	6400	0.1728
24004	Cosmedico E 400 L	Radium	4900	0.1323
24006	Cosmedico E 500 SE	Radium	7200	0.1944
24008	Cosmedico E 500w wire leads	BLV	7200	0.1944
24101	CosmoTech 1200w wire leads Repro	BLV	2400	0.0648
24103	Cosmedico E 1000 L	BLV	2400	0.0648
24171	Cosmedico N 1000 SE	BLV	3400	0.0918
24178	Cosmedico E 800w R7s	BLV	3100	0.0837
24200	CosmoTech 2000w wire leads Repro	BLV	7300	0.1971
24203	Cosmedico E 2000 L 220v	BLV	6900	0.1863

Private Label Branded lamps

Item Part Number	Description	Mfr	Bq	Microcurie (uCi)
21102	Ariana SBSN 1000 SE	Radium	4440	0.1199
21103	JK-RUSA 400w R7s	Radium	960	0.0259
21104	JK-RUSA 400w R7s (1 pack)	Radium	960	0.0259
900044455	ERGOLINE ULTRA 300/500	BLV	1230	0.0332
900327855	ERGOLINE ULTRA 300/500W	BLV	1230	0.0332
900361241	LET 004.0003 CORONA 500 48pk	BLV	2430	0.0656
900590645	LET 004.0004 CORONA 400 4PK	BLV	2430	0.0656
900612555	ERGOLINE 250-500W	BLV	2430	0.0656
900688055	LET 004.0040 CORONA300/500 SE	BLV	2430	0.0656
900722155	CORONA HPA 640 SE FX 1CT/4	BLV	2450	0.0662
900722155	CORONA HPA 640 SE FX 1CT/4	BLV	2450	0.0662
900800645	LET 004.0043 HPA 620	BLV	2430	0.0656
900804445	LET Corona 1000/1500 220V	BLV	6700	0.1809
900806845	LET CORONA 1000W 220V004.0013	BLV	6700	0.1809
900810541	LET 004.0044 HPA 630	BLV	2430	0.0656
902038100	BLACK SUN 300-500w SE	BLV	2430	0.0656
913103645	HPA 1200 FX	BLV	6700	0.1809
913128945	HPA 1040 SE FX 4PK	BLV	6700	0.1809
913132641	HPA 250-500/300SD FX 48PK	BLV	1230	0.0332
913133345	HPA 1220 FX 4PK	BLV	6700	0.1809
913134045	HPA 250-500/SE FX	BLV	1230	0.0332
913137141	HPA 400/30SDL	BLV	1230	0.0332
913138841	HPA400/30SL	BLV	2430	0.0656
914211755	CLEO HPA 640W SE FX	BLV	2430	0.0656
919109045	HPA 1000	BLV	6700	0.1809
919159545	CLEO 400-30S	BLV	2430	0.0656
919220245	400 S	BLV	2120	0.0572
920468441	250-500SDL	BLV	7300	0.1971
920669541	CLEO HPA 700S FX 48PK	BLV	2430	0.0656
920671845	HPA 2040A FX 4PK	BLV	6700	0.1809
920674931	CLEO HPA 700S FX C 48PK	BLV	2430	0.0656
920677041	HPA 250-500 SDC FX 48PK	BLV	1230	0.0332
938358945	HPA 400/30SD	BLV	1230	0.0332
938668945	HPA 1200S FX 4PK	BLV	6700	0.1809
938670245	HPA 1010SE FX 4PK	BLV	6700	0.1809
938671945	HPA 400/30SDC FX 4PK	BLV	2430	0.0656
938672645	HPA 400/30SC 4PK	BLV	2430	0.0656
944447145	HPA400/30 S	BLV	2430	0.0656
944448845	HPA 400 S	BLV	2430	0.0656

uci / Bq = 0.000027

ATTACHMENT 4 - Parts B1 – B5 and B8

Conformance with NUREG 1556, Volume 8 Appendix J, 10 CFR 32.14

This documentation is written for high pressure electron tubes that are to be stored and distributed by Cosmedico Light, Inc in the United States of America.

The following points concerning NUREG 1556, Volume 8 Appendix J, 10 CFR 32.14 Requirements for Exempt License are explained as requested. In this context, it should be realized that Cosmedico has two suppliers of electron tubes, each manufacturing in a similar manner. The two manufacturers are:

BLV Licht un Vakuumtechnik GmbH
Division of USHIO Group
Steinhoring Germany

Radium Lampenwerk GmbH
Division of OSRAM (and sister company to OSRAM Sylvania)
Wipperfurth Germany

Where appropriate, the manufacturer's information will be identified herein. In the case of lamps (electron tubes) made by Radium we have included in totality the information already submitted and on file at NRC, as it was included in the Materials License 20-30024-02E issued to OSRAM Sylvania. One reason that Cosmedico seeks a license is that our company wishes to purchase electron tubes directly from Radium whereas presently we purchase from OSRAM Sylvania, an affiliate of Radium Lampenwerk, Wipperfurth Germany.

BLV Licht Information:

(B1) The byproduct material Kr-85 is gaseous and as a noble gas it will be atomic. We are using premixed argon gas with fractionally small amounts of Kr-85 as filling gas. We are producing on two different production lines with different concentrations of Kr-85 (2.5 MBq/L and 18.5 MBq/L), see "Delivery note for Filling Gas" showing the higher concentration gas mixture. The enclosed calculations are done only for the higher concentration of 18.5 MBq/L and for a lamp of large volume (see attached "Activity Limit Calculations") as this represents the maximum concentration that may be realized across the entire product range. Activity is 11 kBq in this kind of product and, as such, is 100 times less than the NRC Limit of 1110 kBq. Small variations in filling pressure and volume with respect to different lamp types are of minor importance because activity is in all cases well below the limit.

(B2) As an attachment you will find a technical drawing of a typical lamp showing the main gas containment vessel for the electron tube PN 23620000. In the middle of the lamp, a quartz tube is placed with current carrying leads made of Molybdenum-foil and wires. During production, the ends of quartz tube are heated to the melting temperature of 2000° C and then the quartz tube is pinched to effectively seal the ends. In the center, one can see a sealing tip which is the remainder of an exhaust/filling stem for filling the quartz vessel. In addition to argon gas with trace amounts of Kr-85 as an ignition aid, the lamp contains mercury and metal halide salts that function as radiant agents after reaching the operational temperature. This standard technique of pinching quartz glass is used for millions of general lighting lamps per year and for BLV and other manufacturers, this process is well known. The external lead wires are welded to electrical contact metals. Often, lamp caps and holders, designed according the standard of IEC 60061, are used in order to ensure a good mechanical mount in a lighting fixture. In a few cases, a part of the pinched lamp ends are fixed to the lamp holder directly by springs.

(B3) The method of containment is accomplished by sealing the quartz glass by melting. Softening of the seal requires temperatures of around 2000° C, but the operational temperature of the electron tube is well below this softening temperature and is never approached.

(B4) The most severe conditions in normal use of this product will be encountered by inserting the lamp in the lamp socket by hand. The quartz tube is very stable due to the outer cross section. Additionally, for increased stability, glass fibers are used for reinforcement. The forces ordinarily used in the installation of the electron tube and the manipulation in normal handling, are generally insufficient to cause breakage of the tube. Therefore, there is very low risk that the containment envelope will be ruptured in normal usage.

(B5) Results of prototype testing: The quartz vessel is always below atmospheric pressure, at room temperature, and by imperfect sealing would result in a filling up of the arc tube with air. The Kr-85 will remain in the vessel. Besides this, such a leakage could be detected very easily because the presence of a small amount of air disables ignition capability and is detected during production controls.

(B6) Quality control procedures are implemented by our ISO 9001 system (Attachment: Quality certificate 9001.pdf). According to the work flow, we are controlling the machinery, process and the products themselves by visual inspection, gauges, ignition tests and electrical measurements. All these steps are written in lists and are traceable to the lot number. (See various BLVV Quality Control related procedures and documents attached.) The final inspection is done by our quality assurance system which works mainly on the computer based Quipsy system.

(B7) Labeling and marking: Kr 85 will be marked on individual boxes and the outer box. Examples of product labels for an assortment of products are included with this submission.

(B8) As calculated in Mathcad-Activity limit_xmcd.pdf, the activity is defined in relation to volume and pressure reduction. The pressure reduction is achieved by a pressure reducer and the filling gas pressure is controlled independently by a pressure gauge which is checked regularly and calibrated at least once per year. Even if both devices, the pressure reducer and the pressure gauge, are defective, a much higher pressure could not be filled for two reasons. Firstly in the production process, the sealing of the exhaust/filling stem needs a vacuum inside of the lamp because it is heated without any additional pinching. Secondly, a higher than specified filling gas pressure hinders the ignition of the lamp and such a defect would be reflected in the required minimum ignition voltage and detected during ignition tests.

(B9) Additional information regarding lamp safety could be given in the following manner. A risk assessment of someone who would destroy one lamp (unusual use) for example, in a bench vise shows that the exposure dose in such a scenario is very much lower than the yearly natural dose. For purposes of illustration, assume a fairly big storage room of around 400 cubic meters and a lamp that has an activity of around 2000 Bequerel which releases a concentration of 5 Bq/m^3 in the room. Besides the other cosmic radiation and natural radioactivity, a Germany authority would measure the activity of Kr-85 in normal air up to

3 Bq/m^3 http://www.bfs.de/de/bfs/druck/broschueren/br_schauinsland.pdf, page 13. Due to the ventilation of the room the comparable concentration of lamp release is dissipated in some hours. But normal air is breathed over the whole year and therefore the dose by normal air is at least a thousand times greater than the additional dose resulting from breaking a lamp. Furthermore, this comparison is made only on the basis of Kr-85, but naturally occurring radioactivity by other elements from cosmic radiation and natural sources are exceeding this by far. In our opinion, even in the unusual circumstance of purposely destroying a lamp, a person will not be exposed to a significantly greater risk than that already existing in nature.

BLV Licht - und Vakuumtechnik GmbH

Attachment 4 (BLV) - B1 & B8

Aktivity level calculations of the tanning lamp 23627001

Ordered Gas from Osram see delivery note: 18.5 MBq/L

Activity level of 1 cm^3 is 18.5 kBq at 1 bar= 10^5 Pa

Activity reduction by filling pressure of only 60 mbar =

0.06 *18.5 kBq/cm^3=1110 Bq/cm^3

Volume of vessel: length = 4 cm, inner-diameter 1.8 cm
10 cm^3

Overall activity 1110 Bq/cm^3*10 cm^3= 11.1 kBq

NRC Limit for Exempt license lower than 30 µCi=1110 kBq

Conclusion: The NRC-limit allows 100 time more activity in one lamp.

BLV Licht- und Vakuumtechnik GmbH

Münchener Straße 10
85643 Steinhöring
Telefon: +49 (0) 8094 906-0
Internet: www.blv-licht.de
E-Mail: sales@blv-licht.de

Fax Verkauf: +49 (0)8094 906-164
Fax Verwaltung, Technik: +49 (0)8094 906-111
Fax Einkauf: +49 (0)8094 906-136

Geschäftsführer:
Tetsuo Kato
Klaus Elfinger

Bank of Tokyo-Mitsubishi
IBAN DE16 30001 0700 0000 0148 78
Konto. Nr. 511 014 878
Swift code: BOTK DE DX
BLZ: 300 107 00

Handelsregister:
München HRB 55 706
USt-IdNr.: DE131170621
Steuer Nr.: 9156/122/50003

DELIVERY NOTE FOR FILLING GAS

Lieferschein

OSRAM

DE

Auslieferung: 303202553	Auftrag: 202905285	Bestelldatum:	05.05.2008
Datum: 03.06.2008	Kunde: 1001349	Bestellnr.:	16229

Lieferanschrift:
BLV LICHT + VACUUMTECHNIK GMBH
Hohenlindener Str. 7
D-85643 STEINHOERING

Rechnungsanschrift:
BLV Licht- und Vakuumtechnik GmbH
Münchener Str. 10
D-85643 STEINHÖRING

Die mit "AL ungleich N" gekennzeichneten Güter unterliegen bei der Ausfuhr aus der EU der europäischen bzw. deutschen Ausfuhrgenehmigungspflicht. Die mit "ECCN ungleich N" gekennzeichneten Güter unterliegen der US-Reexportgenehmigungspflicht. Auch ohne Kennzeichen, bzw. bei Kennzeichen "AL:N" oder "ECCN:N" kann sich eine Genehmigungspflicht, unter anderem durch den Endverbleib und Verwendungszweck der Güter, ergeben. Alle unsere Lieferungen stehen unter dem Vorbehalt der Beachtung der OSRAM-Exportkontroll-Klausel. Diese kann vom Kunden eingesehen werden unter http://www.osram.com/dcs

Pos.	Menge	ME	Materialnummer Bezeichnung / Kundenartikelnummer Gefahrguthinweise	Charge	Auftragsnummer / Pos. Bestellnummer AL-Nr. ECCN	Nettogewicht KG / Bruttogewicht KG
10	1.217 ≙ 4 Fl. ✓ MO	L	B4680099XX12 GAS AR + 18,5 MBQ KR 85/L Mit folgenden Gefahrgutdaten: ADR - Straße: UN UN 2915 Radioaktive Stoffe, Typ A-Versandstück		202905285 / 000010 16229 N N	2,030 17,100

GEBUCHT
- 3. Juni 2008
durch MO

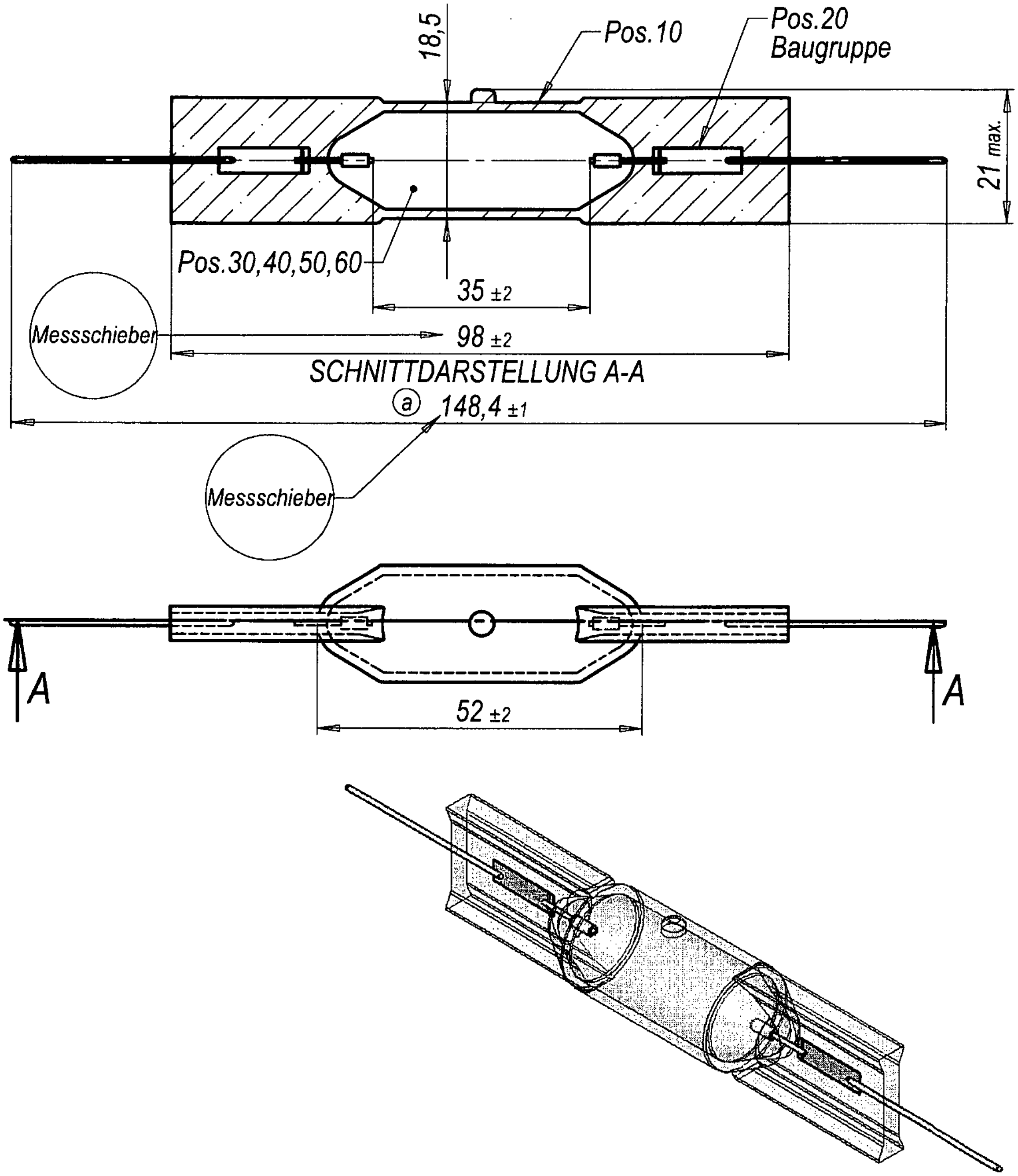
EINGEGANGEN
durch MO

Nettogew.: 2,030 KG Bruttogew.: 17,100 KG Volumen: 0,045 M3	Colli pro Sendung: 4	Spediteur: Trans-o-Flex GmbH & Co. KG Versandart: Speditionssammelgut	Gepackt durch:	Lieferbedingungen: FCA Berlin	Versandstelle: 0801

Ansprechpartner:	Tel.	Fax	E-mail
Philipp	(030) 3386 2607	(030) 3386 2605	J.Philipp@osram.com

UCR: 40503003032025537
VAT-nr. DE811148275 WEEE-Nr. 71568000

Attachment 4 (BLV) Response B2



Vert.: AV,FB2,EE

Technische Änderungen vorbehalten
subject to be changed without prior notice

BLV Licht- und Vakuumtechnik GmbH
Münchner Str. 10
85643 Steinhöring
www.blv-licht.com
Tel. 08094/906-0; Fax 08094/906-111

ISO 2768mH | ISO 1302

Maßstab	1 : 1	1-00/0019/23620000
Artikelnr.:	23620000	

	Datum	Name
Bearb.	04.09.06	Mohr
Gepr.	11.9.06	[signature]
Norm	11.9.06	[signature]

Bezeichnung:

MHL

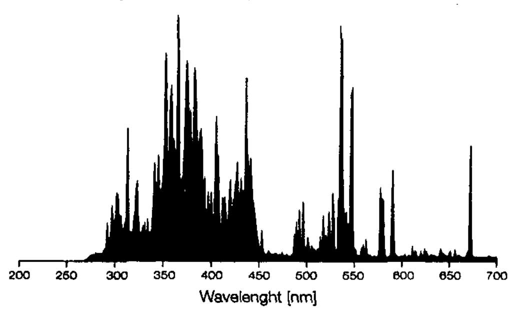
Zeichnungsnr.:
1-00-0019-00-0051

Blatt1
1 Bl.

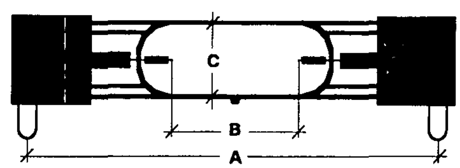
Zust.	Änderung	Datum	Name
a	OAL + Toleranz	11.09.06	MS

Cosmedico
M E 630 P
Metal halide lamp for sun tanning equipment

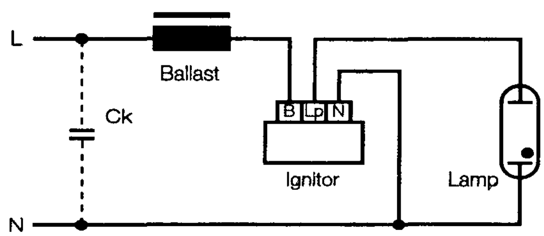
Typical Relative Spectral Radiant Flux



Dimessions



Wiring Diagram



Article-No.	21082
FDA-ACC. No:	
Distance between electrical contacts (A)	**120 mm**
Lighted length (B)	**45 mm**
Bulb diameter (C)	**Ø 16 mm**
Base	**Pin**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**130 V**
Current $I_{Lp.}$	**5 A**
Lamp wattage $P_{Lp.}$	**580 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**

We recommended the ignitor Cosmopower S Z 1000 (#71813) and the parallel connection from the ballasts Cosmopower S 500W (#74428/50Hz) and Cosmopower S 100W (#74245).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.

To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

Remove contaminations (e.g. finger-prints) with 100% alcohol!

<u>Please note!</u>
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

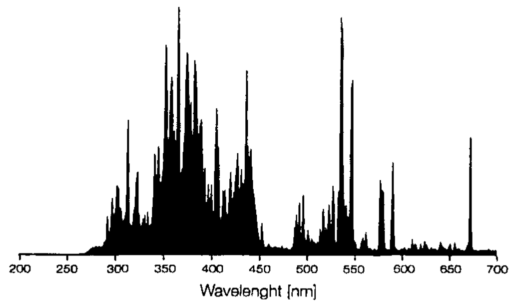
09.08.2007, Subject to modification

come to another world

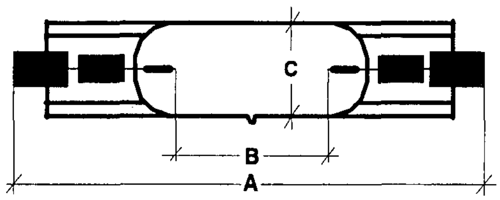
Cosmedico 500K R7s

Metal halide lamp for sun tanning equipment

Typical Relative Spectral Radiant Flux

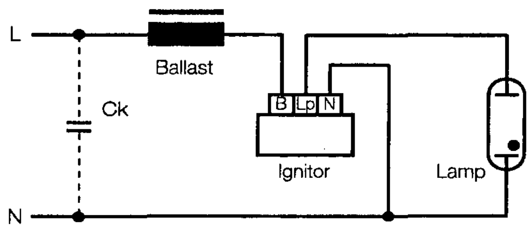


Dimensions



Article-No.	**21084**
FDA ACC.-No.:	
Total length (A)	≤104 mm
Lighted length (B)	33 mm
Bulb diameter (C)	Ø 14 mm
Ceramic base	R7s
Bulb (quartz glass)	Ozone free
Lamp voltage $U_{Lp.}$	135 V
Current I	3,5 A
Lamp wattage $P_{Lp.}$	390 VA
Supply voltage	230 V 50 Hz
Starting voltage	3-4,5 kV
Intial phase	3 min.

Wiring Diagram



We recommended the ballast Cosmopower S 400W (# 74408) and the ignitor Cosmopower S Z 400 (# 71805).
We recommend to change the lamps if the reduction of intensity is down to 75% of its original output. To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 EC and ≥ 750 °C
seal temperature ≤ 350 EC

Remove contaminations (e.g. finger-prints) with 100% alcohol!

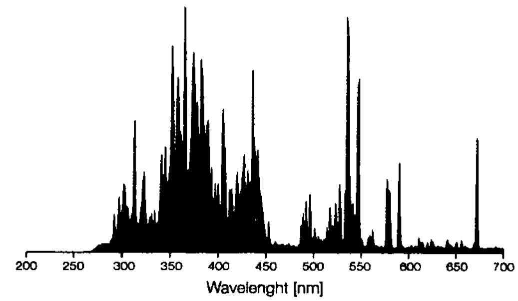
Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

20.11.2008, Subject to modification

Cosmedico Ariana SBSN 1000 SE

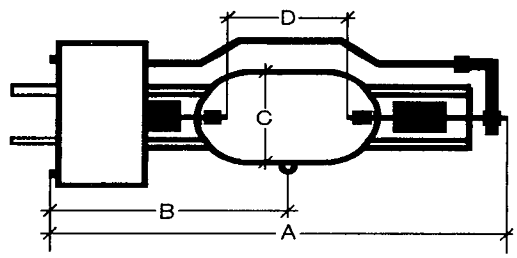
Metal halide lamp for sun tanning equipment

Typical Relative Spectral Radiant Flux

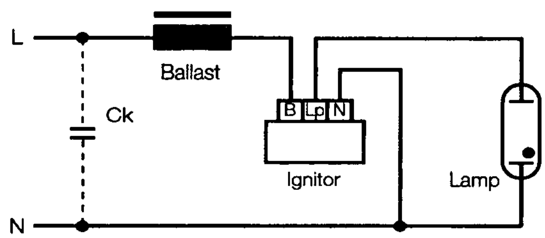


Article-No.	**21102**
Total length (A)	106 (±1) mm
Face to discharge center (B)	57,5 (±1) mm
Lighted length (C)	28,5 (±2) mm
Bulb diameter (D)	≤ Ø 25 mm
Ceramic base	GY9.5
Bulb (quartz glass)	FDA
Lamp voltage $U_{Lp.}$	135 (±20) V
Current $I_{Lp.}$	6,5 A
Lamp wattage $P_{Lp.}$ [1]	800 VA
Supply voltage	230 V 50 Hz
Starting voltage	3-4,5 kV
Intial phase	3 min.
Typical UVA-Radiant flux (315-400nm)	200 W
Useful life [1]	approx. 800 h

Dimension



Wiring Diagram



[2] Recommended ignitor Cosmopower S 1000W (# 71813).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated in horizontal position (±10°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

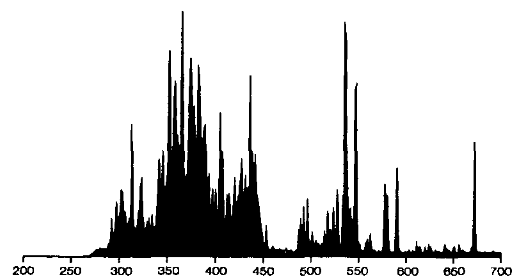
Remove contaminations (e.g. finger-prints) with 100% alcohol!

Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

15.08.2003, Subject to modification

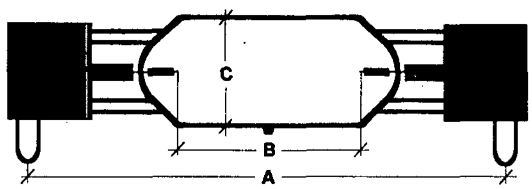
Cosmedico

Cosmedico
M E1530 P
Metal halide lamp for sun tanning equipment

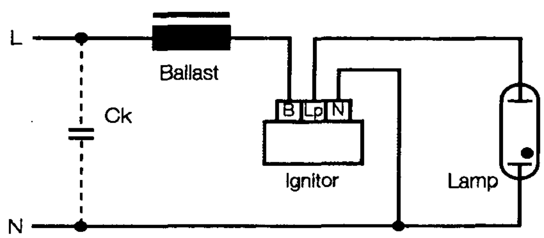


Article-No.	21106
FDA-ACC. No:	
Distance between electrical contacts (A)	128 mm
Lighted length (B)	48 mm
Bulb diameter (C)	Ø 28 mm
Base	pin
Bulb (quartz glass)	FDA
Lamp voltage $U_{Lp.}$	130 V
Current $I_{Lp.}$	9 A
Lamp wattage $P_{Lp.}$	1000 VA
Supply voltage	230 V 50 Hz
Starting voltage	3-4,5 kV
Intial phase	3 min.

Dimessions



Wiring Diagram



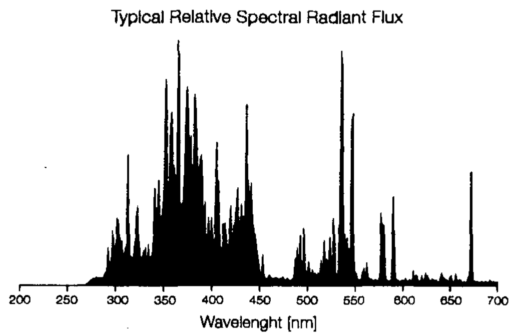
We recommend the ignitor Cosmopower S Z 1000 (#71813) and the ballast Cosmopower S 1000W (#74412/50Hz).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.

To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:
bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C
Remove contaminations (e.g. finger-prints) with 100% alcohol!

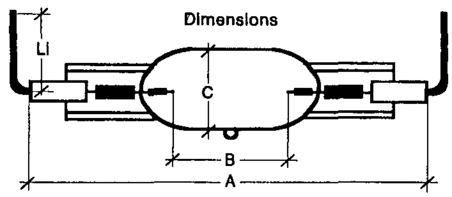
Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

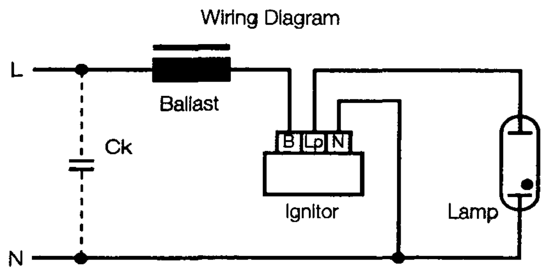
14.09.2007, Subject to modification

Cosmedico
M E 1400 L
Metal halide lamp for sun tanning equipment



Article-No.	21107
FDA-ACC. No:	
Total length (A)	**140 mm**
Lighted length (B)	**48 mm**
Bulb diameter (C)	**Ø 28 mm**
Ceramic base	**Ø 10 mm**
Leads (Li)	**360 mm**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**130 V**
Current $I_{Lp.}$	**9 A**
Lamp wattage $P_{Lp.}$ [1)]	**1000 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**





[1)] Recommended ballast Cosmopower S 1000W (# 74412) with ignitor Cosmopower S Z 1000 (# 71813).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

Remove contaminations (e.g. finger-prints) with 100% alcohol!

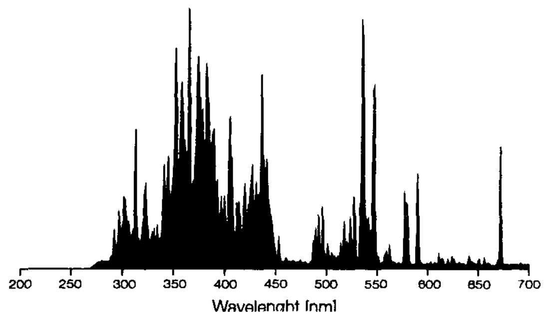
Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

09.08.2007, Subject to modification

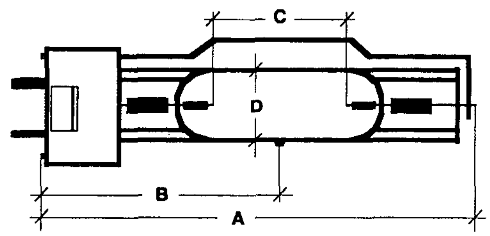
Cosmedico
M E 400 GY9.5

Metal halide lamp for sun tanning equipment

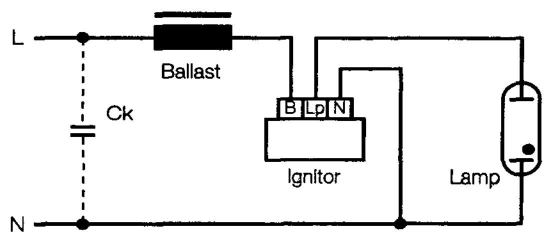
Typical Relative Spectral Radiant Flux



Dimensions



Wiring Diagram



Article-No.	21111
FDA ACC.-No.:	
Total length (A)	≤ 106 **mm**
Face to discharge center (B)	**53 mm**
Lighted length (C)	**33 m**
Bulb diameter (D)	**ø 14 mm**
Ceramic base	**GY9.5**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**135 V**
Current $I_{Lp.}$	**3,5 A**
Lamp wattage $P_{Lp.}$	**380 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**

We recommended the ballast Cosmopower S 400W (# 74408) and the ignitor Cosmopower S Z 400 (# 71805).
We recommend to change the lamps if the reduction of intensity is down to 75% of its original output. To avoid failure of the lamps they have to be operated in horizontal position (±30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

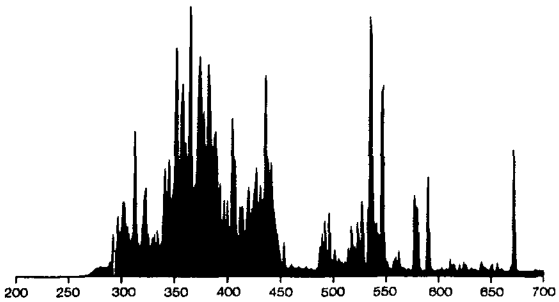
Remove contaminations (e.g. finger-prints) with 100% alcohol!

Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

09.08.2007, Subject to modification

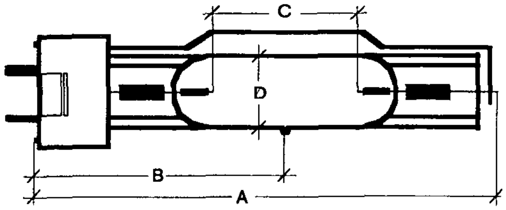
Cosmedico
M E 650 GY9.5
Metal halide lamp for sun tanning equipment

Typical Relative Spectral Radiant Flux

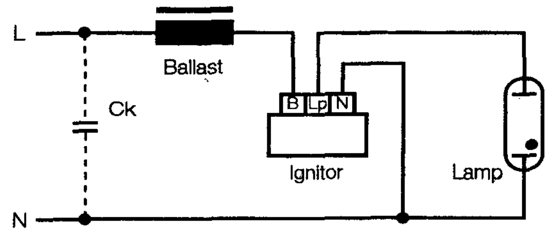


Article-No.	21112
FDA-ACC. No:	
Total length (A)	**128 mm**
Face to discharge center (B)	**60 mm**
Lighted length (C)	**45 mm**
Bulb diameter (D)	**Ø 16 mm**
Ceramic base	**GY9.5**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**140 V**
Current $I_{Lp.}$	**4,5 A**
Lamp wattage $P_{Lp.}$	**580 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**

Dimension



Wiring Diagram



We recommended the ignitor Cosmopower S Z 1000 (#71813) and the parallel connection from the ballasts Cosmopower S 500W (#74428/50Hz) and Cosmopower S 100W (#74245).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

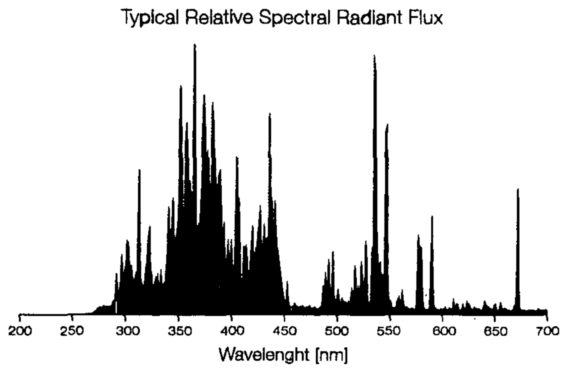
bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

Remove contaminations (e.g. finger-prints) with 100% alcohol!

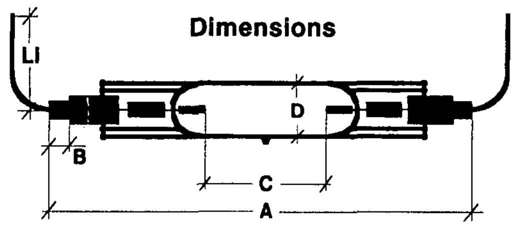
<u>Please note!</u>
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

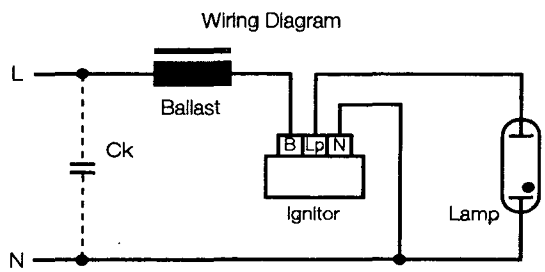
14.09.2007, Subject to modification

Cosmedico
M E 650 LS
Metal halide lamp for sun tanning equipment



Article-No.	21113
FDA-ACC. No:	
Total length (A)	**159 mm**
To socket (B)	**10 mm**
Lighted length (C)	**Approx. 45 mm**
Bulb diameter (D)	**Ø 16 mm**
Ceramic base	**Ø 14 / 10 mm**
Leads (Li)	**380 mm**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**140 V**
Current $I_{Lp.}$	**4,5 A**
Lamp wattage $P_{Lp.}$ [1)]	**580 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**





1) Recommended the ignitor Cosmopower S Z 1000 (# 71813) with a parallel connection from the ballasts Cosmopower S 500W (#74428) and Cosmopower S 100W (#74245).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

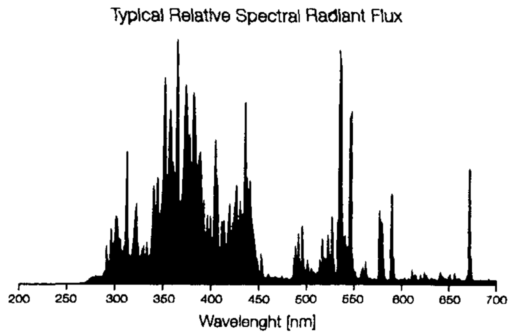
bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

Remove contaminations (e.g. finger-prints) with 100% alcohol!

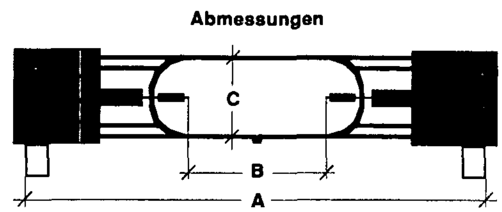
Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

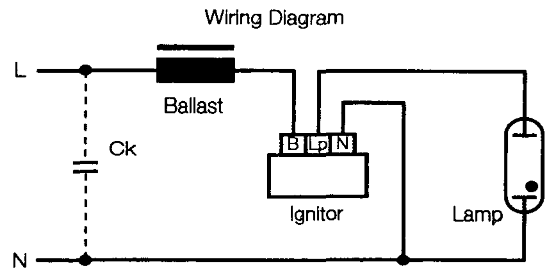
14.09.2007, Subject to modification

Cosmedico
M E 610 B
Metal halide lamp for sun tanning equipment



Article-No.	21114
FDA-ACC. No:	
Distance between electrical contacts (A)	**120 mm**
Lighted length (B)	**45 mm**
Bulb diameter (C)	**Ø 16 mm**
Base	**Pin**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**130 V**
Current $I_{Lp.}$	**5 A**
Lamp wattage $P_{Lp.}$	**580 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**





We recommended the ignitor Cosmopower S Z 1000 (#71813) and the parallel connection from the ballasts Cosmopower S 500W (#74428/50Hz) and Cosmopower S 100W (#74245).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.

To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

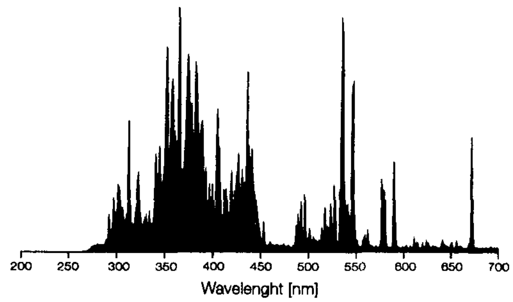
Remove contaminations (e.g. finger-prints) with 100% alcohol!

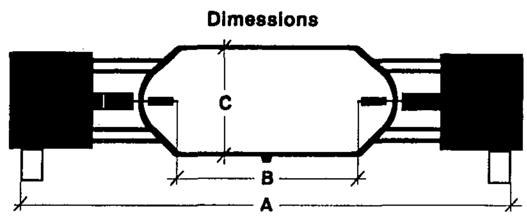
Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

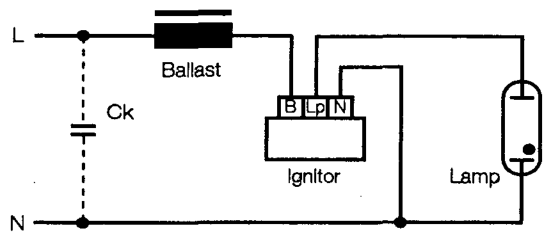
09.08.2007, Subject to modification

Cosmedico
M E 1510 B
Metal halide lamp for sun tanning equipment

Typical Relative Spectral Radiant Flux







Article-No.	21115
FDA-ACC. No:	
Distance between electrical contacts (A)	**135 mm**
Lighted length (B)	**48 mm**
Bulb diameter (C)	**Ø 28 mm**
Base	**blade**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**130 V**
Current $I_{Lp.}$	**9 A**
Lamp wattage $P_{Lp.}$	**1000 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**

We recommended the ignitor Cosmopower S Z 1000 (#71813) and the ballast Cosmopower S 1000W (#74412/50Hz).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.

To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:
bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C
Remove contaminations (e.g. finger-prints) with 100% alcohol!

<u>Please note!</u>
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

14.09.2007, Subject to modification

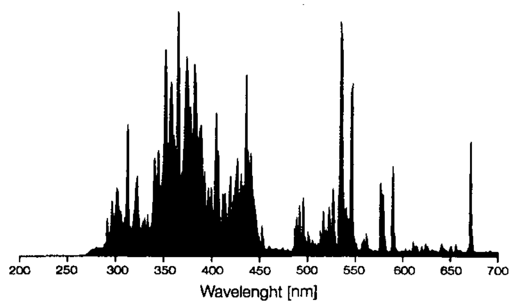
Cosmedico®

come to another world

Cosmedico Cosmotech L 400 R7s

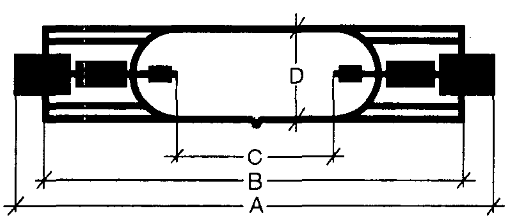
Metal halide lamp for sun tanning equipment

Typical Relative Spectral Radiant Flux

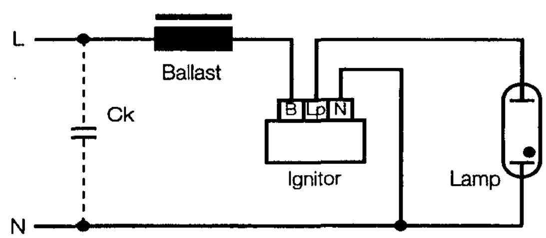


Article-No.	**23049**
FDA-Acc. No:	8020164
Total length (A)	118 mm
Glass length (B)	106,5 (± 2) mm
Lighted length (C)	43 (± 2) mm
Bulb diameter (D)	≤ Ø 18 mm
Ceramic base	R7s
Bulb (quartz glass)	FDA
Lamp voltage $U_{Lp.}$	135 (± 15) V
Current $I_{Lp.}$	3,3 A
Lamp wattage $P_{Lp.}$ [1]	400 VA
Supply voltage	230 V 50 Hz
Starting voltage	3-4,5 kV
Intial phase	3 min.
Typical UVA-Radiant flux (315-400nm)	80 W
Useful life [1]	approx. 800 h

Dimensions



Wiring Diagram



[1] Recommended ballast Cosmopower S 400W (# 74408) with ignitor Cosmopower S 400W (# 71805).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated in horizontal position ("10°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

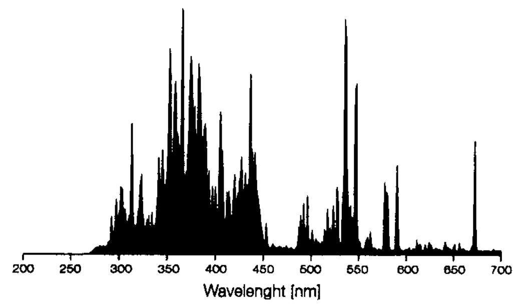
Remove contaminations (e.g. finger-prints) with 100% alcohol!

Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

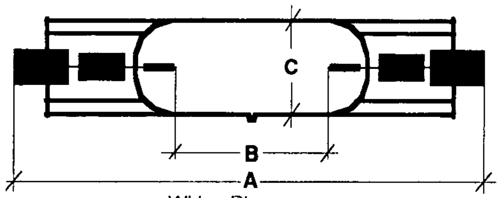
05.10.2004, Subject to modification

Cosmedico
E 400 R7s
Metal halide lamp for sun tanning equipment

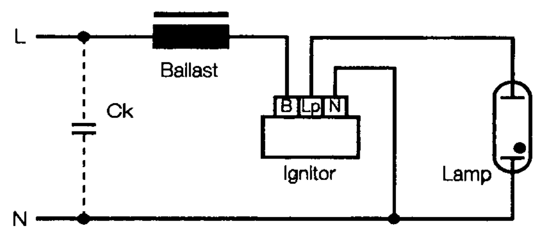
Typical Relative Spectral Radiant Flux



Dimensions



Wiring Diagram



Article-No.	24003
FDA ACC.-No.:	**9220059**
Total length (A)	**106 mm**
Lighted length (B)	**32 mm**
Bulb diameter (C)	**Ø 14 mm**
Ceramic base	**R7s**
Bulb (quartz glass)	**Ozone free**
Lamp voltage $U_{Lp.}$	**130 V**
Current $I_{Lp.}$	**3,5 A**
Lamp wattage $P_{Lp.}$ 2)	**390 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**

We recommended the ballast Cosmopower S 400W (# 74408) and the ignitor Cosmopower S Z 400 (# 71805).
We recommend to change the lamps if the reduction of intensity is down to 75% of its original output. To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 EC and ≥ 750 °C
seal temperature ≤ 350 EC

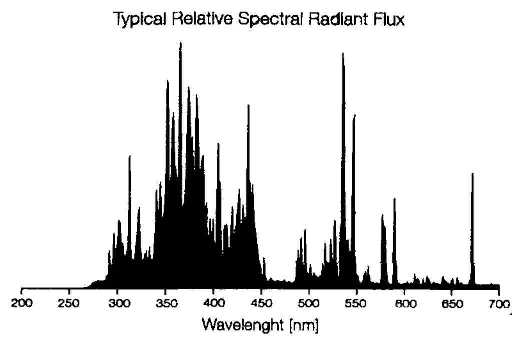
Remove contaminations (e.g. finger-prints) with 100% alcohol!

Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

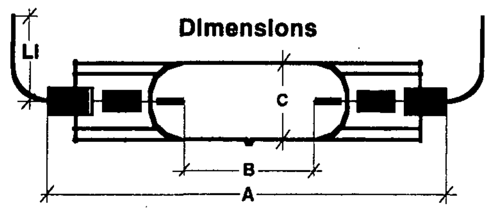
05.07.2007, Subject to modification

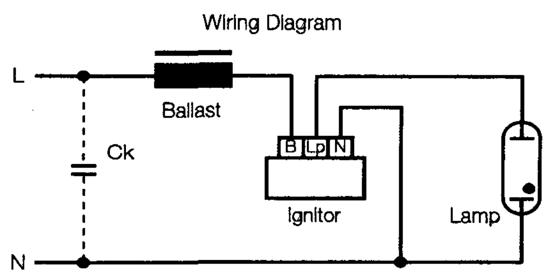
Cosmedico®

Cosmedico
E 400 L
Metal halide lamp for sun tanning equipment



Article-No.	24004
FDA-ACC. No:	9220059
Total length (A)	114 mm
Lighted length (B)	32 mm
Bulb diameter (C)	Ø 14 mm
Ceramic base	Ø 8 mm
Leads (Li)	375 mm
Bulb (quartz glass)	FDA
Lamp voltage $U_{Lp.}$	130 V
Current $I_{Lp.}$	3,2 A
Lamp wattage $P_{Lp.}$ [1)]	380 VA
Supply voltage	230 V 50 Hz
Starting voltage	3-4,5 kV
Intial phase	3 min.





[1)] Recommended ballast Cosmopower S 400W (# 74408) with ignitor Cosmopower S Z 400 (# 71805).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

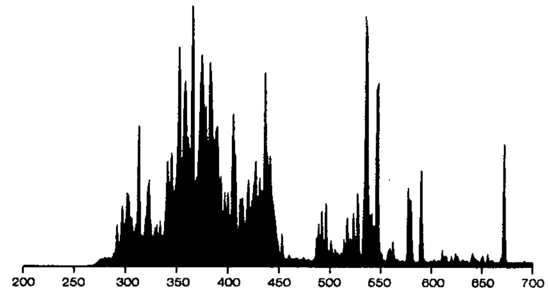
Remove contaminations (e.g. finger-prints) with 100% alcohol!

<u>Please note!</u>
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

06.07.2007, Subject to modification

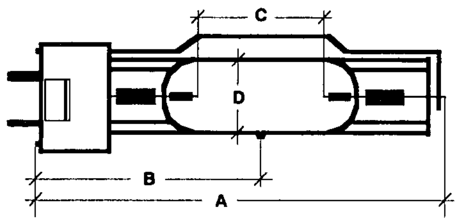
Cosmedico
E 500 GY9.5
Metal halide lamp for sun tanning equipment

Typical Relative Spectral Radiant Flux

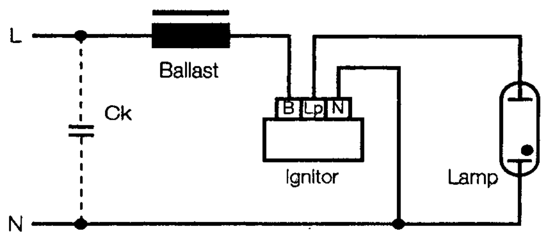


Article-No.	24006
FDA ACC.-No.:	**9220059**
Total length (A)	110 **mm**
Lighted length (B)	**52 mm**
Bulb diameter (C)	**Ø 16 mm**
Ceramic base	**GY9.5**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**130 V**
Current $I_{Lp.}$	**4 A**
Lamp wattage $P_{Lp.}$	**480 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**

Dimensions



Wiring Diagram



We recommended the ballast Cosmopower S 500W (# 74428) and the ignitor Cosmopower S Z 400 (# 71805).
We recommend to change the lamps if the reduction of intensity is down to 75% of its original output. To avoid failure of the lamps they have to be operated in horizontal position (±30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

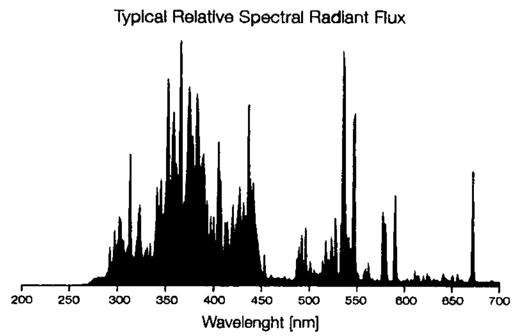
bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

Remove contaminations (e.g. finger-prints) with 100% alcohol!

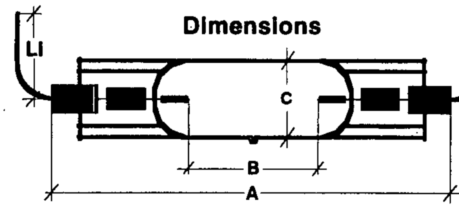
<u>Please note</u>!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

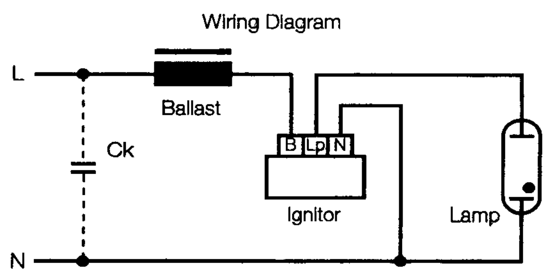
06.07.2007, Subject to modification

Cosmedico E
500 L
Metal halide lamp for sun tanning equipment



Article-No.	24008
FDA-ACC. No:	**9220059**
Total length (A)	**115 mm**
Lighted length (B)	**31 mm**
Bulb diameter (C)	**Ø 16,3 mm**
Ceramic base	**Ø 7,5 mm**
Leads	**375 mm**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**130 V**
Current $I_{Lp.}$	**4 A**
Lamp wattage $P_{Lp.}$ 1)	**480 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**





1) Recommended ballast Cosmopower S 500W (# 74428) with ignitor Cosmopower S Z 400 (# 71805).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

Remove contaminations (e.g. finger-prints) with 100% alcohol!

Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

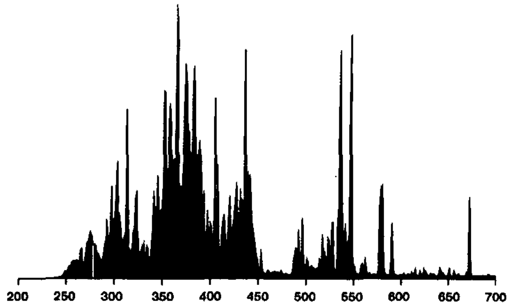
05.07.2007, Subject to modification

come to another world

Cosmedico Cosmotech 1200

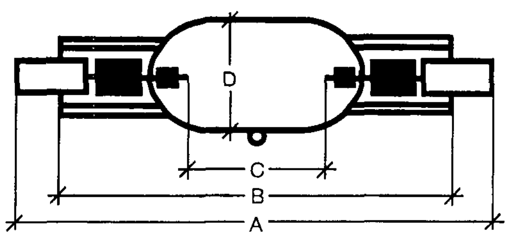
Metal halide lamp for sun tanning equipment

Typical relative Spectral Radiant Flux

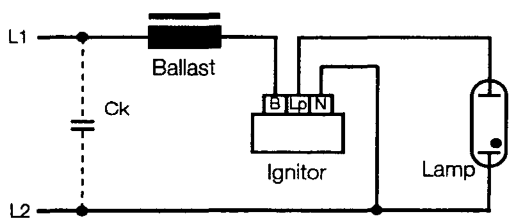


Article-No.	**24101**
Total length (A)	139 (±2) mm
Glass length (B)	114 (±2) mm
Lighted length (C)	50 mm
Bulb diameter (D)	Ø 24,5 mm
Ceramic base	Ø 10 mm
Leads	375 (±5) mm
Bulb (quartz glass)	OZONE FREE
Lamp voltage $U_{Lp.}$	140 (±15) V
Current $I_{Lp.}$	8,5 A
Lamp wattage $P_{Lp.}$ [1)]	1000 VA
Supply voltage	230 V 50 Hz
Starting voltage	3-4,5 kV
Intial phase	3 min.
Typical UVA-Radiant flux (315-400nm)	200 W
Useful life [1)]	approx. 800 h

Dimensions



Wiring Diagram



[1)] Recommended ballast Cosmopower S 1000W (# 74415) with ignitor Cosmopower S 1000W (# 71813).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated in horizontal position (±10°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

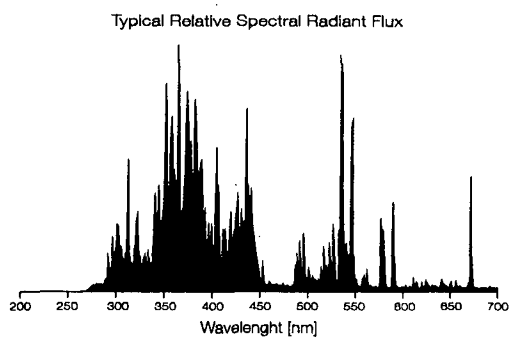
Remove contaminations (e.g. finger-prints) with 100% alcohol!

Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

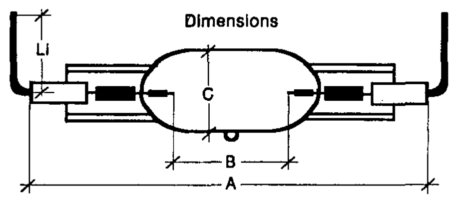
20.11.2003, Subject to modification

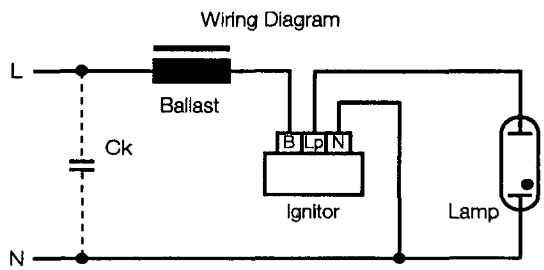
Cosmedico E 1000 L

Metal halide lamp for sun tanning equipment



Article-No.	24103
FDA-ACC. No:	**9220059**
Total length (A)	**139 mm**
Lighted length (B)	**50 mm**
Bulb diameter (C)	**Ø 24,5 mm**
Ceramic base	**Ø 10 mm**
Leads (Li)	**375 mm**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**140 V**
Current $I_{Lp.}$	**8,2 A**
Lamp wattage $P_{Lp.}$ 1)	**1000 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**





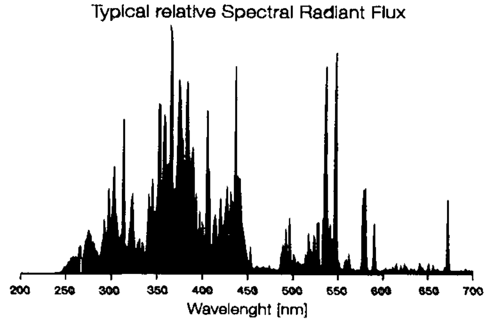
1) Recommended ballast Cosmopower S 1000W (# 74412) with ignitor Cosmopower S Z 1000 (# 71813).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:
bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C
Remove contaminations (e.g. finger-prints) with 100% alcohol!

<u>Please note</u>!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

02.07.2007, Subject to modification

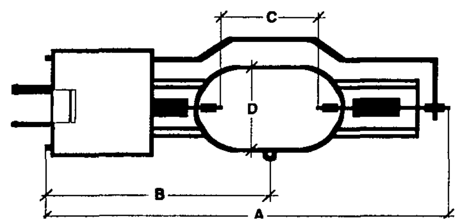
Cosmedico
N 1000 GY9.5
Metal halide lamp for sun tanning equipment

Typical relative Spectral Radiant Flux

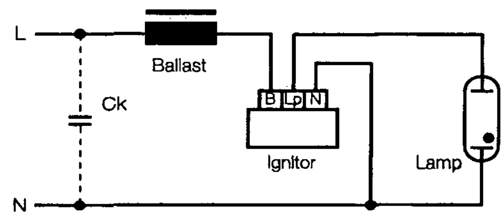


Article-No.	24171
Total length (A)	**129 mm**
Face to discharge center (B)	**74 mm**
Lighted length (C)	**30 mm**
Bulb diameter (D)	**Ø 25 mm**
Ceramic base	**GY9.5**
Bulb (quartz glass)	**Ozone free**
Lamp voltage $U_{Lp.}$	**130 V**
Current $I_{Lp.}$	**8,2 A**
Lamp wattage $P_{Lp.}$ [1)]	**1000 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**

Dimensions



Wiring Diagram



[1)] Recommended ballast Cosmopower S 1000W (# 74412) with ignitor Cosmopower S Z 1000 (# 71813).
The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.
To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

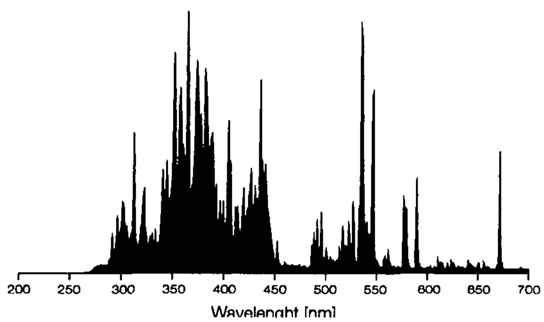
Remove contaminations (e.g. finger-prints) with 100% alcohol!

Please note!
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

02.07.2007, Subject to modification

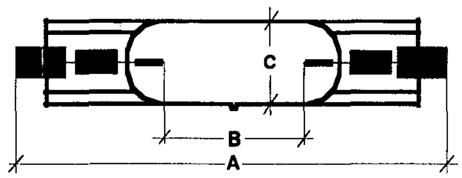
Cosmedico
E 800 R7s
Metal halide lamp for sun tanning equipment

Typical Relative Spectral Radiant Flux

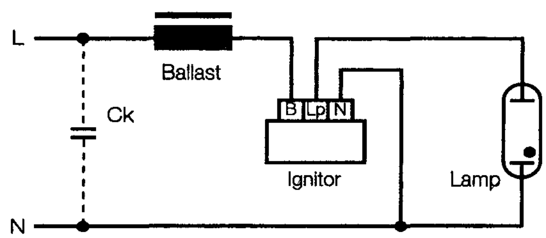


Article-No.	24178
FDA ACC.-No.:	**9220059**
Total length (A)	**≤ 114 mm**
Lighted length (C)	**35 mm**
Bulb diameter (D)	**Ø 18,5 mm**
Ceramic base	**R7s**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**135 V**
Current $I_{Lp.}$	**6,5 A**
Lamp wattage $P_{Lp.}$	**800 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**

Dimensions



Wiring Diagram



We recommended the ballast ignitor Cosmopower S Z 1000 (# 71813).
We recommend to change the lamps if the reduction of intensity is down to 75% of its original output. To avoid failure of the lamps they have to be operated in horizontal position (±30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:

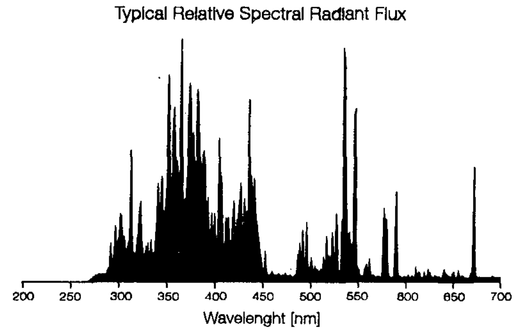
bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C

Remove contaminations (e.g. finger-prints) with 100% alcohol!

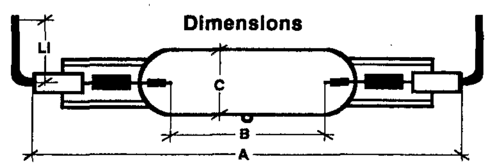
<u>Please note!</u>
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

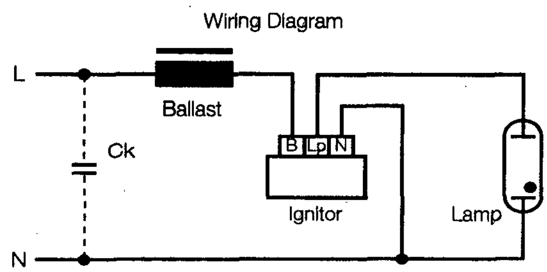
07.08.2007, Subject to modification

Cosmedico
E 2000/220V L
Metal halide lamp for sun tanning equipment



Article-No.	24203
FDA-ACC. No:	**9220059**
Total length (A)	**171 mm**
Lighted length (B)	**75 mm**
Bulb diameter (C)	**Ø 28 mm**
Ceramic base	**Ø 10 mm**
Leads (Li)	**370 mm**
Bulb (quartz glass)	**FDA**
Lamp voltage $U_{Lp.}$	**145 V**
Current $I_{Lp.}$	**15 A**
Lamp wattage $P_{Lp.}$	**2000 VA**
Supply voltage	**230 V 50 Hz**
Starting voltage	**3-4,5 kV**
Intial phase	**3 min.**





We recommended a parallel connection from two ballasts Cosmopower S 1000W (#74423/50Hz) and a parallel connection from two ignitor Cosmopower S Z 1000 (#71813). The useful life is determined on the operation condition of the lamp (for example type of ballast / ignitor used, on / off cycle, cooling conditions, etc.). We recommend to change the lamps if the reduction of intensity is down to 75% of its original output.

To avoid failure of the lamps they have to be operated in horizontal position (+/- 30°) with adequate cooling. If the following operating temperatures are exceeded, the lamp may be destroyed:
bulb temperature ≤ 950 °C and ≥ 750 °C
seal temperature ≤ 350 °C
Remove contaminations (e.g. finger-prints) with 100% alcohol!

<u>Please note!</u>
Follow sunlamp equipment manufactures instructions. Tubular metal halide lamps emit a very intensive UV-radiation. Filter and safety glasses must be used as eyes and skin may be damaged within seconds otherwise.

10.08.2007, Subject to modification

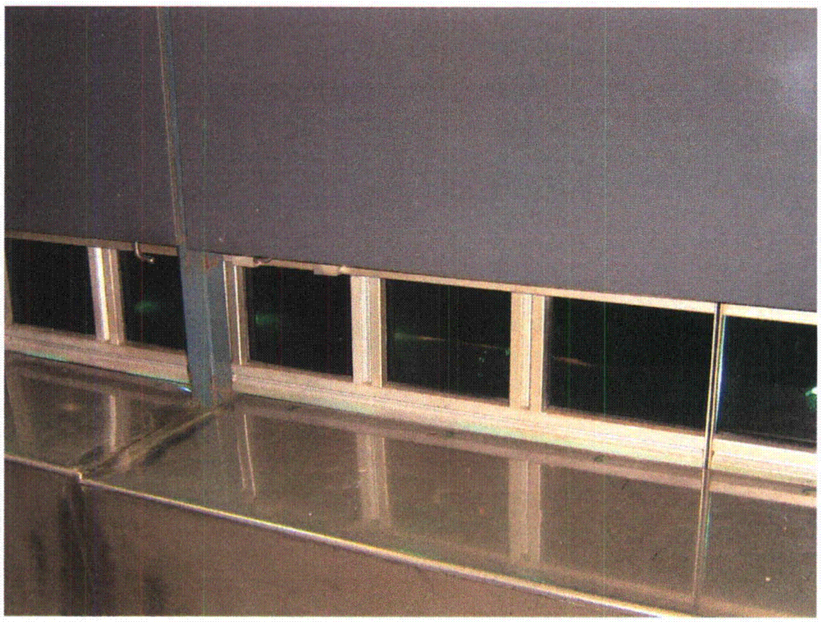
Attachment 5 - NUREG 1556, Vol 8, Appendix J, Requirement B6

Quality Control Procedures

Quality Control of Gas Filling Integrity – BLV Supplier

Same or similar practices employed at other Electron Tube manufacturers.

Inline testing means that every lamp from this machine is burnt and sorted if a lamp doesn't glow when subjected to a tesla coil. One possible reason for a failure is a leaky lamp, one that does not contain the fill gas.



A more general testing is the visual inspection of glow as seen in the picture. Even the glow of a slightly "leaky" lamp will change from faint Blue to a more intense Red.

All lamps are lighted and measured for lamp voltage and other electrical characteristics. Any lamp which does not exhibit electrical readings that are within specified tolerances is rejected and NOT shipped.

ATTACHMENT 5 – (B6)

Attachment 5 (B6)

Computer based final inspection protocol of quality department

WAP Prüfprotokoll

BLV USHIO Group

Prüfbericht Nr.: 74626_10_0

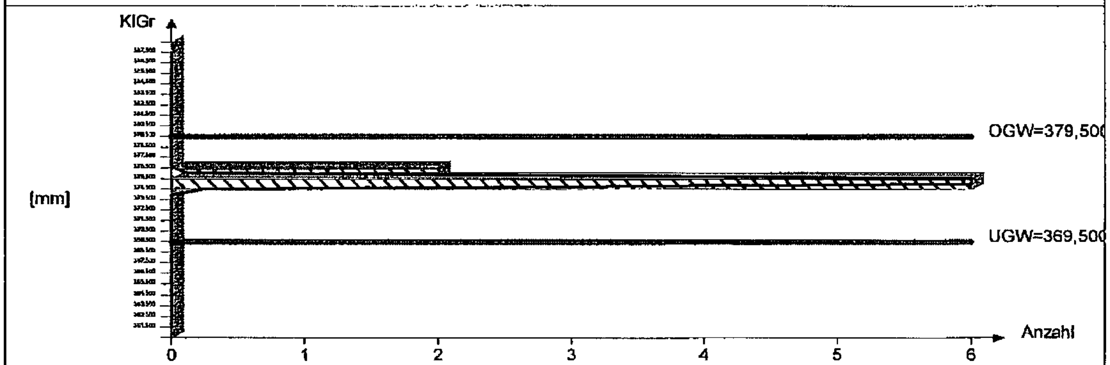
Auftragsnummer:	74626_10_0	**Losumfang:**	53 STCK number of lamps
Artikel-Bez.:	MHL 450	**Lieferdatum:**	02.10.2009
Artikel-Nr.	23060208	**KW-Code:**	9/40 traceability by date year/calendar week
Chargen-Nr.	0064130 batch number		

Geprüfte Merkmale

Merkmalsbezeichnung:	Stichprobenumfang:	u.Tol.	Nennwert	o.Tol.	Einheit
Litzenlänge C cable length	8 Stück	-5.000	374.500	5.000	mm

Histogramm

Auftrag: 74626_10_0		Datum von: 1.3.1998 07:00:00	Anzahl Stichproben: 1
Merkmal: Litzenlänge C		Datum bis: 1.2.2010 23:00:00	Anzahl Messwerte: 8



Median: 375	v: 0,214286	xq: 375,25
xmin: 375	s: 0,46291	
xmax: 376	R: 1	

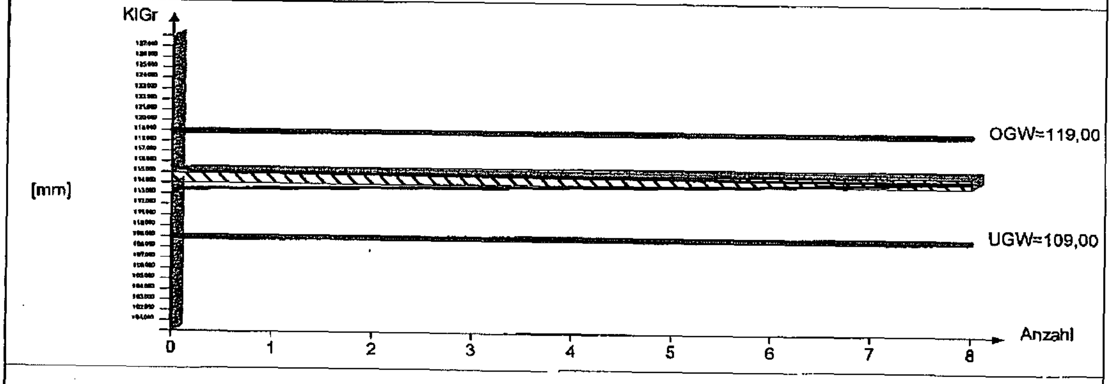
Erstellt am 8.10.2009 um 09:18:21 Erstellt von PT

Merkmalsbezeichnung:	Stichprobenumfang:	u.Tol.	Nennwert	o.Tol.	Einheit
Gesamtlänge OAL - C overall length	8 Stück	-5.00	114.00	5.00	mm

Histogramm

Auftrag: 74626_10_0
Merkmal: Gesamtlänge OAL - C

Datum von: 1.3.1998 07:00:00 Anzahl Stichproben: 1
Datum bis: 1.2.2010 23:00:00 Anzahl Messwerte: 8



Median: 114,285 v: 0,02027 xq: 114,31875
xmin: 114,13 s: 0,142371
xmax: 114,56 R: 0,43

Erstellt am 8.10.2009 um 09:18:22

Erstellt von PT

Sichtprüfung mit Anzahl Fehler: *visual inspection*

Merkmalsbezeichnung	**Luxen und Luxbild WAP-C**	*Ignition test by High Voltage*
Stichprobenplan:	**AQL 0,65**	*Quality level 0,65 %*
Stichtprobenumfang:	**20**	
Anzahl Fehler:	**0**	**Entscheidung: IO** *Decision okay*

Lampe ohne Funktion	**0**	*Don't lite*	
Luxbild nicht in Ordnung	**0**	*Appearance of glow is out of order*	

Sichtprüfung mit Anzahl Fehler: *visual inspection*

Merkmalsbezeichnung	**Sichtprüfung Folie-C**	*visual inspection of Mo-foil in pinching*
Stichprobenplan:	**AQL 0,65**	
Stichtprobenumfang:	**20**	
Anzahl Fehler:	**0**	**Entscheidung: IO**

Beschädigung der Folienkante	**0**		

Sichtprüfung mit Anzahl Fehler:

Merkmalsbezeichnung Sichtprüfung Stempelung Lampe Stamping of lamp
Stichprobenplan: AQL 0,65
Stichtprobenumfang: 2
Anzahl Fehler: 0 **Entscheidung:** IO

Stempelung nicht nach Stempelvorschrift	0	Right stamp according to database?	
Stempel nicht leserlich	0	Readability on lamp.	

Sichtprüfung mit Anzahl Fehler:

Merkmalsbezeichnung Sichtprüfung Stempelung Verpackung Stamping on lampbox
Stichprobenplan: AQL 0,65
Stichtprobenumfang: 2
Anzahl Fehler: 0 **Entscheidung:** IO

Verpackung falsch	0	Type of lamp box	
Stempelung nicht nach Stempelvorschrift	0	Right stamp	
Lampe in Faltschachtel fehlt	0	Missing lamp in box	
Verpackung beschädigt	0	Appearance of box -> defect?	

Sichtprüfung mit Anzahl Fehler: visual inspection

Merkmalsbezeichnung WAP-MHL-C
Stichprobenplan: AQL 0,65
Stichprobenumfang: 20
Anzahl Fehler: 0 **Entscheidung:** IO

Elektrode gebrochen broken electrode	0	Beschichtung löst sich	0	coating
Elektrode Oxydiert oxidation of electr.	0	Beschichtung verschmutzt	0	coating
Quarzart falsch Kind of quartz	0	Sockel mit Absplitterung	0	lampbase
Arctube geschwärzt black arctube	0	Sockel gebrochen	0	lampbase
Lampe aufgeblasen deformed glass	0	Sockel verschmutzt	0	lampbase
Kontakt schief contact deformed	0	Litze verschmutzt	0	wire dirty
Beschichtung fehlt Coating is missing	0	Abschmelzung abgesplittert	0	exhaust tip
Quarzsprung crack in glass	0	Abschmelzung nicht in Ordnung	0	exhaust tip

Sichtprüfung mit Anzahl Fehler:

Merkmalsbezeichnung Warnhinweis
Stichprobenplan: AQL 0,65
Stichprobenumfang: 2
Anzahl Fehler: 0 **Entscheidung:** IO

Einlegezettel Warnhinweis fehlt	0	Missing Warnings and Instruction paper.	

Bemerkung: **Stempelung auf Lampe nicht nach Stempelvorschrift**
"Cosmedico" wurde falsch gestempelt = Cosmedic Lampen wurden neu gestempelt i. O.
HG 07.10.2009

This is a second run because name Cosmedic was incomplete. After second stamping Cosmedico was stamped according to stamping code

Freigabe zur Lieferung: **IO**

Prüfer: HG Name and sign of inspector

Datum: 8.10.2009 Unterschrift: ....

Attachment 5 (B6)
Products that are supplied by Radium under current license of OSI. Same processes and QC procedures are employed for our products.

U.S. NUCLEAR REGULATORY COMMISSION

Amendment No. 15

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 letter dated October 6, 2008
1. Osram Sylvania Products, Inc.	3. License Number 20-30024-02E is amended in its entirety to read as follows:
2. 100 Endicott Street Danvers, MA 01923	4. Expiration date: August 31, 2011
	5. Docket No. 030-33162 Reference No. 31-23515-01E

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. Krypton-85	A. Gas	A. Not Applicable (see License Condition No. 10)
B. Promethium-147	B. Plated sources	B. Not Applicable (see License Condition No. 10)

9. Authorized use:

Pursuant to Section 32.14, 10 CFR Part 32, "Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material"; the licensee is authorized to distribute krypton-85 contained in electron tubes, such as glow switches used in starters and fluorescent lamps, and arc tubes used in HID lamps; and promethium-147 as contained in electron tubes, such as glow starter bottles used in fluorescent lamps, to persons exempt from licensing pursuant to Section 30.15, 10 CFR Part 30, or equivalent provisions of the regulations of any Agreement State.

CONDITIONS

10. This license does not authorize possession or use of licensed material.

11. The licensee is authorized to distribute only from its facilities located 1651 South Archibald Avenue, Ontario, CA; 1100 Tyrone Pike, Versailles, KY; 2460 Broadhead Road, Bethlehem, PA; 435 East Washington Street, Winchester, KY; and 665 South Willow Street, Manchester, NH.

12. The licensee shall submit periodic material transfer reports as specified in Section 32.16, 10 CFR Part 32.

NRC FORM 374A U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE SUPPLEMENTARY SHEET	License Number 20-30024-02E
	Docket or Reference Number 030-33162
	Amendment No. 15

CONDITIONS

(Continued)

13. The licensee is exempt from the labeling requirements of 10 CFR 32.15(d) as they apply to individual electron tubes, provided that each immediate container is labeled in accordance with 10 CFR 32.15(d).

14. The Corporate Radiation Safety Officer and the official records are located at 171 Traver Road, Pleasant Valley, NY 12569.

15. Except as specifically provided otherwise by 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 U.S. 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 February 23, 2001;
    B. Letter dated May 30, 2001;
    C. Letter dated November 17, 2003;
    D. Letter dated February 23, 2004;
    E. Letter dated May 3, 2004;
    F. Letter dated June 28, 2004;
    G. Letter dated December 21, 2004;
    H. Letter dated October 6, 2008; and
    I. Letter dated December 22, 2008.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date January 13, 2009

By [signature]
Richard K. Struckmeyer
Materials Licensing Branch
Division of Materials Safety
and State Agreements
Office of Federal and State Materials
and Environmental Management Programs
Washington, DC 20555l

Environmental Health & Safety

OSRAM SYLVANIA

October 6, 2008

Division of Industrial and Medical Nuclear Safety
Office of Nuclear Materials Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Ref: License No. 20-30024-02E

Dear Sir or Madam:

This is a request to amend the above referenced license to add a new type of metal halide lamp (family), namely Tubular HID Sunlamps. These lamps are manufactured in Germany by Radium Lampenwerk GmbH. They would be distributed in the United States by our firm through any of our licensed distribution centers under the brand names: Cosmedico and JK-RUSA.

Each of the new lamps consists of a quartz arc tube and appropriate electrical connections. There is no outer bulb. See Enclosure #1 for a drawing of Cosmedico ME1530P, one of the lamps with the maximum wattage. The fill gas in each arc tube is an Argon-Kr-85 mixture, with a maximum Kr-85 activity of 120 nCi. This is less than the limit specified for metal halide lamps in our application for renewal of the above license dated 2/23/01, Attachment #2, page 9 of 18. According to the manufacturer, the radiation level at the surface of each lamp is non-detectable.

Enclosure #2 contains examples of (1) individual lamp package labeling and (2) bulk lamp package labeling, where lamps are not shipped in individual packages. Labeling for JK-RUSA branded lamps is essentially the same except for the brand name.

Enclosure #3 is the lamp manufacturing quality assurance program provided to us by the lamp manufacturer.

It should be pointed out that the possession licenses for all Points of Distribution listed in Condition #11 in the above referenced license are up-to-date.

If there are any questions on the above or if additional information is required please contact me. I may be reached directly by mail at 171 Traver Road, Pleasant Valley, NY 12569, email at ahj@sctser.com, fax at (845) 635-5016 or by telephone at (845) 635-8698.

Sincerely,

Alan H. Jones
Corporate Radiation Safety Officer

Enclosures: #1, #2, & #3

cc: Paul Feltri, Danvers, MA
Corporate Environmental & Safety Manager
100 Endicott Street
Danvers, MA 10923
Tel: (978) 750-2054

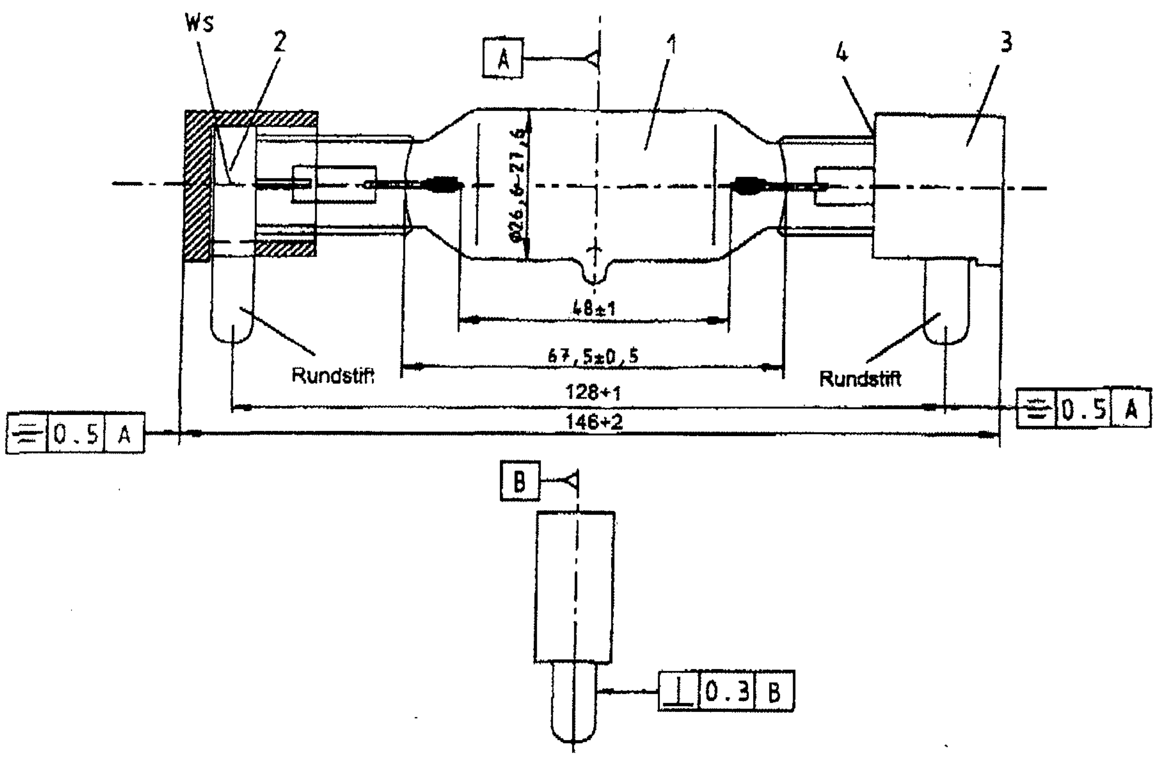
Osram Sylvania Products, Inc.
100 Endicott Street
Danvers, MA 01923

Application For Amendment of Radioactive Materials License No. 20-30024-02E
Enclosure 1 of 3
Date: 10/6/08

1000 Watt Tubular HID Sunlamp Model: Cosmedico ME1510P:

NOT TO SCALE

Measurements in mm



KEY
1 = Quartz arc tube
2 = Metal pin
3 = Base
4 = Potting cement
WS = Resistance weld
Rundstift = Round pin

Osram Sylvania Products, Inc.
100 Endicott Street
Danvers, MA 01923

Application For Amendment of Radioactive Materials License No. 20-30024-02E
Enclosure 2 of 3
Date: 10/6/08

Lamp Package Labeling:

ACTUAL SIZE

Individual Lamp Package:

Cosmedico
M E 1530 P
code no: #21106
NAED 69609
Made in EC
CE

This product is in conformity with performance standards for sunlamp products under 21 CFR Part 1040.20.
Distributed under USNRC license # 20-30024-02E.

Sunlamp-DANGER-Ultraviolet radiation. Follow instructions. Use ONLY in fixture equipped with a timer.
Use ONLY in fixture equipped with an appropriate filter. Follow sunlamp equipment manufacturers instructions.
Avoid overexposure. As with natural sunlight overexposure can cause eye and skin injury and allergic reactions.
Repeated exposure may cause premature aging of the skin and skin cancer.
WEAR PROTECTIVE EYEWEAR: FAILURE TO MAY RESULT IN SEVERE BURNS OR LONG-TERM INJURY TO THE EYES:
Medications or cosmetics may increase your sensitivity to the ultraviolet radiation. Consult physician before using sunlamp if you are using medication or have a history of skin problems or believe yourself especially sensitive to sunlight. If you do not tan in the sun you are unlikely to tan from the use of this product. Lamp filling gas contains Kr-85.

Bulk Lamp Packaging:

Cosmedico®

M E 1530 P

1000 W
code no:
#21106
25 pieces

This product is in conformity with performance standards for sunlamp products under 21 CFR Part 1040.20.
Distributed under USNRC license # 20-30024-02E.

Sunlamp-DANGER-Ultraviolet radiation. Follow instructions.
Use ONLY in fixture equipped with a timer.
Use ONLY in fixture equipped with an appropriate filter.
Follow sunlamp equipment manufacturers instructions.
Avoid overexposure. As with natural sunlight overexposure can cause eye and skin injury and allergic reactions.
Repeated exposure may cause premature aging of the skin and skin cancer.
WEAR PROTECTIVE EYEWEAR; FAILURE TO MAY RESULT IN SEVERE BURNS OR LONG-TERM INJURY TO THE EYES.
Medications or cosmetics may increase your sensitivity to the ultraviolet radiation.
Consult physician before using sunlamp if you are using medications or have a history of skin problems or believe yourself especially sensitive to sunlight.
If you do not tan in the sun you are unlikely to tan from the use of this product.
Lamp filling gas contains Kr-85.

CE
Made in Germany
323 16463
NAED: 69609

4 046949 211066

Cosmedico Licht GmbH / Kölner Str. 8 / 70376 Stuttgart / Deutschland / www.cosmedico.de

Osram Sylvania Products, Inc.
100 Endicott Street
Danvers, MA 01923

Application For Amendment of Radioactive Materials License No. 20-30024-02E
Enclosure 3 of 3
Date: 10/6/08

Lamp Testings, Measurements & Quality Control:

(AS SUPPLIED BY RADIUM LAMPENWERK GmbH)

Testings Performed:

"After the filling process the lamp voltages of all lamps are monitored. A burner which is not inside the specification is regarded as a possible leaker and is discarded. After putting the socket on the burner all lamps are burnt in. A lamp passing this test is considered to be o.k. because a leaking lamp would not start up."

Measurements:

"The filling devices are controlled once a week. This is done by controlling the filling pressure of a burner which is actually being processed.
The quantity of Kr-85 in the arc tube is a function of the specific activity of the filling gas and volume of the arc tube. Each tank of the Argon-Krypton-85 mixture received from the supplier comes with a certification concerning the Krypton-85 concentration. The determining parameter for the volume with a given diameter is the pinching distance. This value is controlled twice every shift for each different type."

Quality Control

"After pinching every burner is controlled visually. Burners with cracks or channels in the pinch is discarded.
After filling every burner is switched on and the lamp voltage is monitored. Burners not inside the specification are being destroyed.
During continuous production periods life and reliability tests are performed on a regular basis, e.g. 3 lamps per type and day are tested for electrical parameters and UV-output."

Environmental Health & Safety

OSRAM SYLVANIA

December 22, 2008

Mr. Richard Struckmeyer
Materials Licensing Branch
Division of Materials Safety & State Agreements
Office of Federal & State Materials &
Environmental Management Programs
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Ref: License No. 20-30024-02E
Your letter dated December 2, 2008
Mail Control No. 022714

Dear Mr. Struckmeyer:

Before responding to the specific questions in your letter, I wish to call your attention to the change in the structure of our Distribution License that was made at the time of the most recent license renewal in 2001.

Prior to that renewal, every lamp model had been listed in the license at the time of the previous renewal and by many subsequent amendments. For the 2001 renewal it was proposed that rather than licensing each individual lamp model by number and having to amend the license each time there was a new lamp model number or a model number change, we requested the licensing of lamp families (types) instead. This would allow for new lamp models to be added to a family or changes to a lamp in a family requiring a new model number, without having to amend the license, provided that the lamp remained in the same family and met the license requirements of that family, such as radioactive material used and activity limit, QC testing, labeling, etc. This request was approved by the Commission with the issuance of the renewed license. Since then, the new license structure has reduced the number of required license amendments due to minor changes to lamp models within families or new lamps being added to existing lamp families. The license amendment request contained in my letter of October 6, 2008 is for a new lamp family.

Re. Your questions in the above referenced letter:

#1 The requested information was provided in our October 6, 2008 license amendment request cover letter for the product we are asking to be added to our license, namely Tubular HID Sunlamps. Each lamp contains an Argon/Kr-85 gas mixture up to a maximum of 120 nanocuries. As stated in my letter, this product (lamp family) will be distributed under the brand names, Cosmedico and JK-RUSA.

#2 10CFR32.14b(2) states that the required information is for each product, not necessarily every model of the product. Currently there are 14 models of the Tubular HID Sunlamp that we desire to distribute, with varying operating voltages that are all of essentially the same design and construction. The information on design and construction details of the product, shown in Enclosure #2 of our amendment request, are for the Kr-85 containing model with the highest Kr-85 content and operating voltage.

#3 The Argon/Kr-85 gas mixture is sealed in the glass tube (burner) by pinching the glass as referenced in the Quality Control section in Enclosure #3 of our amendment request. In the same section, the test procedure is described that insures that the 'pinch' has taken. If the some of the gas has leaked out, the lamp will not perform properly and is discarded. (See also #4, below.)

OSRAM SYLVANIA Services Inc. www.sylvania.com Telephone (978) 777-1900 Fax (978) 750-2523 100 Endicott Street Danvers, MA 01923

OSRAM
SYLVANIA

#4 Our distribution license has never required prototype testing of glass lamps containing a small quantity of Kr-85. (Ref. Page 9 of 18 of Attachment #2, to our license renewal application, dated 2/23/01) Normal usage of these lamps consists of placement in a fixture by a user and removal when it no longer functions. The release of the small quantity of Kr-85 contained in these lamps would occur only in the event of the breakage of the quartz bulb. This would not be considered normal usage. The Testings Performed and Quality Control procedures, described in Enclosure #3 of our amendment request, would detect any leakers after filling.

#5 Because the amount of Kr-85 used in the subject lamps is too small to be accurately measured by radiation detection equipment, the only practical method of controlling the amount of the Kr-85 in the lamps is described in the Measurement section in Enclosure #3 of our amendment request. The Argon/Kr-85 gas mixture is certified by the manufacturer as to the concentration of Kr-85. The volume of glass tube to be filled depends on the inside diameter of the tube and the fill length as determined by the pinching distance.

Further information provided by the lamp manufacturer, Radium Lampenwerk GmbH:

- The pressure of the Argon/Kr-85 gas mixture in the supply tank is regulated to provide the desired quantity of the mixture in the glass tube for the lamp model being manufactured;
- If the gas pressure in the lamp tube were to be significantly out of specification, there would be a problem with the ignition of the finished lamp and Quality Control would reject the lamp;
- If the volume of the lamp pinch were to be out of specification, the lamp voltage would not be in the right range, and therefore the lamp would not operate properly and Quality Control would reject the lamp;
- No lamp is manufactured containing more than 0.12 microcuries of Kr-85.

#6 Radium's Quality Assurance practices for the manufacture of Tubular HID Sunlamps are described in Enclosure #3 of our amendment request. The subject lamps will only be sold by Osram Sylvania to customers for installation by them into fixtures. Osram Sylvania will not install the lamps into fixtures, nor will we sell lamps pre-installed in fixtures.

If there are any questions on the above or enclosed or if additional information is required please contact me. I may be reached directly by mail at Osram Sylvania Products, 171 Traver Road, Pleasant Valley, NY 12569, by telephone at (845) 635-8698 or fax at (845) 635-5016.

Sincerely,

Alan H. Jones
Corporate Radiation Safety Officer

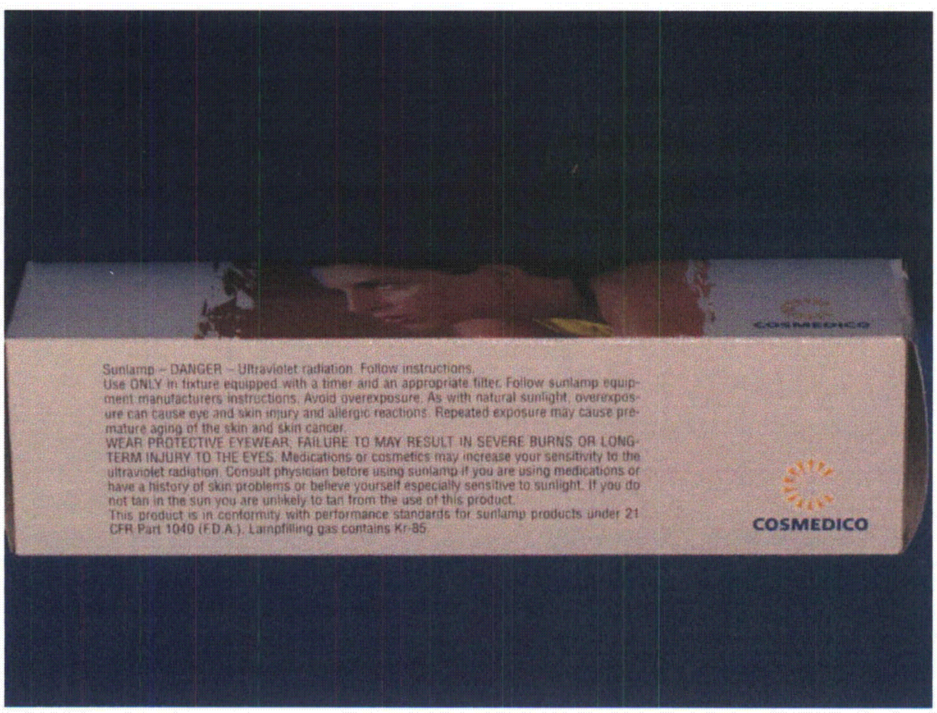
cc: P. Feltri, Danvers, MA
Corporate Environmental & Safety Manager
100 Endicott Street
Danvers, MA 10923
Tel: (978) 750-2054

Attachment 6 - NUREG 1556, Vol 8, Appendix J, Requirement B7
Markings and Labels

ATTACHMENT 6 – (B7)

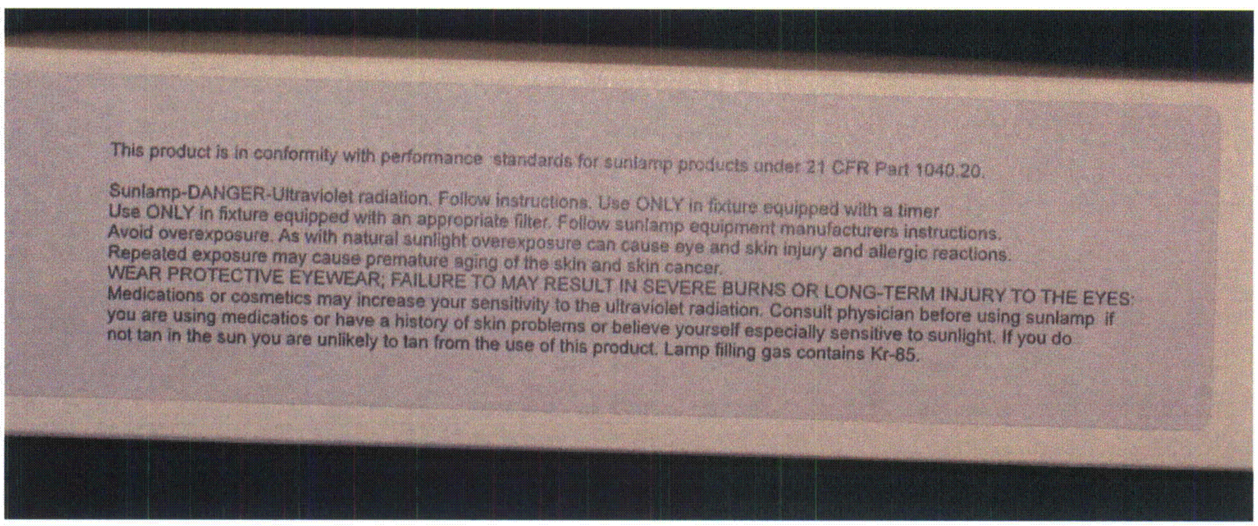
- **Proposed method of labeling**: Lamp cartons and uniquely associated individual lamp boxes contain a statement that the item contains Kr85. In certain instances, an insert Notice may be added to the individual lamp package. **EXAMPLES SHOWN ON THE FOLLOWING PAGES.**

Product Number 20046

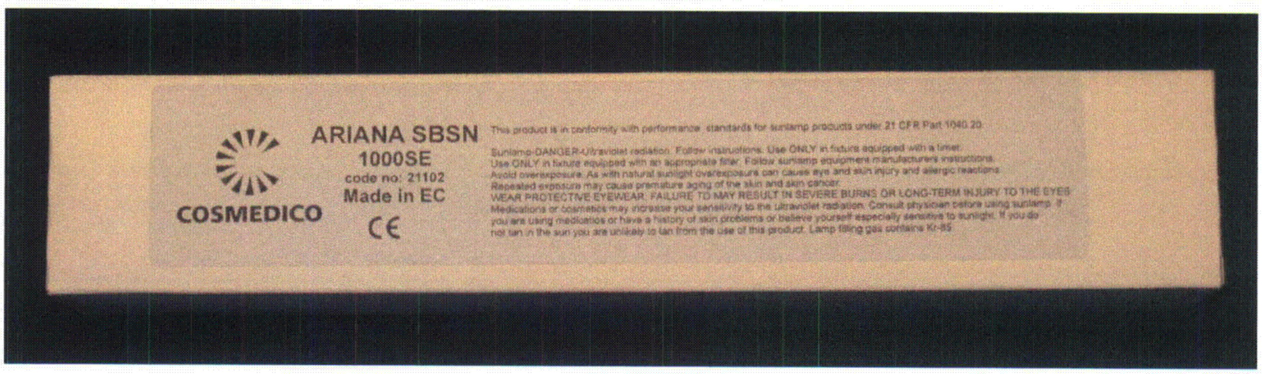


022785

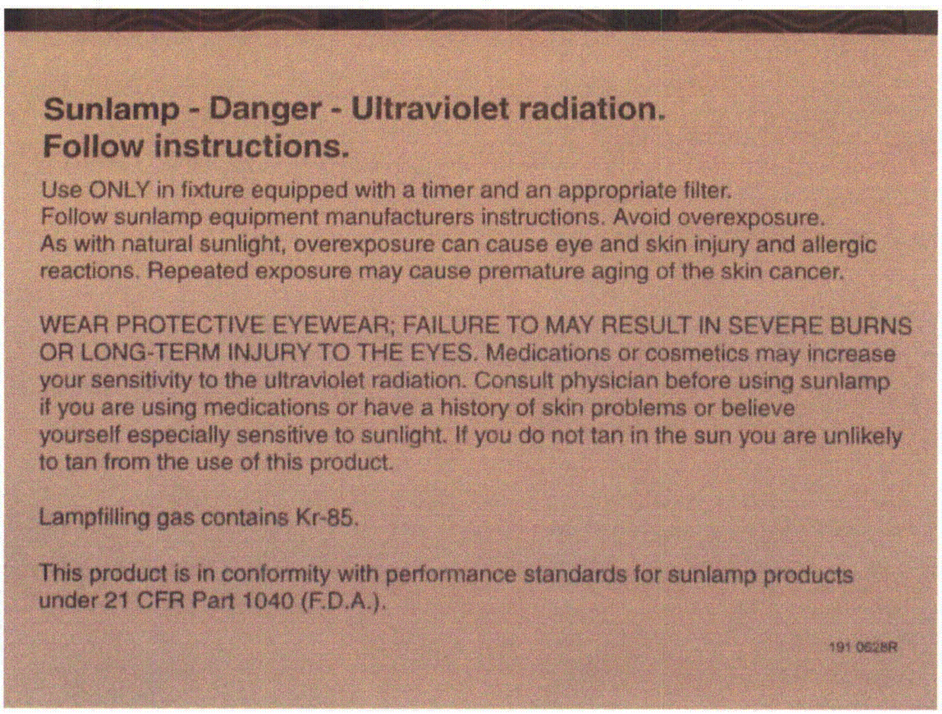
Product Number 21082



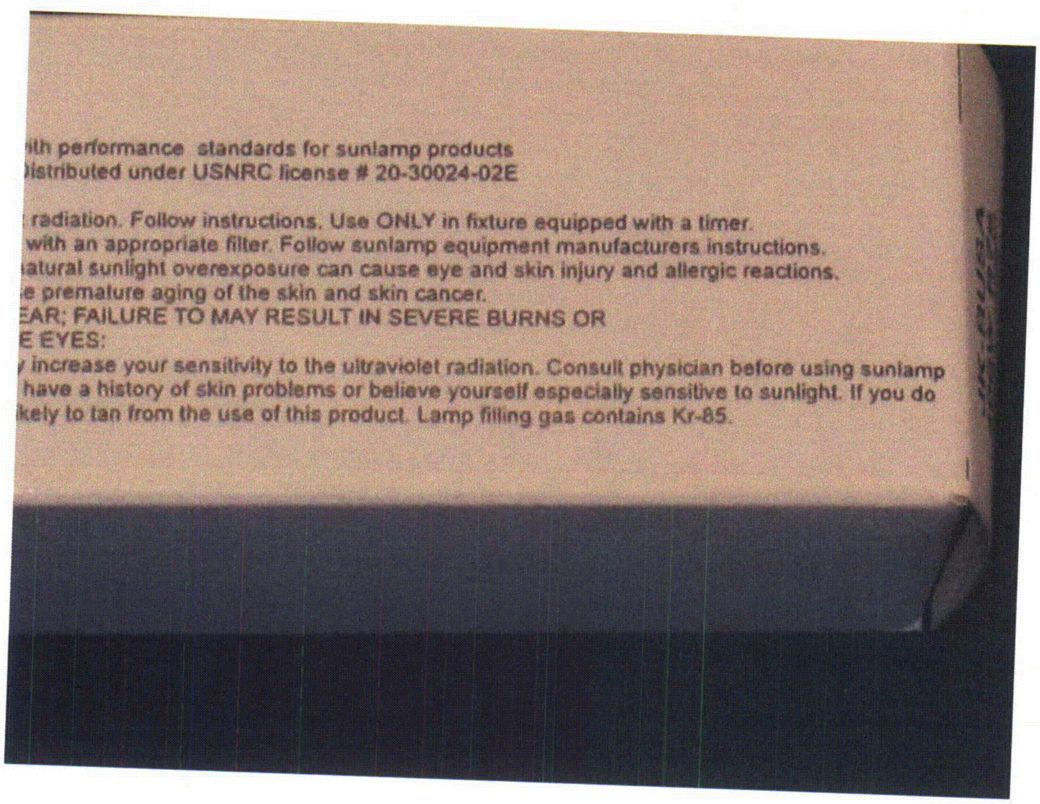
Product Number 21102



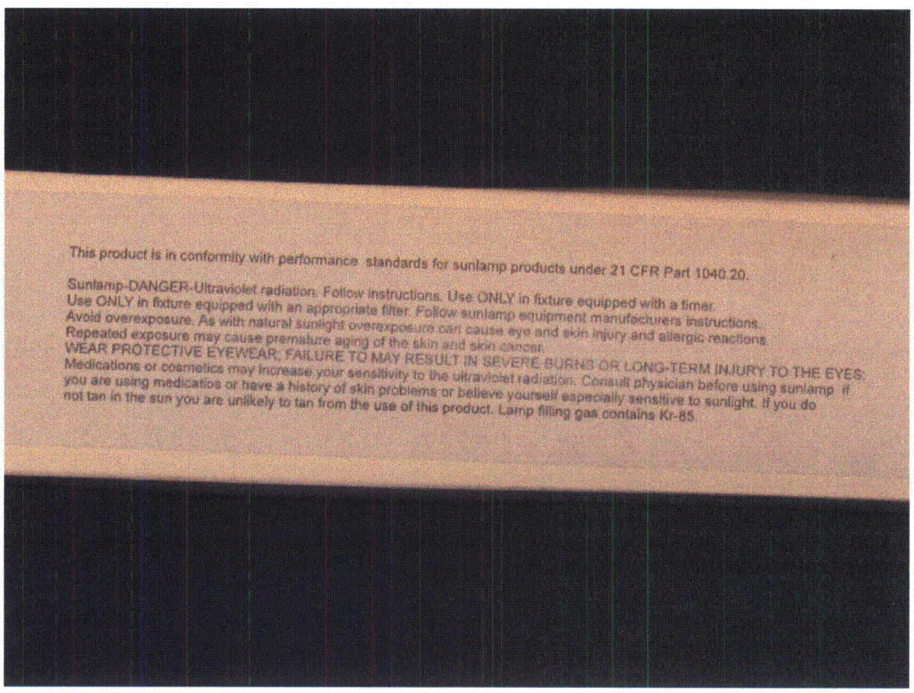
Product Number 21103



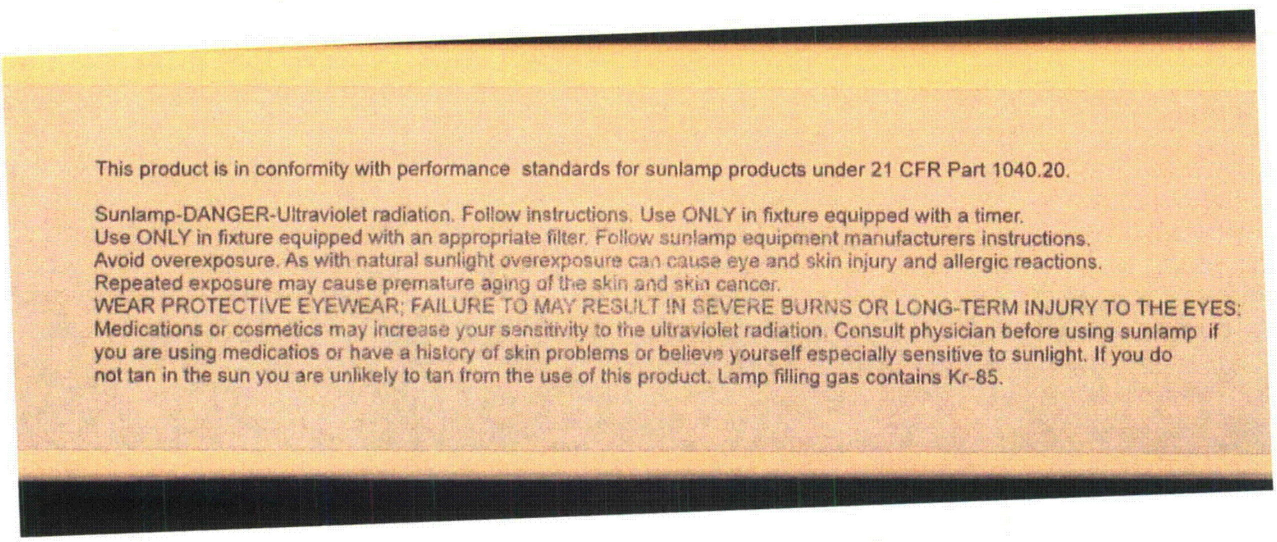
Product Number 21104



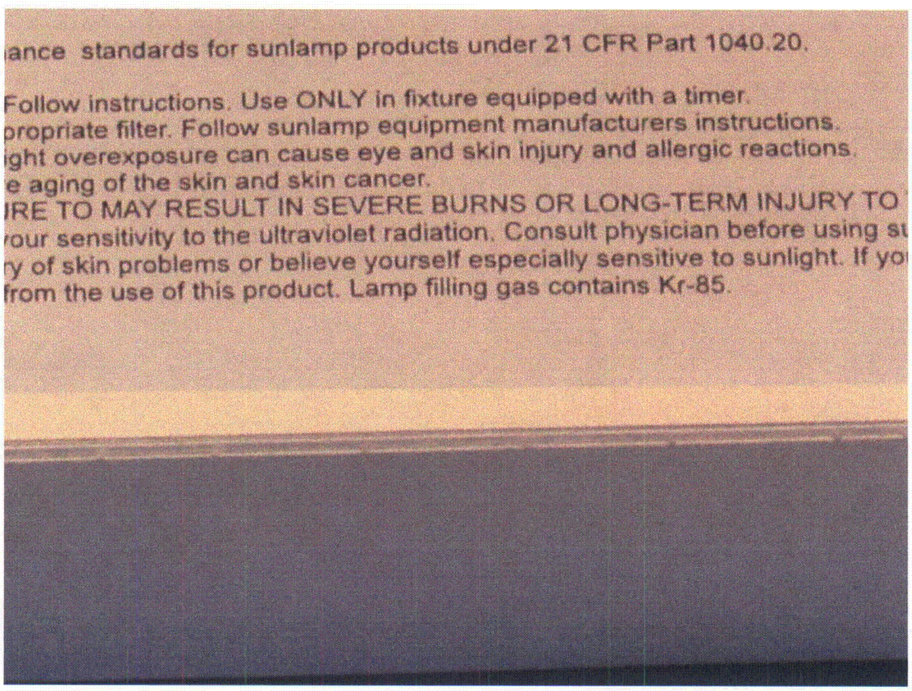
Product Number 21106



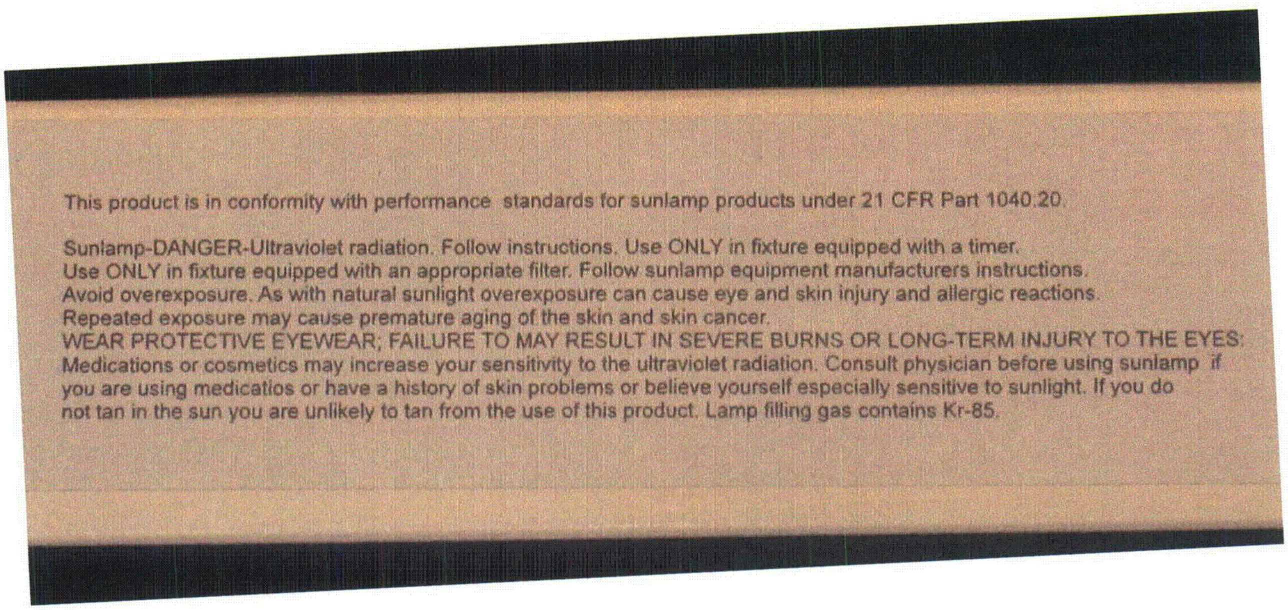
Product Number 21107



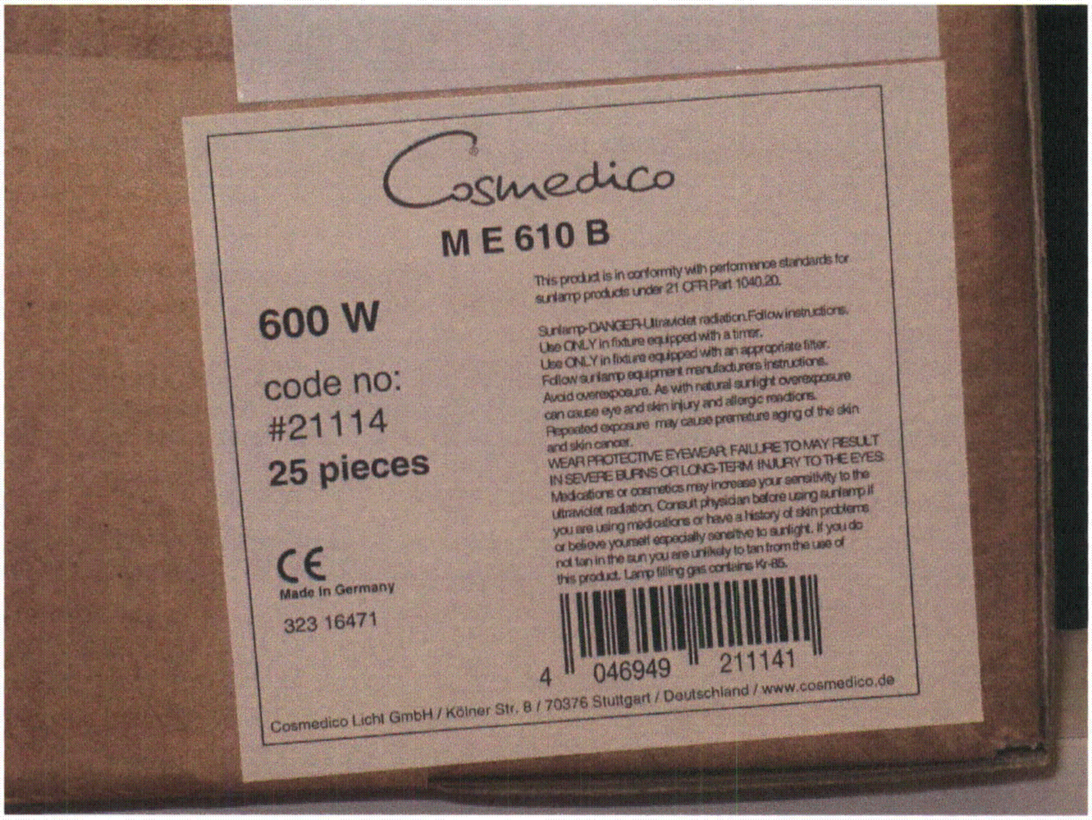
Product Number 21111

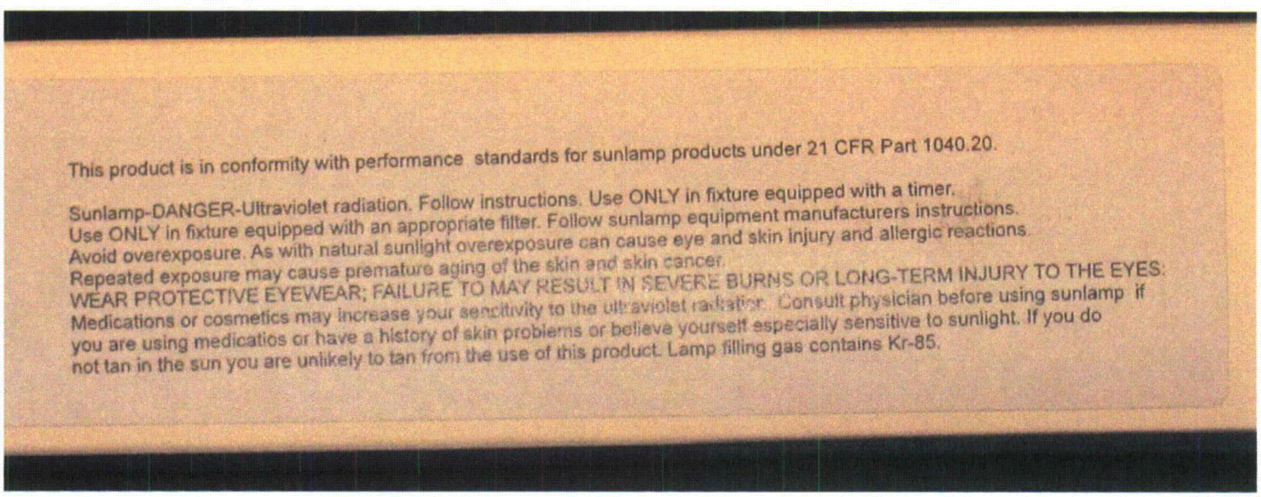


Product Number 21113

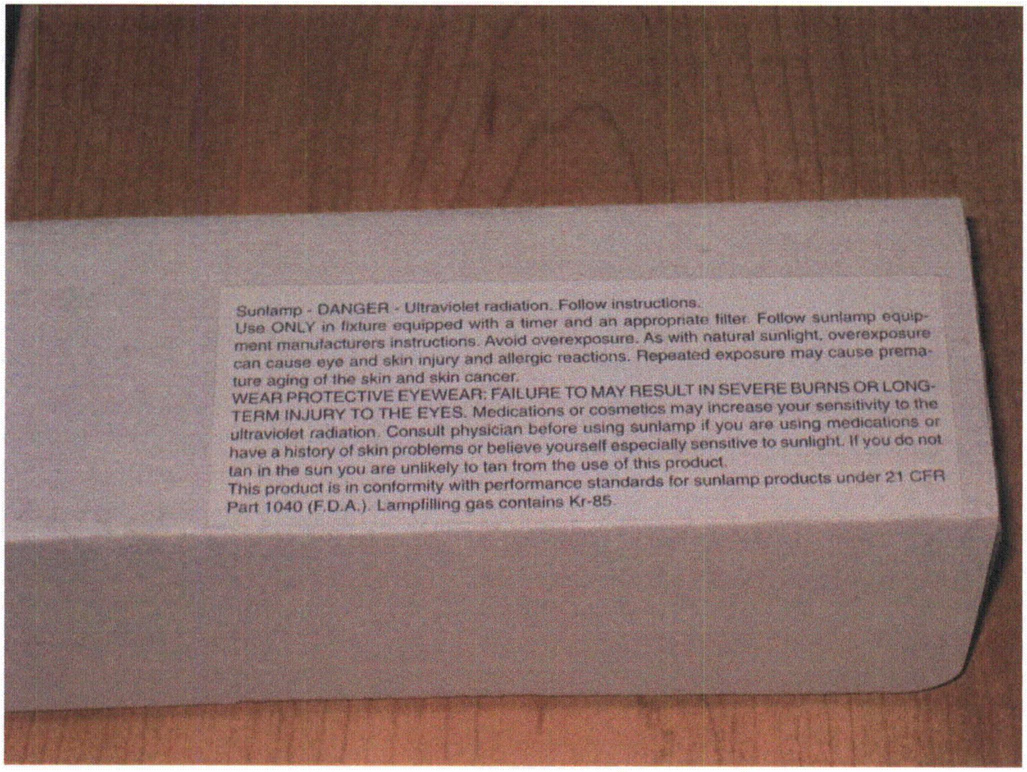


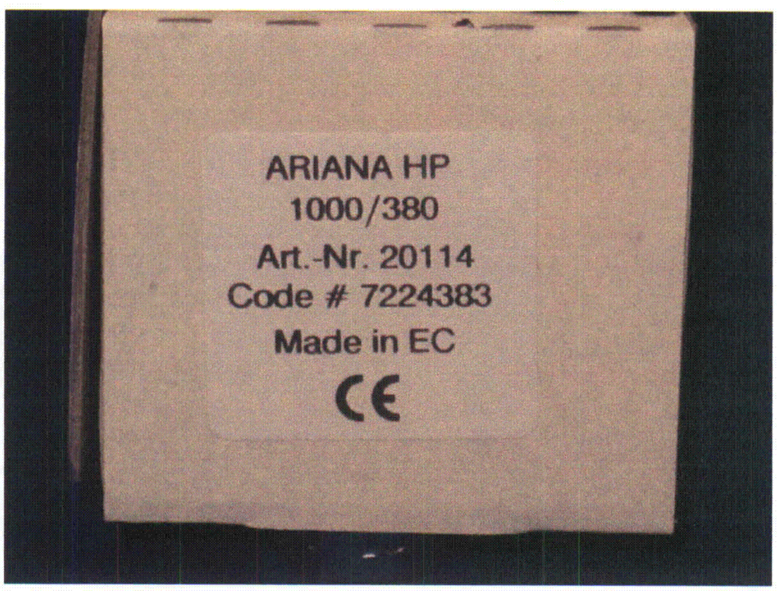
Product Number 21114



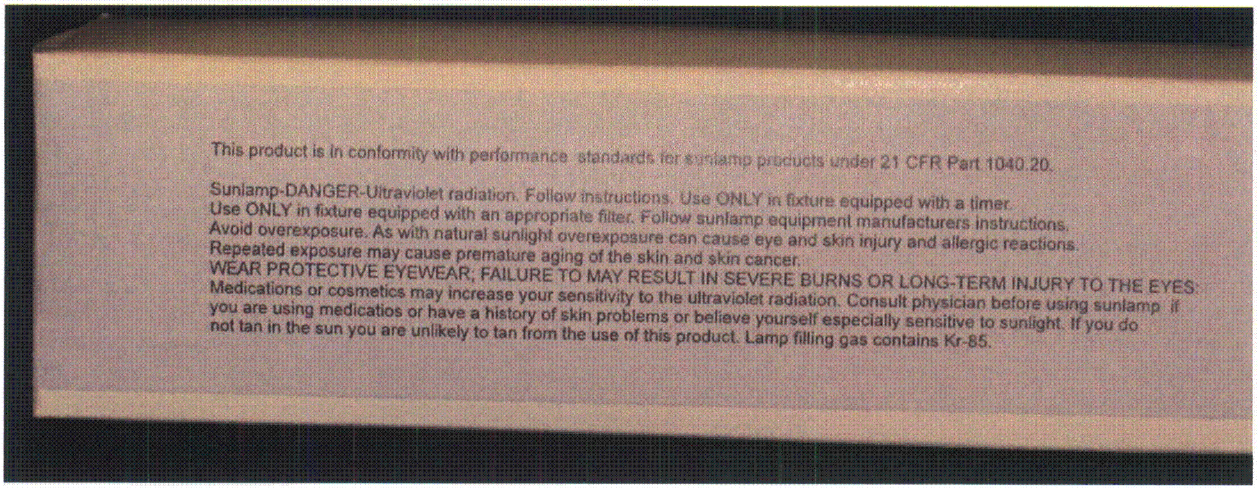


Product Number 20114

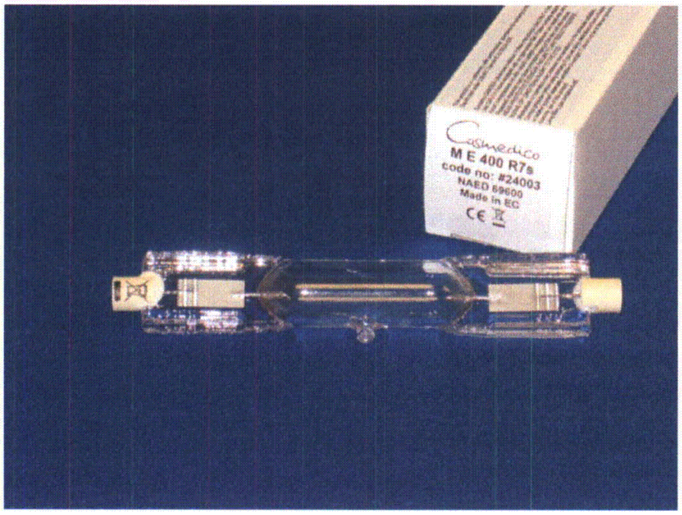




Product Number 21115



Product Number 24003



This product is in conformity with performance standards for sunlamp products under 21 CFR Part 1040.20.
Distributed under USNRC license # 20-30024-02E

Sunlamp-DANGER-Ultraviolet radiation. Follow instructions. Use ONLY in fixture equipped with a timer.
Use ONLY in fixture equipped with an appropriate filter. Follow sunlamp equipment manufacturers instructions.
Avoid overexposure. As with natural sunlight overexposure can cause eye and skin injury and allergic reactions
Repeated exposure may cause premature aging of the skin and skin cancer.
WEAR PROTECTIVE EYEWEAR; FAILURE TO MAY RESULT IN SEVERE
BURNS OR LONG-TERM INJURY TO THE EYES:
Medications or cosmetics may increase your sensitivity to the ultraviolet radiation.
Consult physician before using sunlamp if you are using medicatios or have a history of skin problems
or believe yourself especially sensitive to sunlight. If you do not tan in the sun you are unlikely to tan
from the use of this product.
Lamp filling gas contains Kr-85.

ATTACHMENT 7 (B9)

Krypton

Symbol:	**Kr**
Atomic Number: *(protons in nucleus)*	**36**
Atomic Weight:	**84**

What Is It? Krypton is a colorless, odorless, tasteless gas about three times heavier than air. It was discovered in 1898 by Sir William Ramsay and Morris Travers in the residue left after evaporating water, oxygen, nitrogen, helium, and argon from a sample of liquid air. The name comes from the Greek work *kryptos*, meaning hidden. As a noble gas, krypton is generally inert and forms very few chemical compounds. It occurs in nature as six stable isotopes. (Isotopes are different forms of an element that have the same number of protons in the nucleus but a different number of neutrons.) Krypton-84 is the most prevalent, comprising about 57% of natural krypton. The other five stable isotopes and their relative abundances are krypton-78 (0.4%), krypton-80 (2.3%), krypton-82 (12%), krypton-83 (11%), and krypton-86 (17%).

Eleven major radioactive isotopes of krypton exist of which only two – krypton-81 and krypton-85 – have half-lives long enough to warrant concern. Krypton-81 has a half-life of 210,000 years, and krypton-85 has a half-life of 11 years; the half-lives of the other krypton isotopes are less than two days. Krypton-85 is the isotope of concern at Department of Energy (DOE) environmental management sites such as Hanford. It is produced by the fissioning of uranium and plutonium and is present in spent nuclear fuel. The low specific activity of krypton-81 limits its radioactive hazards.

Radioactive Properties of Key Krypton Isotopes

Isotope	Half-Life *(yr)*	Specific Activity *(Ci/g)*	Decay Mode	Radiation Energy *(MeV)*		
				Alpha *(α)*	Beta *(β)*	Gamma *(γ)*
Kr-81	210,000	0.021	EC	-	0.0051	0.012
Kr-85	11	400	β	-	0.25	0.0022

EC = electron capture, Ci = curie, g = gram, and MeV = million electron volts; a dash means the entry is not applicable. (See the companion fact sheet on Radioactive Properties, Internal Distribution, and Risk Coefficients for an explanation of terms and interpretation of radiation energies.) Values are given to two significant figures.

Where Does It Come From? Krypton is naturally present in meteorites and minerals in trace quantities. It exists naturally in the atmosphere at a concentration of about 1 cubic centimeter per cubic meter (cm^3/m^3). Radioactive krypton-85 is present in the natural environment in minute quantities due to the spontaneous and neutron-induced fission of uranium and other actinides. Krypton-81 and krypton-85 are both present in the atmosphere due to neutron capture reactions from cosmic ray neutrons interacting with stable krypton isotopes. Krypton can be obtained as a byproduct from the liquefaction and separation of air.

The major source of krypton-85 is nuclear fission. When an atom of uranium-235 (or other fissile nuclide) fissions, it generally splits asymmetrically into two large fragments – fission products with mass numbers in the range of about 90 and 140 – and two or three neutrons. (The mass number is the sum of the number of protons and neutrons in the nucleus of the atom.) Krypton-85 is one such fission product with a fission yield of about 0.3%. That is, three atoms of krypton-85 are produced per 1,000 fissions. An estimated 5 million curies of krypton-85 were released to the atmosphere as a result of nuclear weapons tests from 1945 through 1962. A large commercial nuclear power plant produces about 300,000 curies of krypton-85 per year, essentially all of which is retained within the fuel elements. This gaseous radionuclide is a component of spent nuclear fuel and is generally released to the atmosphere when the fuel is reprocessed. About 50,000 curies of krypton-85 were released to the atmosphere as a result of the accident at Three Mile Island in which a large number of fuel elements ruptured.

How Is It Used? Krypton has a number of industrial and medical applications. It is used alone or in combination with argon and neon in fluorescent lights. It emits a characteristic bright orange-red color and is used in lights at airports because the red light is visible for long distances and penetrates fog and haze to a greater extent than ordinary light. Krypton is also used in tungsten-filament projection lamps for home movies and slide projectors. A krypton gas laser produces a very intense and concentrated light, and these lasers are used for medical applications such as surgery on the retina of the eye. The intense krypton laser light causes the blood to clot during the surgery, thus preventing further bleeding with subsequent loss of vision, and the laser is so accurate that surrounding tissues are not damaged.

Krypton is also used as a standard because the spectral lines of its isotopes are very sharp. In 1960, the International Commission on Weights and Measures defined the length of the standard meter as exactly 1,650,763.73 wavelengths (in a vacuum) of the orange-red line in the emission spectrum of krypton-86. This unit was redefined in October 1983 as the path length of light in a vacuum during a time interval of 1/299,792,458 of a second. Radioactive krypton-85 is used to detect leaks from sealed containers, with the escaping atoms being identified through their radiation. Krypton-85 is also used to excite phosphors in light sources with no external source of energy and in medicine to detect abnormal heart openings.

What's in the Environment? The highest concentrations of krypton are in the atmosphere. Krypton is present in air at a concentration of about 1 cm^3/m^3, or parts per million by volume. On a mass basis, the concentration is about 3 mg/kg. For comparison, the krypton concentration in the atmosphere of Mars is about 1/3 this amount (0.3 cm^3/m^3). Krypton is naturally present in the earth's crust at a concentration of about 0.15 micrograms per kilogram (μg/kg), and its concentration in seawater is about 0.21 μg/liter. Krypton-85 has been released to the atmosphere during nuclear fuel reprocessing activities and as a result of past aboveground nuclear weapons tests. In 1970, the concentration of krypton-85 in the atmosphere reached about 10 picocuries (pCi)/m^3 (or 10 trillionths of a curie per m^3), mainly from nuclear weapons tests and plutonium production activities. The concentration is significantly lower now due to the relatively short half-half of this radionuclide, the cessation of aboveground nuclear weapons tests worldwide by 1980, and the shutdown of plutonium production facilities at DOE sites. Neither the oceans nor the land surfaces act as significant sinks for this radionuclide. Krypton-85 is in spent nuclear fuel stored at certain sites (such as the DOE Hanford Site).

What Happens to It in the Body? As a noble gas, krypton does not generally participate in any biological processes. After being taken into the body, a very small amount can be dissolved in the bloodstream and distributed to organs and tissues throughout the body. Nevertheless, the tissue of most concern from exposure to a cloud of krypton-85 gas is generally the skin, with most of the dose resulting from the beta particles associated with its radioactive decay.

What Are the Primary Health Effects? The main health concern is the increased likelihood for cancer induction, and the exposure pathway of most concern is external exposure in a cloud of gas. The radiation dose for krypton-85 (the primary isotope of concern) from an external cloud of gas is more than 130 times higher than the dose from any gas in the lungs and more than 200 times higher than that from any gas in body organs and tissues after being taken into the body. For kypton-81, most of the dose is associated with gamma rays that will irradiate all tissues and organs of the body. In contrast, much of the dose for kypton-85 is from beta particles, and the skin is the primary tissue of concern.

What Is the Risk? Radiation doses from inhaling or ingesting krypton are small compared to the dose from external radiation, such as could occur in a cloud of krypton gas. In contrast to most other radionuclides, lifetime cancer mortality risk coefficients have not been developed for the inhalation and ingestion of krypton isotopes. The only pathway for which cancer mortality risk coefficients have been developed is external exposure. External gamma risk coefficients for krypton-81 and krypton-85 were used to estimate lifetime cancer mortality risks for submersion in krypton clouds. If it is assumed that krypton releases occurred and 100,000 people were continuously exposed to a cloud of air with an average concentration of 1 pCi/cm^3 over a period of one year, then the estimated number of fatal cancers in this group of 100,000 would be 2 for krypton-81 and less than 1 for krypton-85. (This is in comparison to the 20,000 people from this group who would be predicted to die of cancer from all other causes per the U.S. average.) This risk is due to the beta particles and gamma rays associated with the two krypton isotopes. *(For more information, see the companion fact sheet on Radioactive Properties, Internal Distribution, and Risk Coefficients and the accompanying Table 1.)*

Conf-730503--3

SM-172/76

RELATIVE RADIOLOGICAL IMPORTANCE OF ENVIRONMENTALLY RELEASED TRITIUM AND KRYPTON-85*

PAUL S. ROHWER
ENVIRONMENTAL SCIENCES DIVISION
OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TENNESSEE, UNITED STATES OF AMERICA

Abstract

TRITIUM (HTO) AND ^{85}KR ARE EXPECTED TO CONTINUE AS PROMINENT COMPONENTS OF THE RADIOACTIVE EFFLUENTS FROM NUCLEAR FACILITIES. Simple comparison of air concentrations of HTO and ^{85}Kr with their respective maximum permissible concentrations does not provide a good indication of their relative radiological importance. Detailed considerations for each radionuclide emphasize differences which influence radiotoxicity. Dose estimates are presented, and the associated risks are compared for equal radionuclide concentration in air: somatic risk (HTO $\sim$10X ^{85}Kr) and genetic risk (HTO $\sim$50X ^{85}Kr). For populations in close proximity to the facility, ^{3}H will probably be the most significant dose contributor if nearly equal quantities of the two radionuclides are released. When projected radionuclide production and release figures are considered, the relative radiological impacts appear to be more nearly equal on a local basis for some facilities. However, in the latter case it is predicted that ^{85}Kr will contribute the greater dose to the global population.

*Research sponsored by the United States Atomic Energy Commission under contract with the Union Carbide Corporation.

1.0 INTRODUCTION

Tritium and ^{85}Kr are prominent in the radioactive effluent from a nuclear facility, because they are produced in large quantities and they have radioactive half-lives of moderate length (12.3 and 10.8 years, respectively). Based on the projected nuclear power economy in the United States and the free world, it has been estimated that by the year 2000 the annual production rates for ^{3}H and ^{85}Kr will be 14.6 and 520 MCi, respectively [1]. Estimated accumulations by that date are 96 MCi of ^{3}H and 3,150 MCi of ^{85}Kr [1]. Although in principle it is possible to design a nuclear facility to attain any desired low emission rate, it has not been practical to concentrate and retain the radionuclides. Continued release of ^{3}H and ^{85}Kr by the nuclear industry is anticipated [2]. The relative radiological significance of these radionuclides should be a consideration in decisions concerning capital outlays to construct new radwaste cleanup systems or to modify existing ones. Each nuclear facility has a responsibility to limit individual and population doses** resulting from its operation. Characteristics relevant to radiological assessment of environmental releases of ^{3}H and ^{85}Kr are discussed in detail in this paper, and estimated radiological insults to man are compared for equal concentrations of the two radionuclides.

2.0 TRITIUM

2.1 Radiotoxicity

Tritium released to the environment is in the form of tritiated water (HTO) primarily, or it is soon oxidized to that form. As HTO it behaves as ordinary water throughout the hydrosphere. This is the most hazardous form for environmental ^{3}H, because it is metabolized like ordinary water and readily enters the body through the gastrointestinal tract, the lungs, and the skin. The International Commission on Radiological Protection (ICRP) has recommended for occupational workers exposed to HTO a maximum permissible body burden (MPBB) of 2000 μCi [3]. In other words, that quantity of HTO in a 70-kg reference man yields a dose rate to the whole body of 5 rems/year. The 2000-μCi MPBB, one of the largest MPBB values recommended for any radionuclide, is based on the fact that ^{3}H is a pure emitter with a low effective absorbed energy (0.006 MeV per disintegration) [4] and that as HTO it is distributed uniformly throughout the body water pool where it has a short effective half-time (10 days) [5]. A fraction of the ^{3}H taken in as HTO is known to become organically bound. The extent of such binding and its effect on ^{3}H retention will be discussed in the section giving dose estimates for ^{3}H.

**The use of "dose" throughout this paper is actually "dose equivalent."

2.2 Radionuclide Specific Characteristics

2.2.1 Transmutation and Quality Factor

Assuming that one can estimate the quantity of ^3H deposited in the reference tissue, assessment of the toxicity is complicated by questions of possible transmutation effects and of intrinsic biological effectiveness of the weak beta emissions (0.018 MeV maximum). When a ^3H atom undergoes radioactive decay, the molecular structure of which it is a part suddenly contains a helium atom where a hydrogen atom formerly existed. In his recent review of the radiobiology of ^3H, Thompson [6] concluded on the basis of cellular level studies and animal studies that transmutation effects do not seem to add significantly to the ionizing radiation effects. To adjust for the varying biological effectiveness of different irradiation conditions the ICRP recommends that a Quality Factor (QF) be used to account for differences in linear energy transfer (LET) [7]. The LET for a low-energy ^3H beta is higher than that for a more energetic beta, gamma, or x-irradiation. The ICRP at one time recommended a QF of 1.7 for a beta radiation having a maximum energy <0.03 MeV [7]. Some experimental evidence appeared to support the QF of 1.7 for ^3H, but questions of experimental endpoint and choice of reference radiation source tended to make interpretation difficult. Bond [8] evaluated the potential hazards from HTO and concluded from reviews of pertinent biological material that there appears to be little convincing evidence that the QF is significantly different from unity. The ICRP now recommends that a QF of 1.0 be used for all beta, gamma, and x-irradiation [4].

2.2.2 Bioaccumulation

The possibility of environmental ^3H concentrating in a particular organism, in dietary items, or in a reference tissue of man is always a concern. Although most chemical reactions discriminate against the incorporation of ^3H in favor of hydrogen [9], the possibility of some concentration of ^3H cannot be ruled out completely. For example, Bond [8] has suggested that discrimination against ^3H "leaving" a biochemical compound once it is incorporated might be greater than that for its "entering" the compound. That phenomenon would lead to concentration or "trapping" of ^3H in the compound in question. In reviewing ecological aspects of environmental ^3H behavior, Elwood [10] found that the isotopic effects of ^3H involved in most exchange reactions appear to be negligible. He states that "data from field studies in both acutely and chronically exposed ecosystems seem to support the idea that there is no concentration above that of environmental concentrations in food or water at any level of a food chain, although complex aquatic food chains and food chains in temperate climates have yet to be studied in detail." In fact, according to Elwood, "in most ecosystems, tritium concentrations would tend to become diluted at various stages of a food chain or in compartments of a coupled system."

2.2.3 Organic Binding

The human body is approximately 60% water and 10% hydrogen [3], thus two-thirds of the hydrogen in the body is present as water and one-third is present as organic hydrogen. Following the entry of HTO into the body, a fraction of the ^3H exchanges with hydrogen bound in organic molecules. One-third of the organically bound hydrogen in tissue is considered exchangeable, with that fraction decreasing as the fat content of the tissue increases [11]. Tritium present as HTO also can be incorporated by metabolic processes into nonexchangeable positions in tissue constituents. The rate and extent of incorporation of ^3H from HTO as tissue-bound ^3H is dependent on the metabolic activity of the tissue. Timing and duration of the exposure relative to the metabolic activity is also important. If the HTO is available for incorporation during formation and growth of a tissue (high metabolic rate), the probability of extensive organic labeling is enhanced. On this basis, the highest concentrations of organically bound ^3H are expected in those tissues and population segments which are in formative and growth stages at the time of an acute exposure. As the exposure duration increases to the chronic case, ^3H concentrations approach equilibrium values with a single tritium-to-hydrogen ratio common to all parts of the hydrogen pool. Organic binding would not be expected to cause significant bioaccumulation of ^3H from HTO, because water is approximately as hydrogen rich ($\sim$11% by weight) as any compound ever becomes (recall that the human body is $\sim$10% hydrogen). Another point is the influence of exposure pathway on the extent of organic binding. Experiments with rats chronically exposed to tritiated drinking water at a constant concentration have shown that the organically bound ^3H in tissue solids did not exceed 35% of the concentration maintained in the intake water [12]. The implication is that two-thirds of the organically bound hydrogen comes from organically bound hydrogen in food. Exposure pathway can be an important consideration in attempting to estimate the extent of organic binding.

Tritium loss from organic molecules, like its incorporation, is dependent on the metabolic activity. Thus mechanisms tending to retard ^3H incorporation also tend to retard its release. Tritium which becomes organically bound has a longer effective half-time, but it represents a small fraction of the total ^3H intake [11]. The role which organic binding plays in determining the radiological significance of HTO exposure is discussed in the following section.

2.3 Dose Estimation

Dose estimates for ^3H exposures customarily consider only that ^3H entering the body water pool. Tritium is not an external exposure hazard, because the only radiation emission is the low-energy beta particle (0.018 MeV maximum) with a maximum range in water or soft tissue of only 0.005 mm (0.55 mg/cm^2) [13]. Recent skin measurements suggest 4 mg/cm^2 for average epidermal thickness [14], with the radiosensitive layer being below that depth. The radiation dose received following exposure to ^3H is therefore primarily internal, and the major portion of this dose is attributable to the ^3H present as HTO in the body water pool. Figure 1 presents an estimate of dose for a 1-µCi intake of HTO, with the dose presented as a function of the age of the individual exposed. Whenever

ORNL-DWG 73-2937

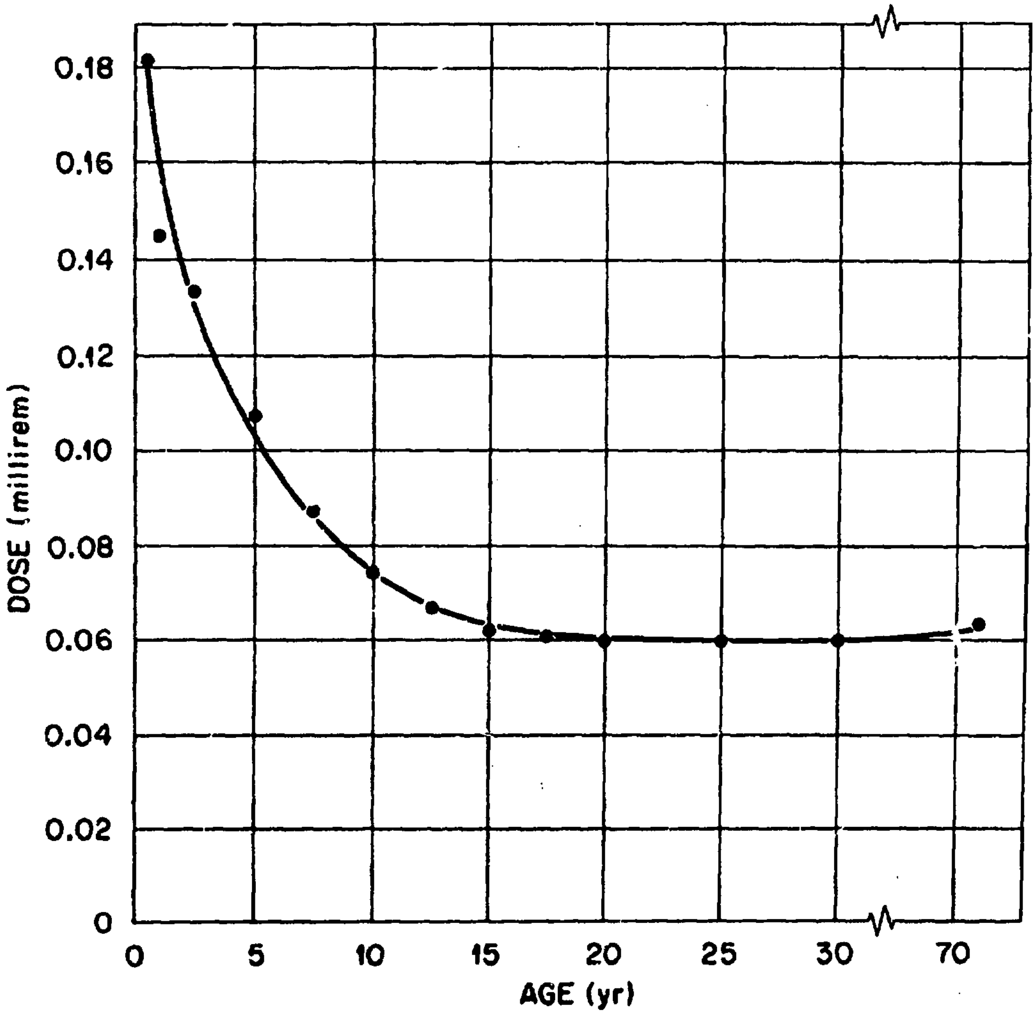


Fig. 1. Dose to the whole body per microcurie intake of HTO as a function of age.

a population is exposed it is desirable to be able to estimate the amount of variation in dose among subgroups, age groups in this example, and to identify the group receiving the highest dose (the critical group). The ^{3}H dose model from ICRP Publ. 10 was used to prepare Fig. 1, with the additional assumptions that the QF for ^{3}H betas is 1.0 and that the total body mass is the reference tissue. The estimated dose per microcurie of intake for an infant is approximately three times that for an adult. The curve in Fig. 1 reflects a range of effective half-times for HTO in the body water pool from 3.3 days for an infant to 10 days for an adult, and a range in body weights from 8 to 71 kg [15]. It is important to recognize that other factors such as ambient temperature, personal habits, and diet may alter the picture shown in Fig. 1. For example, an estimate of daily water intake as a function of age is shown in Fig. 2. In this case there is approximately a factor of 3 operating in the reverse direction, thus if the exposure pathway is via water ingestion, the dose differential among age groups would be negligible. A similar situation exists if the primary exposure pathway is inhalation of HTO vapor [15]. If other exposure pathways are of primary importance, only a situation-specific evaluation can verify the absence of a critical population age group for HTO exposure. However, the expected ^{3}H release from nuclear facilities will be continuous. Since the ^{3}H will be present in the environment as HTO, thereby available to be ingested or inhaled in that form, little variation in radiation dose among population age groups is anticipated. Accidental or short-term releases of HTO in greater than usual quantities will increase the probability of there being critical groups within the exposed population which may receive a greater radiation dose because of one or more unique exposure pathways connecting them with the radioactivity source.

Returning to organic binding and its possible importance, the data of Snyder et al. [16], presented in Fig. 3, illustrate the excretion of ^{3}H by man following an acute exposure. Two components are clearly evident in the excretion curve with the hint of a third longer term component. The initial component was assigned a half-time of 8.7 days and the second a value of 34 days. Later data covering longer follow-up periods for other exposed individuals have verified the existence of the third component with a half-time in the range 300 to 600 days [17,18]. There is a tendency to ascribe the components of the excretion curve to various hydrogen pools in the body even though the compartments are chemical in nature rather than identifiable with specific organs or tissues. Typical suggestions are: 8.7 days--body water; 34 days--exchangeable ^{3}H in organic materials; and 300 to 600 days--nonexchangeable ^{3}H in organic materials, eventually freed by catabolic processes. The existence of permanently fixed hydrogen pools has also been suggested [19]. The probability of a very slowly replaced or a fixed hydrogen pool becoming heavily tritiated at the time of its formation due to a transient surge of environmental ^{3}H at a concentration significantly elevated above ambient levels is small. Thompson [6] has pointed out that exposures resulting as a consequence of such non-steady-state conditions might increase the dose to an individual, but would not increase the total population dose. Snyder et al. [16] estimated that the second component of their retention function increased the whole-body dose estimated for the first component by 1.7%. On the basis of their own data Sanders and Reinig [17] reported that bound ^{3}H could augment the dose they estimated for body water ^{3}H by up to 25%. Similar dose estimates by Bennett [20] for acute intake of ^{3}H indicate that 84% of the tissue dose is due to ^{3}H in body water and 16%

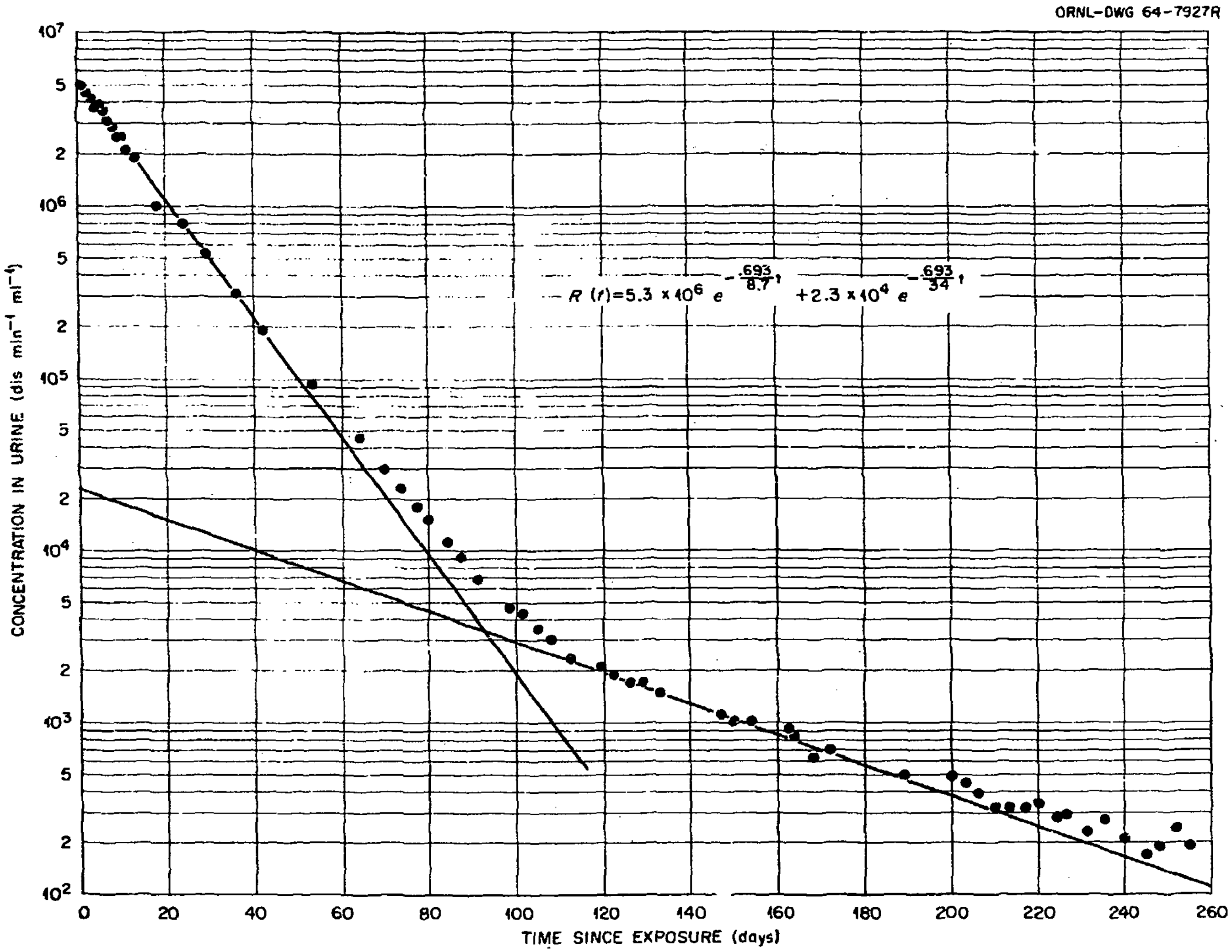


Fig. 3. Tritium concentration in urine.

is due to organically bound ^3H. A theoretical model for ^3H behavior in man was recently described by Croach [21]; the model is based on the assumption that ^3H enters the body in a manner typical for hydrogen and that once assimilated it behaves the same as ordinary hydrogen. Results obtained by Croach with that model suggest that very little ^3H from an acute exposure can become permanently bound, and even if that which became bound stays there until it decays, not enough can enter to make a significant contribution to total dose. With regard to the chronic exposure situation, Bond [8] has noted that since two-thirds of the body hydrogen is in body water, that if one assumes equilibrium with uniform labeling of all organic materials at the level existing in the body water, the body burden of ^3H, and hence the dose rate to the total body, can be increased no more than 50% over that which exists in the absence of organic binding. Based on his theoretical model, Croach states that "the energy deposition from permanently bound ^3H cannot increase the energy deposition (or whole-body dose) in the steady-state system with no permanently bound ^3H by more than $\sim$10%" [21]. Since dose estimates in Fig. 1 include the body water ^3H contribution only, it would be prudent to increase values taken from this figure by approximately 20% to include the dose contribution due to organically bound ^3H.

3.0 KRYPTON-85

3.1 Radiotoxicity

Krypton-85 is a noble gas and when it is released to the environment it tends to become distributed almost homogeneously over the surface of the globe and throughout the troposphere [1]. Environmental ^{85}Kr will accumulate in the atmosphere with little depletion by the biosphere. Thus the inventory will be determined by the release rate and the radioactive half-life of the radionuclide. Depletion of the atmospheric inventory of ^{85}Kr by washout, dry deposition, and deposition through adsorption on particles also will be negligible [22]. Krypton-85 generally is classified as a radionuclide of low radiotoxicity for a number of reasons: (1) it is primarily a beta emitter, β_1 - 0.672 MeV maximum with 0.996 abundance, β_2 - 0.16 MeV maximum with 0.004 abundance, and γ_1 - 0.514 MeV with 0.004 abundance; (2) it is poorly absorbed in the body, the blood/gas partition coefficient is 0.05 approximately, and the tissue/blood partition coefficient is 1 for all tissue except fat, for which it is 10 [23]; and (3) the principal radiation dose is delivered to the external body surface (skin), a tissue which is not particularly radiosensitive.

3.2 Dose Estimation

Unlike ^3H, ^{85}Kr dosimetry is not complicated by uncertainties concerning bioaccumulation, organic binding, and the quality factor. Dose estimates calculated from the work of Kirk [24] are presented in Table I. The data presented in Table I are for continuous exposure in an infinite cloud having a ^{85}Kr concentration of 1 pCi/cm^3, and the external dose calculations are for 50% of the point dose at the center of the cloud. The values in Table I illustrate the relative contribution of each ^{85}Kr

Table I. Dose estimates for ^{85}Kr assuming continuous exposure in an infinite cloud (1 pCi/cm^3)

Origin	Dose (millirem/year) Skin	Whole Body	Gonads
Gamma and Bremsstrahlung			
External	16.4	13.4	16.4
Internal		0.002	0.0007
Beta			
External	2076		
Internal		0.76	0.28
	2093	14.2	16.7

emission to the total dose estimated for the respective reference tissues. The dose estimates in this table are in good agreement with those found in other detailed treatments of ^{85}Kr dosimetry [25]. As one would expect, the estimated dose is almost entirely due to external exposure; ∿95% of the whole body and gonad doses is due to external gamma and bremsstrahlung, and over 99% of the skin dose is due to external beta. The beta skin dose value given in Table I is applicable to the skin surface, with the more important dose being that received at the depth of the shallowest layer of live skin. This depth generally has been assumed to be 7 mm, and it is estimated that the beta dose at that depth is approximately 50% of the surface dose [26]. Recent measurements using a new technique [14] suggest that a more reasonable value for radiological protection purposes is 4 mm, in which case the depth dose is estimated to be 70% of the surface dose [26].

4.0 RADIOLOGICAL COMPARISONS

4.1 For Unit Concentrations

4.1.1 Dose

Some confusion over the relative dose contributions of these two radionuclides may arise from a consideration of the maximum permissible concentrations in air (MPC_a) for unrestricted areas appearing in 10CFR20 [27]. The respective MPC_a's are: 0.2 pCi/cm^3 for ^3H and 0.3 pCi/cm^3 for ^{85}Kr. It is generally erroneously assumed that these concentrations produce equivalent radiation doses to the individual, or doses of equal biological significance. This is not true for these two radionuclides. It has been stated [28] that future recommendations of the ICRP are expected to include an increase of the MPC_a for ^{85}Kr by a factor of approximately 5. Although he does not suggest that such a revision of the MPC_a is desirable, calculations by Kirk [24] illustrate that the MPC_a for ^{85}Kr is conservative by at least a factor of 4.8, i.e., exposure at the MPC_a results in doses which are less than one-fourth of the dose limit on which the MPC_a is based. The preceding sections of this paper show that these two radionuclides are quite different in many characteristics which profoundly influence their respective radiological impacts. The effects of those differences are evident in the dose estimates presented in Table II. All of the dose estimates are for exposure to a unit concentration (1 pCi/cm^3 of air) of radioactivity. The ^3H values for whole body and gonads include dose contributions for inhalation and skin absorption, assuming HTO vapor absorption through the skin to be 75% of that via inhalation [31]. The values in Table II demonstrate the good agreement among dose estimates from various literature sources. The table bears out the fact that ^3H exposure results in essentially uniform irradiation of the whole body, while the skin dose is by far the largest one for ^{85}Kr. The whole-body dose for ^{85}Kr is approximately 1% of the skin dose.

Table II. Estimated dose for ^{85}Kr and HTO in air at a concentration of 1 pCi/cm^3

Exposure	Dose (millirems/year)	Reference
^{85}Kr at 1 pCi/cm^3		
Surface of skin or clothing	2093	Kirk [24]
	1690	Hendrickson [26]
	2080	Dunster and Warner [18]
	1664	Whitton [29]
	1830	Diethorn and Stockho [25]
Shallowest layer of live skin		
4 mm	1450[a]	
7 mm	1040[b]	
Whole body	14.2	Kirk [24]
	23.3	Hendrickson [26]
	14.1	Dunster and Warner [28]
	15.2	Diethorn and Stockho [25]
Gonads	16.7	Kirk [24]
	23.3	Hendrickson [26]
	17.3	Dunster and Warner [28]
	15.2	Diathorn and Stockho [25]
^{3}H (HTO) at 1 pCi/cm^3		
Surface of skin or clothing	~0	Turner, Kaye, and Rohwer [30]
Whole body	960[c]	
	1070[c]	ICRP [4,5]
	1080[c,d]	Bennett [20]
Gonads	960[c]	
	1000[c]	Osborne [31]

[a] Calculation based on the works of Kirk(24) Hendrickson(26), and Whitton(14).
[b] Calculation based on the works of Kirk(24) and Hendrickson(26).
[c] Intake via skin absorption assumed to be 75% of that due to inhalation(31).
[d] Calculated for acute intake only.

4.1.2 Risk

Considering somatic risk first, compare the 1,040- to 1,450-millirem skin dose for ^{85}Kr with the 960- to 1,080-millirem whole-body dose for ^{3}H. Although these dose estimates are of nearly equal magnitude, they are not of equal significance. The dose limit recommended for members of the public by the ICRP for skin (3 rems/year) is six times that recommended for the whole body (0.5 rem/year) [7]. If one accepts cancer induction as the radiological response and death as the endpoint, the reduced significance attached to skin irradiation is born out since 9 out of 10 skin cancers are curable [32]. Another intangible reduction exists since clothing provides protection against the low energy of the ^{85}Kr beta particle. It would appear that the somatic risk from ^{85}Kr is approximately one-tenth of the somatic risk from ^{3}H at equal radionuclide concentrations, a larger fraction than is obtained when whole-body estimates for the two radionuclides are compared.

The genetic risk from ^{85}Kr is estimated to be approximately one-fiftieth of that from ^{3}H at equal concentrations. In this case, the respective gonad dose estimates for the two radionuclides are compared. The genetic dose limit recommended by the ICRP for members of the public is 5 rems in 30 years [7].

4.2 For Local Populations

The comparisons in the preceding section (4.1) are useful in estimating the relative radiological impact of atmospheric releases on local populations when release rates for the two radionuclides are known. When a significant portion of the ^{3}H is released in liquid effluents rather than in gaseous effluents with the ^{85}Kr, exposure pathways other than inhalation and skin absorption may be the most important. In that case only site-specific evaluation is likely to provide an adequate estimate of the relative impacts of the released activities in terms of dose to the local population.

4.3 For Global Population

Released ^{3}H and ^{85}Kr each are freely dispersed in worldwide dilution pools: ^{3}H in the hydrosphere and ^{85}Kr in the atmosphere. Thus each is a potential source of irradiation for the world population. The United Nations Scientific Committee on the Effects of Atomic Radiation has provided information with which one can estimate doses to the world population for releases of various radionuclides, including ^{3}H and ^{85}Kr [33]. The estimated soft tissue dose (assumed to apply to whole body and gonads) to the world population for ^{3}H is from 0.38 to 1.6 μμrads/Ci released. For ^{85}Kr the estimated values are 0.067 μμrad/Ci for gonads, 0.053 μμrads/Ci for whole body, and 8.2 μμrads/Ci for skin. From these values, it is evident that on a unit basis ^{3}H dose to whole body and gonads is nearly an order of magnitude greater than the ^{85}Kr dose to those organs. Recalling the relative risks of whole-body and skin exposures as discussed in section 4.1.2, a unit release of ^{85}Kr yields an estimated skin dose which is approximately radiologically equivalent to the estimated whole-body dose from a unit release of ^{3}H. If we accept the estimate that annual ^{85}Kr production will be 35 times the ^{3}H production rate by the year 2000, and if equal fractions of each are released to the environment, it appears that of the two radionuclides ^{85}Kr will be the predominant contributor to world population dose so long as the nuclear power industry is the primary source of radioactivity release.

5.0 CONCLUSIONS

Tritium and ^{85}Kr probably will continue to be released to the environment from nuclear facilities. The two radionuclides each have unique environmental behavior and dosimetry characteristics which significantly influence radiological impact. The relative importance of the two radionuclides is dependent on the quantity of each released, the mode of release, the pathway of exposure, and the exposed population of interest. For populations located in close proximity to the nuclear facility and atmospheric releases of ^{3}H and ^{85}Kr of equal magnitude, it is estimated that the somatic insult from ^{3}H is 10 times that from ^{85}Kr and the genetic risk due to ^{3}H exceeds that of ^{85}Kr by a factor of 50. When a major portion of the ^{3}H is released directly to surface waters additional exposure pathways must be evaluated to determine the relative importance of ^{3}H and ^{85}Kr releases. When interest is shifted to the global population, ^{3}H and ^{85}Kr are of essentially equal radiological importance on a unit release basis. If one includes considerations for probable differences in production and release rates, ^{85}Kr becomes the more important of the two radionuclides in terms of dose to the global population. Placement of emphasis in designing radwaste treatment systems to remove ^{3}H or ^{85}Kr, or both, is therefore dependent on the identity of the primary population at risk as well as on our quest to reduce all environmental releases of radioactivity to the lowest practicable level.

REFERENCES

[1] COWSER, K. E., BOEGLY W. J., JR., JACOBS, D. G., Health Physics Division Annual Progress Report for Period Ending July 31, 1966, ORNL-4007 (1966) 35.

[2] MARTIN, J. E., GALPIN, F. L., FOWLER, T. W., Technology Assessment of Risk Reduction Effectiveness of Waste Treatment Systems for Light-Water Reactors, Radiation Data and Reports 14 (1973) 1.

[3] International Commission on Radiological Protection, Recommendation of the International Commission on Radiological Protection (Report of Committee 2 on Permissible Dose for Internal Radiation), ICRP Publ. 2, Pergamon Press, London (1959).

[4] International Commission on Radiological Protection, Progress Report from ICRP, Health Physics 17 (1969) 389.

[5] International Commission on Radiological Protection, Recommendations of the International Commission in Radiological Protection (Report of Committee 4 on Evaluation of Radiation Doses to Body Tissues from Internal Contamination due to Occupational Exposure), ICRP Publ. 10, Pergamon Press, London (1968).

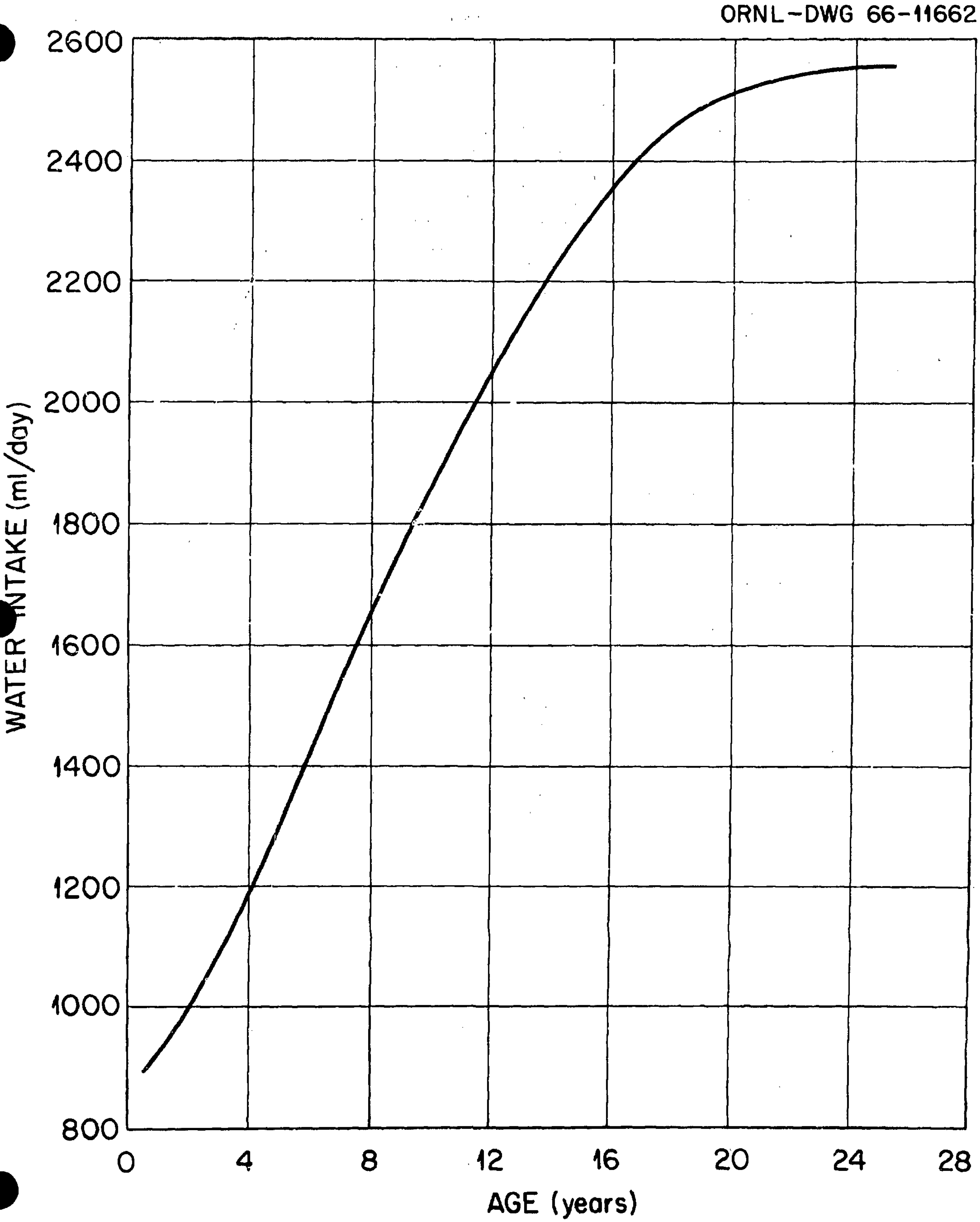


Fig. 2. Daily water intake as a function of age.

[6] THOMPSON, R. C., A Review of Laboratory Animal Experiments Related to the Radiobiology of Tritium, BNWL-SA-3739 (1971).
[7] International Commission on Radiological Protection, Recommendations of the International Commission on Radiological Protection (Adopted Sept. 17, 1965), ICRP Publ. 9, Pergamon Press, London (1966).
[8] BOND, V. P., Evaluation of Potential Hazards from Tritium Water, CONF-700810-6 (1970).
[9] FEINENDEGEN, L. E., Tritium-Labeled Molecules in Biology and Medicine, Academic Press, New York (1967).
[10] ELWOOD, J. W., Ecological Aspects of Tritium Behavior in the Environment, Nuclear Safety 12 (1971) 326.
[11] SIRI, W. F., EVERS, J., "Tritium Exchange in Biological Systems" in Tritium in the Physical and Biological Sciences, Symp. Intern. At. Energy Agency 2 (1961) 71.
[12] THOMPSON, R. C., BALLOU, J. E., Studies of Metabolic Turnover with Tritium as a Tracer, V, J. of Biology and Chem. 223 (1956) 795.
[13] BUSH, W. R., Assessing and Controlling the Hazard from Tritiated Water, AECL-4150 (1972).
[14] WHITTON, J. T., New Values for Epidermal Thickness and Their Importance, Health Physics 24 (1973) 1.
[15] ROHWER, P. S., KAYE, S. V., Age Independent Models for Estimating Internal Dose in Feasibility Evaluations of Plowshare Events, ORNL-TM-2229 (1968).
[16] SNYDER, W. S., et al., Urinary Excretion of Tritium Following Exposures of Man to HTO--A Two Exponential Model, Phys. Med. Biol. 13 (1968) 547.
[17] SANDERS, S. M., REINIG, W. C., Assessment of Tritium in Man, Symp. on Diagnosis and Treatment of Deposited Radionuclides, Excerpta Medica Foundation (1968) 534.
[18] MOGHISSI, A. A., CARTER, M. W., BRETTHAUER, E. W., Further Studies on the Long-Term Evaluation of the Biological Half-Life of Tritium, Health Physics 23 (1972) 805.
[19] KAHN, A. A., WILSON, J. E., Studies of Turnover in Mammalian Subcellular Particles: Brain Nuclei, Mitochondria and Microsomes, J. of Neurochemistry 12 (1965) 81.
[20] BENNETT, B. G., The Radiation Dose Due to Acute Intake of Tritium by Man, HASL-253 (1972).
[21] CROACH, J. W., Theoretical Radiation Dose to the Human System from Assimilated Tritium, Health Physics 24 (1973) 17.
[22] TADMOR, J., Deposition of ^{85}Kr and Tritium Released from a Nuclear Fuel Reprocessing Plant, Health Physics 24 (1973) 37.
[23] WHITTON, J. T., Calculation of Whole Body Dose from Absorption of Inhaled Noble Gases, Health Physics 23 (1972) 573.
[24] KIRK, W. P., Krypton-85 a Review of the Literature and an Analysis of Radiation Hazards, Environmental Protection Agency, Washington, D.C. (1972).
[25] DIETHORN, W. S., STOCKHO, W. L., The Dose to Man from Atmospheric ^{85}Kr, Health Physics 23 (1972) 653.
[26] HENDRICKSON, M. M., The Dose from ^{85}Kr Released to the Earth's Atmosphere, BNWL-SA-3233A (1970).
[27] Title 10, Atomic Energy, Part 20, Standards for Protection Against Radiation, United States Code of Federal Regulations (1970).
[28] DUNSTER, H. J., WARNER, B. F., The Disposal of Noble Gas Fission Products from the Reprocessing of Nuclear Fuel, AHSB(RP)R101 (1970).

[29] WHITTON, J. T., Dose Arising from Inhalation of Noble Gases, RD/B/N1274 (1968).
[30] TURNER, W. D., KAYE, S. V., ROHWER, P. S., EXREM and INREM Computer Codes for Estimating Redition Doses to Populations from Construction of a Sea-Level Canal with Nuclear Explosives, K-1752 (1968).
[31] OSBORNE, R. V., Permissible Levels of Tritium in Man and the Environment, Rad. Res. 50 (1972) 197.
[32] American Cancer Society, 1967 Cancer Facts and Figures (1967).
[33] United Nations, General Assembly, A Report of the United Nations Scientific Committee on the Effects of Atomic Radiation, Vol. 1: Levels, New York (1972).

| IONISIERENDE STRAHLUNG |

SCHAUINSLAND

50 JAHRE MESSSTATION FÜR ATMOSPHÄRISCHE RADIOAKTIVITÄT

Bundesamt für Strahlenschutz

Herausgeber: Bundesamt für Strahlenschutz
Postfach 100149
382001 Salzgitter
Tel.: 030 18333-0
Fax: 030 18333-1885

E-Mail: info@bfs.de

Internet: www.bfs.de

Redaktion: Jacqueline Bieringer und Arthur Junkert

Fotos und Grafiken: BfS

Gestaltung/Druck MAREIS DRUCK GmbH
Zeissstraße 8
89364 Weißenhorn

INHALTSVERZEICHNIS

EINLEITUNG

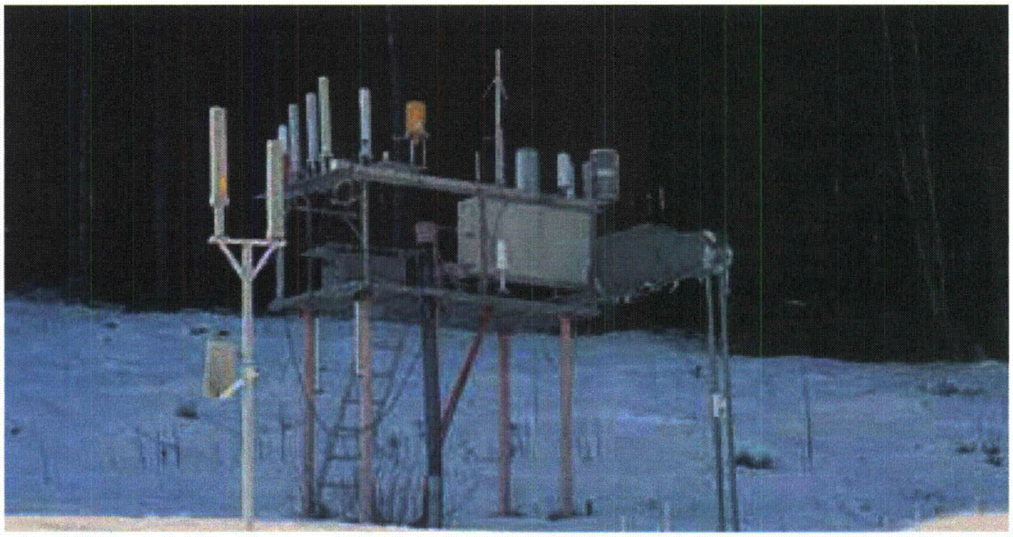
Das Bundesamt für Strahlenschutz betreibt im Südschwarzwald, auf dem Schauinsland, dem Hausberg der Stadt Freiburg, seit 50 Jahren die Messstation für atmosphärische Radioaktivität. Ihre Geschichte ist eng mit dem atomaren Wettrüsten, dem Kernwaffenfallout, der Umweltüberwachung und dem Kernwaffentestabkommen verknüpft. Im Laufe der vergangenen Jahrzehnte haben sich die Aufgaben der Messstation umfassend verändert. Mit dieser Broschüre wird die Entwicklung der Aufgaben bis heute dargestellt.

EINBINDUNG DER MESSSTELLE SCHAUINSLAND IN INTERNATIONALE MESSNETZE

Die Station Schauinsland ist Bestandteil sowohl der nationalen als auch der internationalen Umweltüberwachung. Die Messstation ist eine der vier deutschen Standorte des weitmaschigen Netzwerks der Europäischen Union (EU) („Dense and Sparse Network“) zur Überwachung der Umweltradioaktvität. Nach Artikel 35 des EURATOM-Vertrags werden die dort erhobenen Daten der Gammaortsdosisleistung und Aktivitätskonzentrationen im Luftstaub gegenüber der EU berichtet.

INTERKALIBRATIONS-PLATTFORM

Ende 1990 wurde an der Station eine Plattform errichtet, um unterschiedliche Messgeräte zur Überwachung und Charakterisierung der ionisierenden Umgebungsstrahlung zu testen und miteinander zu vergleichen. Diese Einrichtung dient gegenwärtig als internationale Interkalibrations-Plattform für die

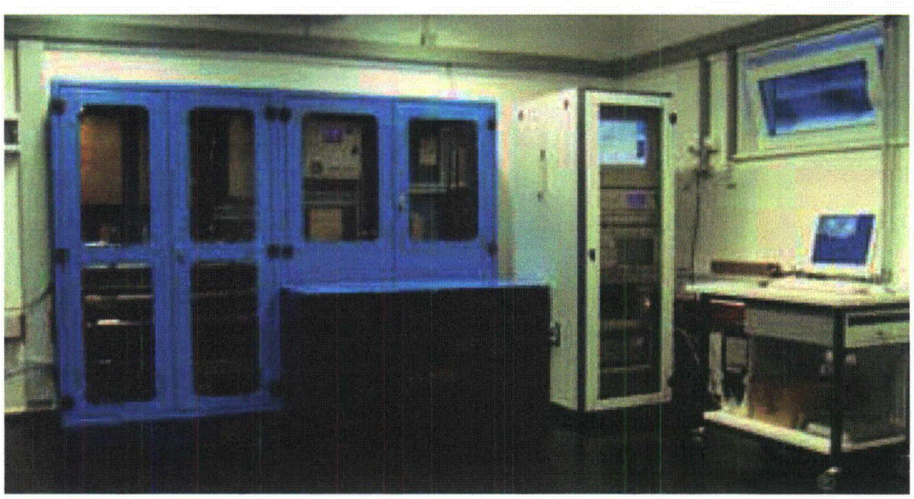


Interkalibrationsplattform

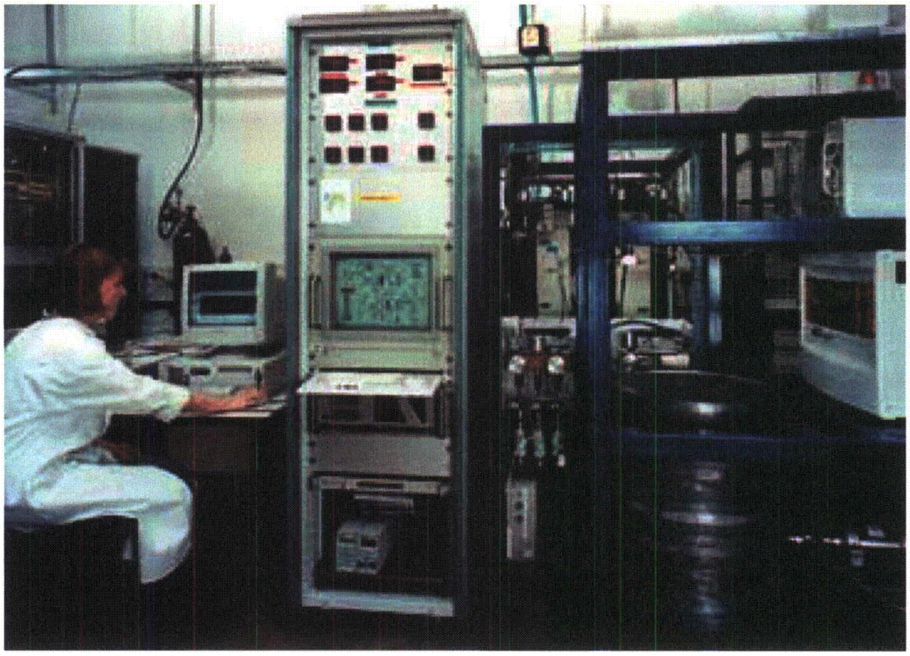
Messung der Gamma-Ortsdosisleistung „ODL-Messung". Zurzeit befinden sich dort Sonden aus Frankreich, Österreich, Finnland und der Schweiz im Langzeitvergleich. Es ist vorgesehen, diese Einrichtung zukünftig als EU-weite Plattform zur Vergleichsanalyse und Qualitätssicherung auszubauen.

KERNWAFFENTESTSTOPP-ABKOMMEN

Nach 1963 wurden überwiegend unterirdische Kernwaffentests durchgeführt. Um jegliche Art von Kernwaffentests endgültig zu unterbinden, wurde 1996 das internationale Kernwaffentest-



SPALAX: Xenon-Messsystem zur Überwachung des CTBT



Systemvergleich

stoppabkommen ausgehandelt. Um seine Einhaltung zu überwachen, wird ein weltweites Messnetz zum Nachweis von aerosolgebunden Radionukliden und von radioaktiven Edelgasen aufgebaut. Ein Nachweis dieser Tests ist ungleich schwieriger, da meist nur radioaktive Edelgase wie z.B. Xenon in die Atmosphäre entweichen können.
Weltweit gibt es nur wenige Messlabors, die mit der spurenanalytischen Edelgasmesstechnik vertraut sind. Daher wurde das BfS gebeten, die CTBTO (Comprehensive Nuclear-Test-Ban

Messcontainer mit „Besuchergruppe"

Treaty Organisation) fachlich bei der Entwicklung zu unterstützen. Zum Nachweis von radioaktivem Xenon wurden insgesamt vier automatische Analysesysteme entwickelt (in den USA, Frankreich, Schweden und Russland).
Das BfS wurde von der CTBTO beauftragt, die Eignung aller vier Systeme durch Vergleichsanalysen in Freiburg zu testen.
Heute ist die Messstation Schauinsland offiziell eine von 80 Messstationen für Radioaktivität weltweit, die die Einhaltung des Kernwaffenteststoppvertrages (Comprehensive Nuclear Test-Ban Treaty, CTBT) überwachen. Die Station ist die einzige ihrer Art in Mitteleuropa und beherbergt zwei Messsysteme zum Nachweis von aerosolgebundenen Radionukliden und radioaktivem Xenon. Die Nachweisgrenzen liegen bei nur wenigen tausendstel Becquerel pro Kubikmeter Luft. Damit ist praktisch jeder oberirdische Test auf der Nordhalbkugel der Erde nachweisbar, wenn die Station von den kontaminierten Luftmassen gestreift wird.
Mit der Einrichtung der CTBTO-Messstellen schließt sich nach mehr als 50 Jahren ein Kreis, der mit der erstmaligen Detektion von Spaltprodukten in Europa auf Freiburgs Hausberg begann.

System zur Messung schwebstoffgebundener Radioaktivität für die Überwachung des CTBT

Messhütte auf Schauinsland 1957 (Zeichnung)

DIE ANFÄNGE

Bereits kurz nach dem 2. Weltkrieg begann eine Arbeitsgruppe der Universität Freiburg auf dem Schauinsland Experimente zur Charakterisierung der kosmischen Höhenstrahlung durchzuführen. Ein Ereignis im März 1953 stellte die Forscher zunächst vor ein Rätsel, da die Messergebnisse nicht in die bisher bekannten Erklärungsmuster passten. Analysen von Niederschlagsproben zeigten erhöhte Beta-Aktivitäten, deren Ursache auf Fallout von Atomwaffentests zurückge
führt werden konnte. Radioaktiver Niederschlag auf dem Dach des Gebäudes, der nur bei einem Atomwaffentest entstanden sein konnte, verfälschte dabei die Messergebnisse der kosmischen Strahlung. Damit war es den Freiburger Forschern zum ersten Mal gelungen, radioaktive Stoffe aus einem oberirdischen Atombombentest in der Wüste Nevadas (USA) nachzuweisen. In der Folge wurden Messgeräte entwickelt, um diese Spaltprodukte gezielt messen zu können. Durch das atomare Wettrüsten gewannen diese Messungen in der Folgezeit immer mehr an Bedeutung. Um die Radioaktivität in der Atmosphäre langfristig besser überwachen zu können, wurde der Bau einer festen Messstation beschlossen. Im Sommer 1957 wurden an der neu gebauten Messstation Schauinsland die kontinuierlichen Messungen zur Überwachung der natürlichen Radioaktivität und des Kernwaffenfallout aufgenommen.

KERNWAFFENFALLOUT

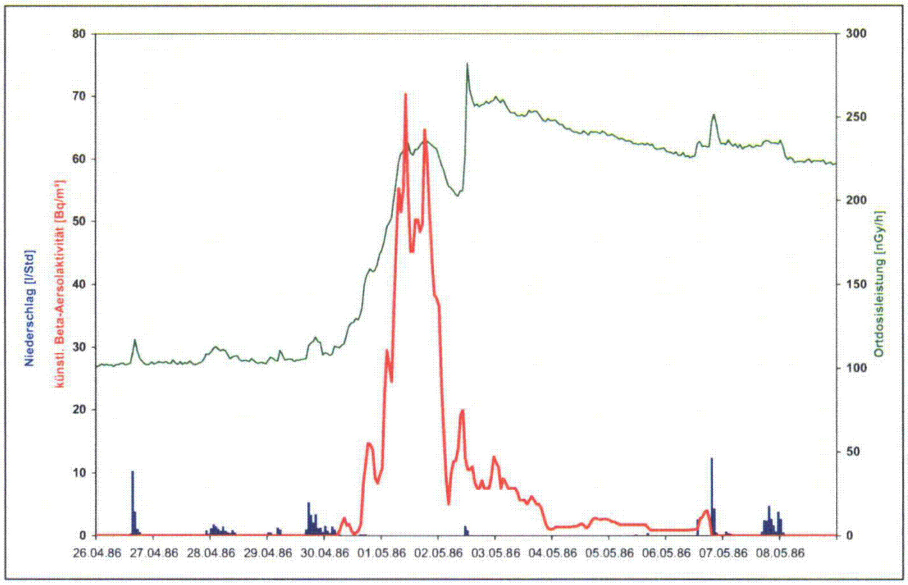
In den Folgejahren gewann die Umweltüberwachung immer mehr an Bedeutung. Es wurden neue Verfahren zur Messung der an den Luftstaub gebundenen Radioaktivität in der Luft entwickelt. Eines dieser Systeme ist seit 1957 in Betrieb und leistet nach wie vor gute Dienste.

Die kontinuierlichen Messungen – nicht nur auf dem Schauinsland, sondern weltweit – zeigten, dass sich die bei den **oberirdischen** Kernwaffentests freigesetzten Radionuklide, insbesondere die langlebigen, radioaktiven Spaltprodukte, Strontium-90 und Cäsium-137, in der Umwelt anreicherten, was von Wissenschaftlern weltweit mit Sorge beobachtet wurde. Auf einem der ersten Treffen 1958 in Genf diskutierten Experten aus ost- und westeuropäischen Staaten über Möglichkeiten zur Feststellung **unterirdischer** Nuklearversuche. Ein Ergebnis dieser Diskussionen war die Unterzeichnung des Vertrages über das teilweise Verbot von Nuklearversuchen durch die Nuklearstaaten USA, Großbritannien und Sowjetunion am 5. August 1963, der oberirdische Kernwaffentests verbietet.

Messung der in der Luft gebundenen Radioaktivität

Staubprobensammler mit hohem Luftdurchsatz zur Messung geringster Spuren schwebstoffgebundener Radioaktivität

Danach wurden nur noch vereinzelt oberirdische Tests durch andere Nuklearstaaten durchgeführt. Auch die letzte oberirdische Atombombenexplosion am 16.10.1980 in China wurde auf dem Schauinsland nachgewiesen.
Zwischen 1945 und 1980 wurden insgesamt 541 oberirdische Kernwaffentests durchgeführt mit einer Gesamtsprengkraft von 440 Megatonnen TNT- äquivalent, das entspricht etwa der 30 000-fachen Sprengkraft der Hiroshima-Bombe.



Verlauf der Aktivitätskonzentration von Spaltprodukten in der Luft, die in Folge des Reaktorunfalls von Tschernobyl auf dem Schauinsland gemessen wurde. Die blaue Kurve zeigt die Menge des Niederschlags, der am 2. Mai 1986 wesentlich zur Ablagerung der Aktivität auf dem Boden beitrug. Diese erkennt man am Verlauf der Gammaortsdosisleistung (grüne Kurve), die längere Zeit mehr als das doppelte des Grundpegels betrug.

ÜBERWACHUNG DER UMWELTRADIOAKTIVITÄT

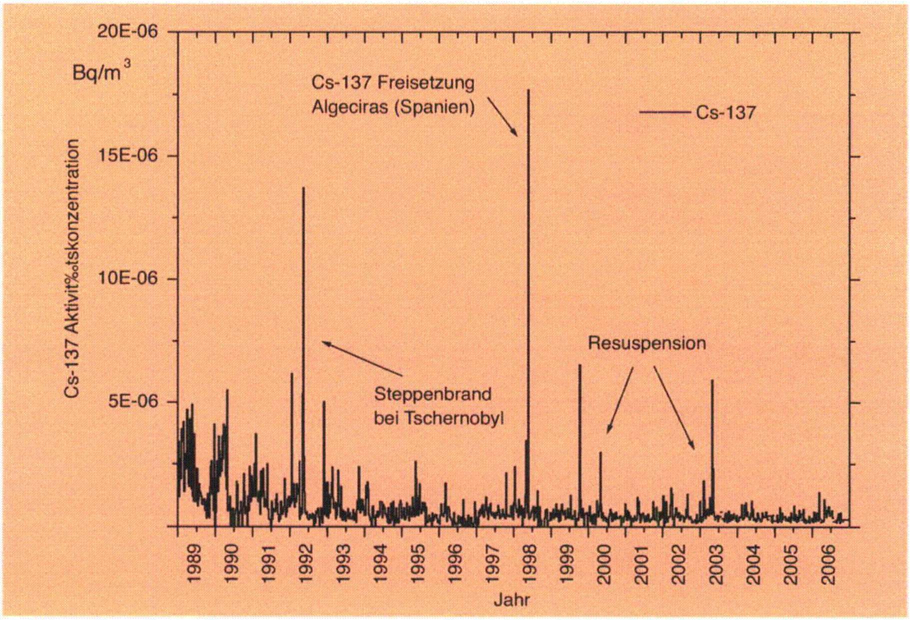
SPURENANALYSE: LUFTSTAUB UND NIEDERSCHLAG

Im Laufe der Jahre hat sich das BfS auf den Nachweis von Radionuklidspuren in der Atmosphäre spezialisiert. Mit den heutigen Messverfahren ist der Nachweis von geringsten Aktivitätskonzentrationen im Luftstaub und im Niederschlag möglich, die um viele Größenordnungen unterhalb dessen liegen, was für Mensch und Umwelt bedenklich ist. So ist das BfS in der Lage, einen radioaktiven Zerfall von Cs-137 pro Sekunde in 3 Millionen Kubikmetern Luft zu erfassen, dies entspricht einem Würfel mit einer Kantenlänge von ca. 130 Metern.

BESONDERE EREIGNISSE

Die Messstation Schauinsland und die Überwachung der Umweltradioaktivität rückten schlagartig in das Bewusstsein der Öffentlichkeit, als am 26. April 1986 das Kernkraftwerk in Tschernobyl explodierte und eine radioaktive Wolke über ganz Europa hinweg zog. Beim Eintreffen der Wolke an der Station wurde diese mit mehreren Messsystemen gemessen und auf ihre Radionuklidzusammensetzung analysiert.

Im Juni 1998 wurde im spanischen Algeciras versehentlich eine medizinische Strahlenquelle zusammen mit Metallschrott im Hochofen eingeschmolzen. Durch die extrem niedrigen Nachweisgrenzen konnte das BfS noch Spuren der dabei freigesetz-

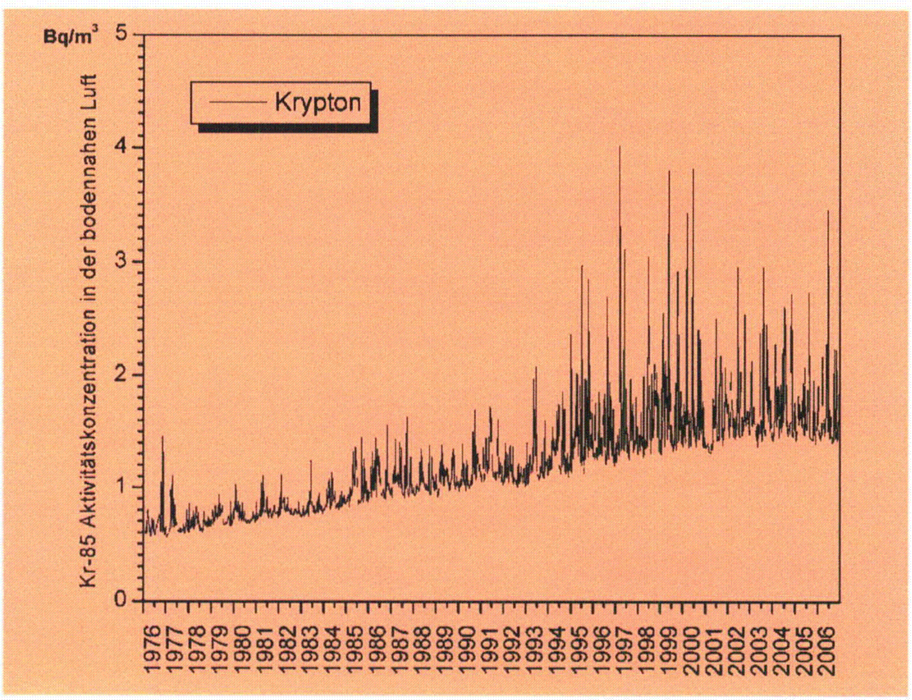


Zeitverlauf der Aktivitätskonzentration von Cs-137 in der bodennahen Luft an der Station Schauinsland

ten Radioaktivität an der 2000 km entfernten Station auf dem Schauinsland nachweisen.

SPURENANALYSE: EDELGASE

1976 begann das Max-Plank-Institut für Kernphysik (zu dem die Messstation Schauinsland damals gehörte) mit der Messung der radioaktiven Edelgase Krypton-85 (Kr-85) und Xenon-133. Diese Messungen sind aufwendig und schwierig, da sich geringe



Verlauf der Aktivitätskonzentration von radioaktivem Kr-85 an der Messstation Schauinsland

Mengen an radioaktiven Edelgasen in der Luft nur sehr schwierig anreichern lassen.
Kr-85 wird vorwiegend aus Wiederaufarbeitungsanlagen für abgebrannte Brennelemente freigesetzt. Aus den Messergebnissen des BfS ist z.B. zu erkennen, in welcher Zeit die betriebliche Sommerpause der Wiederaufarbeitungsanlage in La Hague fällt. In diesen Wochen fehlen die kurzzeitigen Erhöhungen der Kr-85- Aktivität in der Luft.
Aufschlussreich waren die Messungen in Zeiten des kalten Krieges, da es über die Messergebnisse gelang, die Menge kernwaffenfähigen Plutoniums und damit die Kernwaffenarsenale beider Supermächte abzuschätzen.
Heute sind diese Messungen auch für andere wissenschaftliche Disziplinen interessant. Sie dienen z. B. den Umweltwissenschaften zum Studium atmosphärischer Transportprozesse.

ÜBERWACHUNG DER ORTSDOSISLEISTUNG; ODL-MESSNETZ

Seit 1982 wird kontinuierlich die Gamma-Ortsdosisleistung (ODL), d.h. die von außen auf den Menschen einwirkende Strahlenbelastung, an der Station Schauinsland gemessen Die ODL-Messstelle ist seit 1988 in ein flächendeckendes Bundesmessnetz zur Überwachung der Ortsdosisleistung integriert mit derzeit ca. 2000 automatischen Messstationen in Deutschland. Das dient der großräumigen Überwachung der Umweltradioaktivität. Bei Überschreitung eingestellter Schwellenwerte an den einzelnen Messstellen wird eine Frühwarnung ausgelöst und so die frühzeitige Erkennung einer möglichen Freisetzung von künstlicher Radioaktivität in die Atmosphäre sichergestellt.

ODL-Messsonde

Kontakt:

Bundesamt für Strahlenschutz
Postfach 10 01 49
D-38201 Salzgitter
Telefon: +49(0)30 18333-0
Telefax: +49(0)30 18333-1885
Internet: www.bfs.de
E-Mail: info@bfs.de
Gedruckt auf Recyclingpapier aus 100% Altpapier

Bundesamt für Strahlenschutz

The Commonwealth of Massachusetts
Executive Office of Health and Human Services
Department of Public Health
Bureau of Environmental Health
Radiation Control Program
Schrafft Center - Suite 1M2A
529 Main Street, Boston, Massachusetts 02129
(617) 242-3035 (617) 242-3457 - Fax

August 25, 2009

B.M. York, President
Cosmedico Light, Inc.
233 Libbey Industrial Parkway
Weymouth, MA 02189

RE: License Number: 54-0609
Docket Number: 04-8446

Dear Mr. York:

The purpose of this letter is to forward to you a Massachusetts Radioactive Materials License #54-0609 which is being issued based upon your submitted application dated April 21, 2009.

Please review the enclosed document carefully and be sure that you understand all of the conditions.

You must conduct your licensed materials program in accordance with the conditions of your Massachusetts Materials License as well as the statements and representations made in your license application and the Massachusetts Regulations for the Control of Radiation (105 CMR 120.000). We are enclosing for your information, as Attachment A, "Requirements for Radioactive Materials Licensees" as a guideline for the safe use of radioactive materials.

Copies of the Commonwealth of Massachusetts' Regulations for the Control of Radiation (MRCR) (105 CMR 120.000) may be purchased from the State House Bookstore, Room 116, State House, Boston, MA, 02133; Tel. (617) 727-2834. The regulations may also be viewed on our web site at **www.state.ma.us/dph/rcp**.

As this license has been issued in the name of an institution, you must ensure that all license amendment or renewal requests are signed by a representative of the institution's management, so

022785

as to assure us that management has concurred with all commitments. When corresponding with this office, please refer to your license number noted above.

Any change in your licensed activities requires an amendment request, in writing. Licensing correspondence should be directed to: Radiation Control Program, Massachusetts Department of Public Health, Schraffts Building, Mezzanine Level, 529 Main Street, Charlestown MA 02129.

Since serious consequences to employees and the public might result from failure to comply with 105 CMR 120.000, the Commonwealth expects its licensees to pay meticulous attention to detail and to achieve and maintain the high standard of compliance characteristic of Commonwealth of Massachusetts licensees. Also enclosed is a copy of MRCP 120.750-1 "Notice to Employees". MRCR, 105 CMR 120.752 requires that a copy of the Notice to Employees be posted in a conspicuous place.

Licensees will be inspected on a predetermined frequency by staff of the Radiation Control Program. The purpose of the inspection is to ensure that the licensee is conducting activities in accordance with 105 CMR 120.000. Noncompliance with the regulations may result in enforcement actions as specified in the above cited regulations.

If there are any errors or questions regarding this letter or license, please do not hesitate to call this office at 617-242-3035.

Sincerely,

Robert Walker

Robert Walker, Director
Radiation Control Program

RW/sf

Attachments: (1)

Enclosures: (2)

THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC HEALTH
RADIATION CONTROL PROGRAM
MATERIALS LICENSE

Pursuant to Massachusetts General Laws Chapter 111, Sections 3, 5M, 5N, 5O and 5P and Massachusetts Regulations for the Control of Radiation, Section 120.100, Licensing of Radioactive Material, and in reliance on statements and representation heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer radioactive materials 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 105 CMR 120.000. This license shall be deemed to contain the conditions specified in 105 CMR 120.000 and is subjected to all applicable rules, regulations of the Department of Public Health, Commonwealth of Massachusetts, now or hereafter in effect and to any conditions specified below.

Licensee	
	3. License Number: 54-0609
1. Cosmedico Light, Inc.	Amendment No.: New License
2. 233 Libbey Industrial Parkway Weymouth, Massachusetts 02189	4. Expiration Date: August 31, 2014
	5. Docket No: 04-8446

6. **Radioactive Material**	7. **Chemical / Physical Form**	8. **Maximum Possession Limit**
A. Krypton-85	A. Lamps	A. No single lamp to exceed 0.03millicurie; 300 millicuries total

9. Authorized use:

A. For storage incident to the distribution of lamps containing krypton-85.

CONDITIONS

10. Radioactive material may be stored at 233 Libbey Industrial Parkway, Weymouth, Massachusetts.

11. This license does not authorize commercial distribution of licensed material to persons generally licensed pursuant to 105 CMR 120.122(D).

12. This license is subject to an annual fee as determined by the Executive Office for Administration and Finance.

13. Licensed material shall be maintained and stored by, or under the supervision of, individuals who have successfully completed the license's safety training program and who have been

COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH RADIATION CONTROL PROGRAM	LICENSE NUMBER: 54-0609
MATERIALS LICENSE SUPPLEMENTARY SHEET	DOCKET NUMBER: 08-6503
	AMENDMENT NUMBER: New License

designated in writing by the Radiation Safety Officer, Steven Schlitt. The licensee shall maintain records of individuals designated as having completed safety training.

14. Lamps containing licensed material shall not be opened, operated or removed from their original protective packaging by the licensee except under the direct supervision of the Radiation Safety Officer.

15. The licensee shall conduct a physical inventory every six (6) months to account for all lamps received and possessed under the license. The records of the inventories shall be maintained until inspection by the agency and shall include the quantities, manufacturer and model number; the radioisotope; the location of lamps sealed sources, and the date of the inventory.

16. The licensee shall only transport radioactive material or deliver radioactive material to a carrier for transport in accordance with the provisions of 49 CFR Parts 170 through 189, 10 CFR Part 71, and 105 CMR 120.770 "Transportation of Radioactive Material".

17. Except as specifically provided otherwise by this license, the licensee shall conduct its program in accordance with statements, representations and procedures contained in the documents, including any enclosures, listed below. The Massachusetts Regulations for the Control of Radiation (105 CMR 120.000) shall govern, unless statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

    A. Application dated April 23, 2009
    B. Letter dated August 10, 2009

COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH RADIATION CONTROL PROGRAM	LICENSE NUMBER: 54-0609
MATERIALS LICENSE SUPPLEMENTARY SHEET	DOCKET NUMBER: 08-6503 AMENDMENT NUMBER: New License

FOR THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC HEALTH
RADIATION CONTROL PROGRAM

Date 08/25/09

By Robert Walker
Robert Walker, Director

ATTACHMENT A

REQUIREMENTS FOR RADIOACTIVE MATERIALS LICENSEES IN MASSACHUSETTS

1. Operate in accordance with the Massachusetts Regulations for the Control of Radiation 105 CMR 120.200, "Standards for Protection Against Radiation," 120.750, "Notices, Instructions and Reports to Workers; Inspections," and other applicable rules.

2. Possess radioactive material only in the quantity and form indicated in your license.

3. Use radioactive material only for the purpose(s) authorized in your license.

4. Notify this office in writing, preferably 30 days in advance, if any of the following changes are to be made:

   - Change of mailing address;
   - Change of ownership or organization;
   - Change in location of radioactive material storage or use;
   - Any change contrary to a license condition; or
   - Any change to representations made in the license application or supplemental correspondence.

5. Request termination of your license if you plan to permanently discontinue activities involving radioactive material prior to the expiration date of your license.

4-7-97