

National Yang Ming Chiao Tung University

Radiation Protection Plan

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Radiation Protection Plan of National Yang Ming Chiao Tung University

Chapter I General

- Article 1. To protect the health and safety of ionizing radiation operators and prevent ionizing radiation hazards, National Yang Ming Chiao Tung University (the "University") hereby establishes this Radiation Protection Plan (the "Plan"). This Plan covers each campus, and the specific places of operation include Yangming Campus (control number: 87557573), Guangfu Campus (control number: 87557573-1) and Boai Campus (control number: 87557573-2).
- Article 2. This Plan is established in accordance with the provisions stipulated in Article 7 of the Ionizing Radiation Protection Act.
- Article 3. In addition to compliance with relevant regulations, including the Ionizing Radiation Protection Act, the Enforcement Rules for the Ionizing Radiation Protection Act, and the Administrative Regulations for Radioactive Material and Equipment Capable of Producing Ionizing Radiation and Associated Practice, the University shall also execute each radiation protection task according to this Plan.
- Article 4. The radiation protection administrative unit of the University is the Environmental Protection & Health and Safety Center (the "Environmental Safety Center"), and radiation protection management personnel are subordinate to the Environmental Safety Center.

Chapter II Radiation Protection Management Organization

- Article 5. The Environmental Protection & Health and Safety Committee of the University (the "Environmental Safety Committee") is responsible for implementing radiation protection of the University, and planning, supervising, guiding, promoting, and regularly reviewing the Plan overall (the organizational rules and system diagram are shown in Appendix 1 and Appendix 2 respectively) as follows:
1. Establishing a radiation protection plan, submitting it to the competent authority for verification and approval, and supervising and guiding the implementation of this Plan.
 2. Evaluating, revising, and reviewing the relevant provisions of the Plan.
 3. Auditing the radiation protection measures in each place where radioactive

materials and equipment capable of producing ionizing radiation ("radiation sources") exist, immediately stopping the work of those who violate the provisions, and requiring improvement within a certain time limit.

4. Convening radiation safety protection management meetings as needed, and reviewing the radiation safety work of the University.
5. Allocating qualified radiation protection personnel recognized by the competent authority, and assisting with the planning and execution of radiation safety protection work of the University.

Article 6. Article 6: Responsibilities of radiation protection personnel:

1. Reviewing various kinds of radiation protection application cases, reports, and reported cases.
2. Reviewing the investigation and treatment of accidents or incidents.
3. Reviewing and evaluating the qualifications, judgments, and operability of personnel working with radiation.
4. Auditing the Plan, and related radiation protection specifications and operating procedures.

Article 7. Article 7: Responsibilities of radiation protection management personnel:

1. Handling various kinds of radiation protection application cases, reports, and reported cases.
2. Handling various kinds of regular radiation protection applications and operation management work.
3. Handling investigations and the treatment of accidents or incidents.
4. Handling evaluations, and the recognition and management of personnel working with radiation.
5. Handling the execution of radiation safety lectures and training plans.
6. Handling the coaching, inspection, and defect improvement work of radiation laboratories.
7. Formulating or revising the Plan, as well as relevant radiation protection specifications and operating procedures.

Article 8. Article 8: User units of radiation sources shall assign their persons in charge of radiation protection (those with qualified operator certification preferred) to be responsible for assisting with the promotion and execution of the Plan and radiation management duties, as follows:

1. Submitting a request for each operation of radiation laboratory sites, including purchasing, use, deactivation, transfer, permanent deactivation (disposal), and

import and export to the Environmental Safety Center (requests must be submitted via the laboratory environmental safety management system. In case of system failure, requests may be submitted using the paper application form for radiation work specified in Appendix 3), and then submitted to the competent authority for approval before such operations can be implemented.

2. Notifying of any abnormalities, changes, or alterations of operators for the current control and management of sealed and unsealed radioactive materials and equipment capable of producing ionizing radiation to the Environmental Safety Center.
3. Assisting with the regular application of radiation protection tasks, notifying relevant laboratories, and sorting and submitting application materials to the Environmental Safety Center.
4. Assisting with the handling of the assessment and classification of personnel working with radiation, and sorting and submitting relevant materials to the Environmental Safety Center.
5. Immediately advising, correcting, stopping, and reporting relevant actions by personnel in violation of the provisions of this Plan or which may pose a radioactive hazard.
6. Assisting with the investigation and analysis of radiation incidents, keeping records on the handling of such incidents, and reporting to the University within a certain time limit.
7. Assigning personnel to obtain eligible operator certifications according to the provisions of the Administrative Regulations for Radioactive Material and Equipment Capable of Producing Ionizing Radiation and Associated Practice, and reporting to the Environmental Safety Center for verification and filing.
8. Other radiation protection work support as required.

Chapter III Control and Inspection of Radiation Sources

- Article 9. With the assistance and coaching from radiation protection (management) personnel of the University, each laboratory shall establish the nuclides of correctly controlled and managed radioactive materials or equipment capable of producing ionizing radiation, names, quantity, and activity of equipment, and installation positions (as shown in Appendix 4 and Appendix 5) as well as data, including records, on the use of such equipment or materials, and submit them to the University for reference.

- Article 10. The receipt of newly purchased radiation sources shall be reported to the Environmental Safety Center, which the radiation protection officers shall immediately check. The responsible professor of each laboratory shall also properly store radiation sources, locking them in radiation source storage places as needed; the certificate of approval of input (transfer) of a radiation source, specification, structural diagram, maintenance manual, and other technical data shall be properly documented and stored for reference.
- Article 11. A clear and obvious and durable radiation warning mark shall be attached to the surface of radiation source equipment; equipment must also be accompanied with information on specified relevant nuclides, the name of the equipment, activity, and necessary instructions.
- Article 12. To prevent the non-authorized disposal of radiation sources, information on controlled radioactive products and words indicating that the approval of the Atomic Energy Council shall be obtained to dispose of the equipment shall be specified on the equipment card.
- Article 13. Except for those installed in equipment, radiation sources that are not in use shall be stored in an enclosed position, and locked or secured. Only eligible personnel authorized by responsible professors, or radiation source management personnel may unlock or unsecure radiation sources. Relevant records shall be maintained for reference.
- Article 14. Sealed radioactive materials shall be checked regularly. The Environmental Safety Center shall routinely apply for such checks online prior to the fifteenth day of each month.
- Article 15. Units using or holding (unsealed) sealed radioactive materials and equipment capable of producing ionizing radiation shall submit relevant documents, including the record of use of radiation sources, the status quo of operators, records on the actual materials and accounts of unsealed materials, and records on wastewater detection, to the Environmental Safety Center once every half year in preparation for inspection and verification by the Atomic Energy Council.
- Article 16. Units using unsealed radioactive materials shall detect contamination in their workplaces once every week or after completion of operations, and make a record. If wastewater discharge is involved, these units shall sample the wastewater discharged at least twice a year, and detect and analyze their nuclides.

- Article 17. An eligible professional unit shall be entrusted regularly to conduct leakage checks every year on sealed radioactive materials (except gaseous substances). The leakage clean-up report shall be submitted to the Environmental Safety Center in preparation for inspection and verification by the Atomic Energy Council.
- Article 18. Operators using or holding (unsealed) sealed radioactive materials shall take regular measurements of doses on the surfaces of radiation sources, working positions, and the environment. All radiation warning marks and signs must also be checked for stains, and a record kept for reference.
- Article 19. Eligible professional units shall be entrusted to calibrate radiation detection instruments once every year, and calibration reports shall be maintained for reference.
- Article 20. Annual detection certification shall be held for licensed radiation sources, and submitted to the Environmental Safety Center prior to December 31 every year in preparation for inspection and verification by the Atomic Energy Council.
- Article 21. Requests for the purchasing requisition, transfer, and receipt of radiation sources, installation of equipment, change of positions, deactivation, permanent deactivation, abnormal activity of radiation sources, replacement of radiation sources (X-ray tubes), and other relevant activities shall be submitted to the Environmental Safety Center (requested online via the laboratory environmental safety management system) and approved by the Atomic Energy Council before implementation.

Chapter IV Disposal of Radiation Sources

- Article 22. When equipment capable of producing ionizing radiation is deactivated and disposed of in the form of waste, an application shall be submitted to the Environmental Safety Center. The equipment shall be destroyed to the point it may no longer be used based on the specifications of the Atomic Energy Council, and relevant photos shall be retained for reference.
- Article 23. If a radiation source is permanently deactivated and disposed of as radioactive waste, an application with the following documents and attachments shall be submitted to the Environmental Safety Center. A relevant license will be issued following the submission of such documents to the Atomic Energy Council for review and approval:
1. Schedule of Disposal of Sealed Radioactive Materials

2. Copies of the original certificates of radioactive materials
3. Original license granted
4. Relevant documents regarding transportation instructions

After the application is approved by the Atomic Energy Council, the radioactive waste shall be transported to the receiver within three months. The certificate of detection of radiation in the workplace, receipt documents, and original license granted (for equipment that requires a license) shall be checked and submitted to the Atomic Energy Council for reference within 30 days following receipt.

Article 24. When applying for permanent deactivation of unsealed radioactive material, the relevant laboratory shall submit an application with the following documents attached to the Environmental Safety Center and then the Atomic Energy Council for review and approval. Decontamination shall be completed according to the approved plan, and then reported to the Atomic Energy Council for inspection:

1. The original license granted for materials or equipment requiring such license
2. Decontamination plan

The contents of the decontamination plan shall include the duration and method of decontamination, method of disposing of radioactive waste, division of decontamination work areas, and personnel control measures.

Chapter V Regional (Laboratory) Control

Article 25. Each laboratory shall divide control areas in places where radiation sources are located, and put in place clear and obvious and durable radiation warning marks. A sign must also be in place reading "Radiation workplace. Do not enter without permission". The Radiation Safety Code of Practice (as shown in Appendix 6) shall be individually established and posted in each place where radioactive materials are used.

Article 26. When entering a control area with radiation sources to work, relevant personnel may work only after receiving advance approval from the responsible professor of each laboratory.

Article 27. Before working with radiation sources, relevant personnel shall read the Radiation Safety Code of Practice carefully, multiple times, and provide the relevant certificate of radiation protection training to management personnel for review. A thermoluminescent dosimeter (TLD) shall be used when working

to measure the radiation being absorbed by personnel to ensure there is no risk to personnel safety.

Article 28. If relevant equipment must be maintained in a laboratory, the radiation source must be in a closed or shutdown state, and the operation shall be conducted by the equipment manufacturer or eligible operators. A TLD and radiation monitor shall be worn as needed. Otherwise, the responsible professor or management personnel of this laboratory shall prohibit such operations.

Article 29. Relevant records of personnel operating radiation sources for research work in the above-mentioned control area as well as the time of use of such radiation sources and work contents shall be maintained for reference.

Chapter VI Personnel Lecturing, Training, and Protection

Article 30. Those under the age of 18 shall not engage in any work related to ionizing radiation.

Article 31. Students or research fellows who need to engage in ionizing radiation work based on teaching needs (general operators) shall undergo three hours of radiation protection education and training, and obtain the relevant training certificates (the period of validity of which shall be five years). The operation of registered radiation sources shall be implemented under the guidance of eligible personnel. The operation of licensed radiation sources may be implemented only under the direct supervision of eligible operators. The aforesaid operators shall receive three hours of continual education and training every year following assessment and classification as personnel working with radiation.

Article 32. Qualifications of eligible operators: the "Certificate of 36 Hours of Radiation Safety Training" for licensed radiation sources, and the "Certificate of 18 Hours of Radiation Safety Training" for registered radiation sources.

Article 33. Operators shall undergo three hours of education and training and obtain the relevant training certificates (the period of validity of which shall be five years). Lectures or training courses may be provided with reference to the following: I. Basic radiation course; II. Radiation measurements and doses; III. Biological effects of radiation; IV. Radiation protection course; V. Atomic energy related regulations; VI. Safety operating procedure and code of practice; VII. Relevant information provided by the competent authority. Personnel may engage in radiation work only after completing the required training.

Article 34. All personnel engaged in radiation operations must undergo an assessment to

classify whether they are "personnel working with radiation" or "personnel not working with radiation". The assessment and recording method of personnel working with radiation is shown in Appendix 7 "Measures and Instructions for the Assessment and Classification of Personnel Working with Radiation", and Appendix 8 "Assessment and Classification Form for Personnel Working with Radiation".

Article 35. Personnel working with radiation shall wear a TLD when operating radiation sources to detect radiation doses of personnel. The radiation protection officers of the University will evaluate whether personnel not working with radiation must wear a TLD. If a TLD is required, each laboratory shall handle the implementation of dose monitoring of individual personnel, and regularly submit the relevant data to the qualified professional unit for calculation and reading. Relevant test reports shall also be maintained, and copies of such reports shall be submitted to the University for reference.

Article 36. The dose limit of occupational exposure of personnel working with radiation shall comply with the following provisions:

1. The effective dose in a period of every five consecutive years shall not exceed 100mSv, and the effective dose in any single year shall not exceed 50mSv.
2. The equivalent dose exposed to crystalline lens shall not exceed 150mSv within a year.
3. The equivalent dose exposed to skin or limbs shall not exceed 500mSv within a year.

Article 37. The individual annual dose limit of those aged 16-18 who undertake radiation work teaching or work training shall comply with the following provisions:

1. The effective dose shall not exceed 6mSv.
2. The equivalent dose exposed to crystalline lens shall not exceed 50mSv.
3. The equivalent dose exposed to skin or limbs shall not exceed 150mSv.

Article 38. The annual dose limit caused by radiation work to ordinary people shall comply with the following provisions:

1. The effective dose shall not exceed 1mSv.
2. The equivalent dose exposed to crystalline lens shall not exceed 15mSv.
3. The equivalent dose exposed to skin shall not exceed 50mSv.

Article 39. After the University receives notification that a female working with radiation is pregnant, the employer shall immediately review the person's working conditions, and ensure that the embryo or fetus undergoes the same radiation

protection as that of ordinary people.

The equivalent dose exposed to the surface of the hypogastrium of a female working with radiation mentioned in the preceding paragraph shall not exceed 2mSv for the remainder of her pregnancy, and the agreed effective dosage caused by the absorption of radioactive nuclides in the body shall not exceed 1mSv.

Chapter VII Medical Monitoring

- Article 40. New personnel working with radiation must undergo physical examinations, and regular health checkups during the period of employment. The health checkup items shall comply with the provisions of the Occupational Health Protection Rules before relevant personnel may engage in radiation work; special health checkups shall be implemented for special personnel. The personnel working with radiation mentioned above are obliged to undergo such examinations. Those who are not personnel working with radiation may not be subject to the aforesaid rules. Relevant examination fees shall be prepared and disbursed by each user unit.
- Article 41. Radiation work shall be discontinued for personnel exposed to radiation and assessed as unsuitable for radiation work following a health checkup.
- Article 42. The medical monitoring of personnel working with radiation, and the rescue, diagnosis, and treatment of injured personnel is entrusted to the specially engaged medical institution of the University.
- Article 43. All the above-mentioned examination records shall be documented and maintained for reference.

Chapter VIII Procedures for Handling and Reporting Incidents

- Article 44. Information, including the telephone number and addresses of radiation control services agencies in Taiwan, shall be made public (as shown in Appendix 9) for the purpose of emergency contacts.
- Article 45. Primary causes of incidents include:
1. Damage due to natural disasters, such earthquakes, floods, fire, etc. that pose a threat to personnel safety. Such situations shall be handled by minimizing the hazards caused by such disasters. Preventive measures shall therefore be taken as the best way to avoid such damage.
 2. Human factors:

- (1) Operators have insufficient radiation protection knowledge.
- (2) Operators fail to follow the stipulated procedures.
- (3) Lack of alertness of personnel causes failure to locate a potential hazard.

Methods for handling the aforesaid problems are as follows:

- (1) Each laboratory shall strengthen their resistance to radiation safety hazards.
- (2) Operators engaged in radiation work shall learn basic professional knowledge and have a certain understanding of the biological hazards of radiation.
- (3) Personnel shall strictly abide by radiation protection rules and ensure good working habits.

Article 46. Process flow for handling radiation incidents:

- 1. When the following incidents occur, necessary protective measures shall be taken first, and such incidents shall be immediately reported to the Environmental Safety Center, which shall then notify the Atomic Energy Council
 - (1) The dose absorbed by personnel exceeds the provisions stipulated in the ionizing radiation protection safety standards.
 - (2) The radiation intensity outside radiation workplaces or the concentration of radioactive materials in the water, air, or sewers exceeds the provisions stipulated in the ionizing radiation protection safety standards. The sewers mentioned in this paragraph do not include sewage treatment facilities, septic tanks, or filter tanks owned or operated by facility operators.
 - (3) Radioactive materials are lost or stolen.
 - (4) Other major radiation incidents designated by the competent authority.
- 2. A written report containing the following information shall be sent to the Atomic Energy Council by letter within 30 days following the occurrence of an incident:
 - (1) Description of incident including the person(s) involved, event, time, place, and object(s).
 - (2) Cause analysis of the incident.
 - (3) Radiation impact assessment.
 - (4) Process of handling of the incident, subsequential measures, and detection records.
 - (5) Review of improvements and preventive measures.

(6) Other matters designated by the competent authority.

3. The preceding report shall be submitted to the Atomic Energy Council by letter for verification and reference within 30 days from the date the incident occurs or is learned of, except those submitted to and later approved by the competent authority. The radiation incident report form is shown in Appendix 10 below.

Article 47. The procedures of the University for handling fires due to radioactive material in workplaces and incidents when working with radiation are shown in Appendix 11 and Appendix 12 respectively.

Chapter IX Record Retention

Article 48. The retention period for records is as follows:

	Name of record	Retention period
I	1. Minutes of Radiation Safety Meetings 2. Detection Instrument Calibration Records 3. Radioactive Materials Management Records 4. Radiation Protection Lectures and Study Records (Operator Education and Training)	Three years
II	1. Test Reports 2. Clean-up Reports 3. Radiation Safety Evaluation Reports 4. Regular Verification Records 5. Detection of Wastewater Sample Records 6. Detection of Workplace Records	Five years
III	1. Regular In-service Education and Training of Personnel Working with Radiation Records 2. Personal Archives of Personnel Working with Radiation after Resignation or Graduation 3. Individual Dose Monitoring Records for Personnel Working with Radiation	10 years
IV	Reports of physical examinations and health checkups of personnel working with radiation, special medical monitoring reports, and other relevant documents	30 years
V	Historical Record of Occupational Exposure of Personnel Working with Radiation	At least 30 years from the date the relevant personnel discontinue their involvement

		in radiation work, and up until the personnel working with radiation are 75 or older.
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Article 49. This Plan will be implemented following verification of and filing with the Atomic Energy Council. Should this Plan be revised in future, it shall be submitted to the Atomic Energy Council by letter for verification and filing.

Appendix I. Measures for the Establishment of the Environmental Protection & Health and Safety Committee of National Yang Ming Chiao Tung University

Approved by the 4th Administration Meeting of National Yang Ming Chiao Tung University in the 2020 school year on April 28, 2021

- Article 1. To maintain the environmental quality of campuses, prevent occupational hazards, and protect the general and occupation health and safety of faculty members, National Yang Ming Chiao Tung University (the "University") hereby establishes the Environmental Protection & Health and Safety Committee (the "Committee") and formulates these Measures in accordance with the relevant laws and regulations pertaining to environmental protection, and occupational health and safety.
- Article 2. The Committee is responsible for deliberating, coordinating, and making recommendations on the following matters:
1. Environmental protection policy and relevant actions
 2. Health and safety policy and relevant actions
 3. Matters related to the operations of toxic chemical substances
 4. Matters related to radiation protection
 5. Matters related to biological laboratory safety
 6. Matters related to controlled drugs
- Article 3. The Committee is composed of 24 members; organizational constitution is as follows:
1. Chairperson: Served by the President of the University
 2. Deputy chairperson: Served by the Vice President of the University
 3. Member & executive security: Served by the Director of the Environmental Safety Center
 4. Ex-officio members: Campus Center Director of the Environmental Safety Center, the Dean of General Affairs, Director of the Personnel Office, Leader of the Security Group, and Director of the Tainan Branch
 5. Selected members: The chairperson of the Committee will select one biochemistry specialist, one radiation protection specialist, and one drug control specialist from the Yangming Campus; and one chemical safety specialist, one environmental engineering specialist, one M&E specialist, one protection technology specialist, and one engineering specialist from the Chiao Tung Campus. A specialist refers to a teacher or manager in each relevant field.
 6. Appointed members: eight worker representatives of the University will be

elected and assigned to serve as appointed members.

The tenure of ex-officio members is adjusted based position. The tenure of selected members is two years, and such members may be consecutively elected and reappointed. The tenure of appointed members is two years. Newly appointed worker representatives shall assume the position of members of the Committee upon reelection or by-election of worker representatives.

Article 4. The Committee may set up the following work groups or committees based on business operational needs, and such groups or committees may establish operation procedures and measures separately.

1. Environmental Protection Workgroup
2. Health and Safety Workgroup
3. Radiation Protection Workgroup
4. Controlled Drug Workgroup
5. Toxic Chemical Material Management Committee

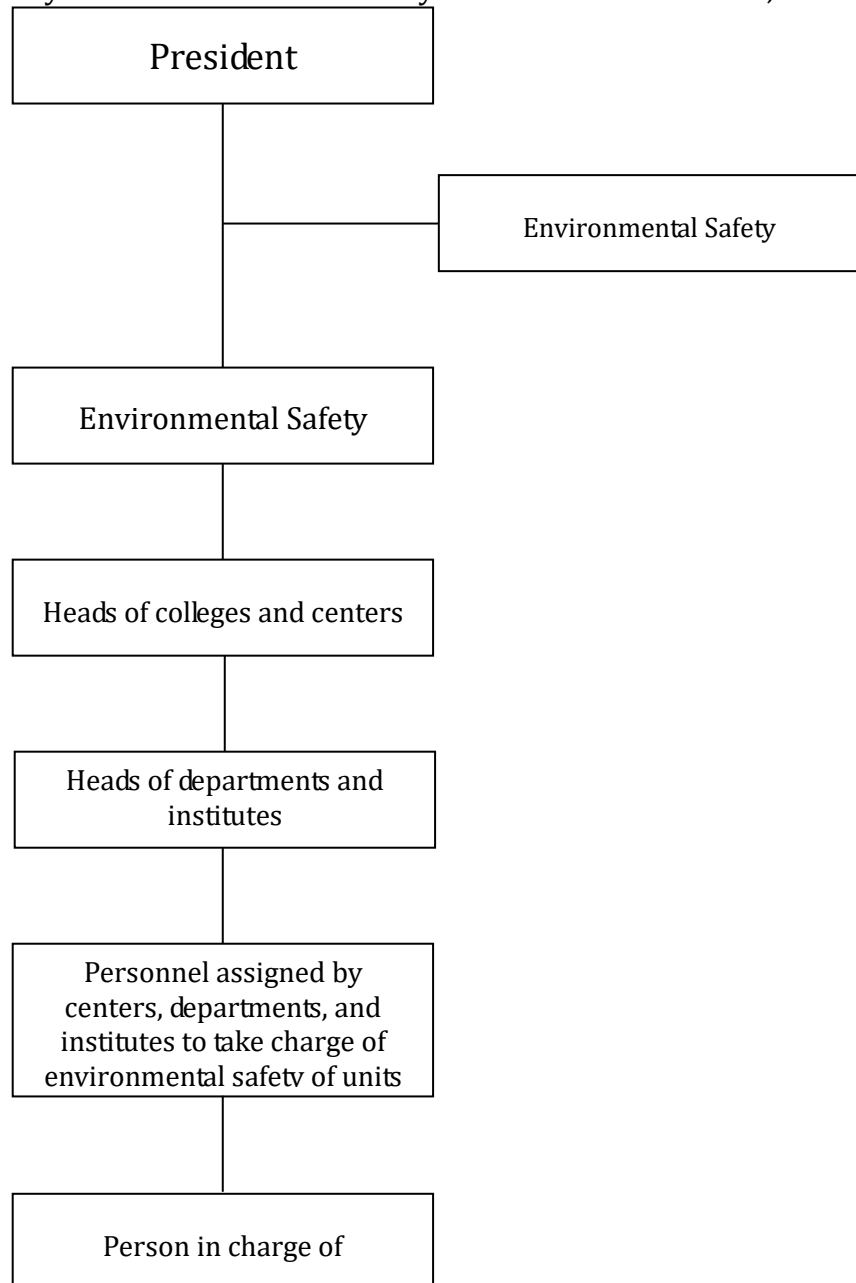
Article 5. The Committee convenes a meeting once every three months, and may convene interim meetings as needed.

Article 6. The Committee may invite relevant units to assign personnel to attended relevant meetings as a nonvoting party as needed.

Article 7. These Measures will be implemented following deliberation and adoption in an administration meeting; the same procedure applies to any amendments to these Measures.

Appendix II. Diagram of the Organizational System of National Yang Ming Chiao Tung University

Drafted by the Environmental Safety Center on October 18, 2021



Appendix III. Application Form for Working with Radiation of National Yang Ming Chiao Tung University

I. Basic data:

1. Name of unit:	2. Responsible teacher in the laboratory:
3. Applicant:	4. Applicant's contact number:
5. Laboratory site:	6. Eligible operator(s):

II. Applied matter:

1. Reason for application: <input type="checkbox"/> New purchase <input type="checkbox"/> Permanent deactivation (disposal) <input type="checkbox"/> Change of registered matters <input type="checkbox"/> Relocation to a new address <input type="checkbox"/> Replacement of radiation source (X-ray tubes) <input type="checkbox"/> Transfer-in <input type="checkbox"/> Transfer-out <input type="checkbox"/> Replacement of operator <input type="checkbox"/> Deactivation <input type="checkbox"/> Resumption of use <input type="checkbox"/> Reissue after loss <input type="checkbox"/> Renewal after expiry of period of validity <input type="checkbox"/> Other: _____.	
2. Reason for application:	
3. License number:	4. Name of equipment/material:
5. Type of license: <input type="checkbox"/> Registered equipment <input type="checkbox"/> Licensed equipment <input type="checkbox"/> Registered material (<input type="checkbox"/> Sealed <input type="checkbox"/> Unsealed) <input type="checkbox"/> Licensed material (<input type="checkbox"/> Sealed <input type="checkbox"/> Unsealed)	

III. Detailed information of import, export, and transfer

License number:

<div> <div> <input type="checkbox"/> Import</div> <div> <input type="checkbox"/> Export</div> </div>		
<div> <input type="checkbox"/> Import</div> <div> <input type="checkbox"/> Export</div>	a. Country of buyer/seller:	b. Name of seller:
	c. Contact person of seller	d. Contact number of seller:
<div> <input type="checkbox"/> Transfer-in</div>	a. Transferring unit:	b. Person in charge of transferring unit:
	d. Contact person of transferring unit:	e. Contact number:
<div> <input type="checkbox"/> Transfer-out</div>	a. Receiving unit:	b. Person in charge of receiving unit:
	d. Contact person of receiving unit:	e. Contact number:

Detailed specifications

Item No.	Name	Brand	Model	1. Nuclide and activity of material 2. Maximum energy of equipment	Qty	Unit

Applicant	Person in charge of environmental safety	Responsible teacher	Head of applying unit	Person in charge of the Environmental Safety Center	Head of the Environmental Safety Center	President/authorized agent

Date of receipt of documents by the Environmental Safety Center:

Appendix IV. List of Equipment Capable of Producing Ionizing Radiation for Management Yangming Campus

Department or institute: Department of Biomedical Imaging and Radiological Sciences

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
Deng-She-Zi No. 2007559	Cabinet X-ray machine	Rad Source	RS2000	3042 Rad	Source MXR-165	59-1318	Aug. 2007	Radiation Exposure Room 138, Biomedical Engineering Building (Teacher Shih-Ming Hsu)	Teaching research	Shih-Ming Hsu	Fu-Zhuan-Shi-Zi No. 00459	
Deng-She-Zi No. 2009365	Computed tomographic scanner	GE	Triumph	GR0116 Source 1	Xay CMX508SS	212094	Jul. 2009	Molecular Core Lab, 2/F, Positron Center, Taipei Veterans General Hospital (Teacher Chuan-Lin Chen)	Teaching research	Chuan-Lin Chen	Fu-An-Zheng-Zi No. 10722	
Deng-She-Zi No. 2010539	X-ray machine for academic research	SHIMADZ	UUD150L-40E	3M5262A0C008	SHIMADZU/1 /2P13DK-85	CM6F5401300C	Jul. 2011	Room 133, Biomedical Engineering Building (Teacher Shih-Ming Hsu)	Teaching research	Shih-Ming Hsu	Fu-Zhuan-Shi-Zi No. 00459	
Deng-She-Zi No. 2013541	X-ray machine (fixed type) for research	Petrick	TAF	001	Petrick /P060.24F200W	14613	Aug. 2016	Room 132, Biomedical Engineering Building (Teacher Jyh-Cheng Chen)	Teaching research	Jyh-Cheng Chen	Fu-An-Zheng-Zi No. 11739	
Deng-She-Zi No. 2013541	X-ray machine (fixed type) for research	Petrick	TAF	001	Petrick /P060.24F200W	14613	Aug. 2016	Room 132, Biomedical Engineering Building (Teacher Jyh-Cheng Chen)	Teaching research	Jyh-Cheng Chen	Fu-An-Zheng-Zi No. 11739	
Deng-She-Zi	X-ray machine	JOB	PORTA100HF	1671467	TOSHIBA/D-124	6C26738	Dec. 2016	TAF Certified	Teaching	Jyh-Cheng	Fu-An-Zheng-Zi	

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
No. 2013712	(mobile type) for research							Laboratory, 2/F, No. 127, Zhi-He Research Park (Teacher Jyh-Cheng Chen)	research	Chen	No. 11739	
Deng-She-Zi No. 201371	X-ray machine (fixed type) for research	NanoRay	biotech	None	NM08X0400	HT15007	Dec. 2016	Room 133, Biomedical Engineering Building (Teacher Shih-Ming Hsu)	Teaching research	Shih-Ming Hsu	Fu-Zhuan-Shi-Zi No. 00459	
Deng-She-Zi No.1019829	Dental X-ray machine	PLANMECA	Intra	IXRF82420	None	None	Oct. 2018	Room 133, Biomedical Engineering Building (Teacher Shih-Ming Hsu)	Teaching research	Shih-Ming Hsu	Fu-Zhuan-Shi-Zi No. 00459	
Deng-She-Zi No. 2015595	X-ray machine for academic research	Spellman	PDM90	PN900X4343	111033405	A00106	Jun. 2019	Room 135, Biomedical Engineering Building (Department of Biomedical Imaging and Radiological Sciences, Jyh-Cheng Chen)	Teaching research	Jyh-Cheng Chen	Fu-An-Zheng-Zi No. 11739	

Department or institute: Faculty of Dentistry

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
Deng-She-Zi No.1017136	X-ray machine	PLANMECA	Intra	IXRF72503	PLANMECA/D-0711SB	22090	Jul. 2009	Room 306-1, Dentistry Building (Teacher Yih-Wen Gung)	Teaching research	Yih-Wen Gung	78 Yi-Zi No. 00857	
Deng-She-Zi No. 2012635	Dental X-ray machine	Planmeca	ProX	IPX013841	D-041SB	3J64588	Jan. 2015	Room 306-2, Dentistry Building (Teacher Hen-Li Chen)	Teaching research	Hen-Li Chen	76 Yi-Zi No. 00637	
Deng-She-Zi No. 2015657	Dental X-ray machine	POYE	PY-70M	108198	D-0415	8G44973	Jul. 2019	Room 306-3, Dentistry Building (Teacher Yi-Ching Ho)	Teaching research	Yi-Ching Ho	Fu-Xun-Zi No. 93A212	
Deng-She-Zi No. 2015963	Dental X-ray machine	POYE	EXPERT 3DS+	108253	D-054S	7K24359	Nov. 2019	Room 306-4, Dentistry Building (Teacher Cheng-Chieh Yang)	Teaching research	Cheng-Chieh Yang	Yi-Yong-Zi No. 850344	

Department or institute: Institute of Biomedical Engineering

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
Deng-She-Zi No. 2013526	X-ray module	NanoRay biotech	NS-082505	NSX1500	NanoRay biotech	HTS089	Aug. 2016	Room A317-1, 4/F, Experimental Building (Teacher Tse-Ying Liu)	Teaching research	Tse-Ying Liu	Fu-Xun-Zi No. F401	

Department or institute: Brain Research Center

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
Deng-She-Zi No. 2013964	X-ray machine (mobile type) for research	MILabs	U-CTHR	80473	MILabs/MCBM65M-70	17349	May 2017	Brain Laboratory, 2/F, No. 125, Zhi-He Research Park (Teacher Xin-Xian Ye)	Teaching research	Xin-Xian Ye	106 Ci-Xin-Fu-Xun-Zi No. 041	

Guangfu Campus

Department or institute: Department of Applied Chemistry

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
Deng-She-Zi No. 2000453	X-ray diffractometer	BRUKER	D8-advance	D8/03-202044	KEL Cu2k	472339	Jun. 2003	Room 102, Science Building 2, Instrumentation Resource Center (Teacher Chi-Shen Lee)	Structural analysis	Chi-Shen Lee	82 Fu-Xie-Xun-Zi No. 61098	
Deng-She-Zi No. 2011539	X-ray diffractometer	BRUKER	APEX DUO	4581	(1)1 μ S-tube-E025 (2)KFF-Mo-2k-90	(1)10684-Cu (2)506121	Oct. 2012	Room 102E, Science Building 2, Instrumentation Resource Center (Teacher Chien-Lung Wang)		Chien-Lung Wang	82 Fu-Xie-Xun-Zi No. 61098	Newly purchased on February 18, 2013

Department or institute: Department of Materials Science and Engineering

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
Deng-She-Zi No. 2009727	X-ray diffractometer	BRUKER AXS	D8 DISCOVER	204836	KFL CU2K	401198		Room M101, Engineering Building 6	Teaching research	Wei-Fang Mai	Fu-An-Xun No. 0970711	

Note: Two X-ray diffractometers were purchased at the same time with certificate No. of Deng-She-Zi No. 2009727, and the other device (D2 PHASER) was listed as exempted from control. Therefore, it was not required to list it for management.

Department or institute: Center for Nano Science and Technology

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Model	No.						
Deng-She-Zi	X-ray	BEDE	D1	B50293	PW2773/00	DK183004	Feb. 4, 2003	X-ray Laboratory,	Teaching	Liang-Yi	Fu-An-Xun-Zi	

No. 2001533	diffractometer							Solid-State Electronics Building	research	Lai	No. 0970378	
Deng-She-Zi No. 2015761	X-ray diffractometer	PANalytical	AERIS	4023 000 53133	9430 033 73105	424544	Jul. 2019	Room 207, Solid-State Electronics Building	Teaching research	Liang-Yi Lai	Fu-An-Xun-Zi No. 0970378	Newly purchased in August 2019
	E-beam lithography system	ELIONIX	ELS-7500EX	H34-088				Room R101, 1/F, Solid-State Electronics Building	Teaching research	Liang-Yi Lai	Fu-An-Xun-Zi No. 0970378	Additionally listed for management on October 5, 2021

Department or institute: Center for Nano Science and Technology

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufactur e	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
	E-beam lithography system	JEOL	JBX-6000FS	SB8110000090001				Room R139, 1/F, Solid-State Electronics Building	Teaching research	Liang-Yi Lai	Fu-An-Xun-Zi No. 0970378	Additionally listed for management on October 5, 2021

Department or institute: Department of Electrophysics

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
Deng-She-Zi No. 2000692	X-ray machine for analysis and authentication	RIGAKU	MINIFLEX	ND3669N	RIGAKU A-20-Cu	0598	1983	SC-358, Science Building 3 (Teacher Chih-Wei Luo)	Teaching research	Mao-Yuan Lo	Yuan-Xun 11005080	
Deng-She-Zi No. 2011538	X-ray machine for analysis and authentication	BRUKER	D8-Discover	206983	KEL Cu 2k C	473576	Sep. 2012	SC-B026, Science Building 3 (Teacher Chih-Wei Luo)	Teaching research	Mao-Yuan Lo	Yuan-Xun 11005080	Newly purchased on February 18, 2013
Deng-She-Zi No. 2011498	X-ray machine for analysis and authentication	Marresearch	μX	12.319	HB025	11387Mo		SC-B026, Science Building 3 (Teacher Chih-Wei Luo)	Teaching research	Mao-Yuan Lo	Yuan-Xun 11005080	Newly purchased on March 7, 2013

Boai Campus

Department or institute: Department of Biological Science and Technology

Registration certificate No.	Name of equipment	Brand	Model	No.	X-ray tube ball		Date of manufacture	Equipment location (attached diagram and photo)	Purpose	Operator	Certificate No.	Remarks
					Brand and model	No.						
Deng-She-Zi No. 2017313	X-ray machine	SPECTRAL	A1855	13044				Room 202, 2/F, Laboratory Animal Center, Boai Campus In vivo analysis imaging system	Teaching research	Ssu-Yi Lai	Fu-An-Xun-Zi No. 1100442	Newly purchased (transferred-in) on May 26, 2021

List of Equipment Capable of Producing Ionizing Radiation for Management (General Statistics Table)

Campus	Department or institute	Name of equipment	Registration certificate No.	Qty	Remarks
Yangming	Department of Biomedical Imaging and Radiological Sciences	Cabinet X-ray machine	Deng-She-Zi No. 2007559	1	
		Computed tomographic scanner	Deng-She-Zi No. 2009365	1	
		X-ray machine for academic research	Deng-She-Zi No. 2010539	1	
		X-ray machine (fixed type) for research	Deng-She-Zi No. 2013541	1	
		X-ray machine (mobile type) for research	Deng-She-Zi No. 2013712	1	
		X-ray machine (fixed type) for research	Deng-She-Zi No. 2013719	1	
		Dental X-ray machine	Deng-She-Zi No.1019829	1	
	Faculty of Dentistry	X-ray machine	Deng-She-Zi No.1017136	1	
		X-ray machine for academic research	Deng-She-Zi No. 2015595	1	
		Dental X-ray machine	Deng-She-Zi No. 2012635	1	
		Dental X-ray machine	Deng-She-Zi No. 2015657	1	
		Dental X-ray machine	Deng-She-Zi No. 2015963	1	
	Institute of Biomedical Engineering	X-ray module	Deng-She-Zi No. 2013526	1	
	Brain Center	X-ray machine (mobile type) for research	Deng-She-Zi No. 2013964	1	
Guangfu	Department of Applied Chemistry	X-ray diffractometer	Deng-She-Zi No. 2000453	1	
			Deng-She-Zi No. 2011539	1	
	Department of Materials Science and Engineering	X-ray diffractometer	Deng-She-Zi No. 2009727	1	
	Center for Nano Science and Technology	X-ray diffractometer	Deng-She-Zi No. 2001533	1	
		X-ray diffractometer	Deng-She-Zi No. 2015761	1	
		E-beam lithography system		1	
	Center for Nano Science and Technology	E-beam lithography system		1	
	Department of Electrophysics	X-ray machine for analysis and authentication	Deng-She-Zi No. 2000692	1	
		X-ray diffractometer	Deng-She-Zi No. 2011538	1	
		X-ray diffractometer	Deng-She-Zi No. 2011498	1	
Boai	Department of Biological Science and Technology	Cabinet X-ray machine	Deng-She-Zi No. 2017313	1	
Total				25	

Appendix V. Table of Accounts of Radioactive Materials

Yangming Campus

Department or institute: Department of Biomedical Imaging and Radiological Sciences

Material license No.	Nuclide	Activity	Brand	No.	Spec.	Size	Qty	Equipment location of radiation source	Responsible teacher	Operator	Certificate No.	Remarks
Wu-Zi. No.1101527 (Licensed)	Cs ¹³⁷	4.44×10 ¹³ Bq	STS	Biobeam2000/004	Rod source	Large 1	1	Room 138, Biomedical Engineering Building	Teacher Yi-Jang Lee	Yi-Jang Lee	Fu-An-Zheng-Zi No. 10569	
Wu-Zi. No.1101530 (Licensed)	Co ⁶⁰	3.4×10 ¹⁴ Bq	AECL	E-78/37AECL	Rod source	Large 1	1	Room 138, Biomedical Engineering Building	Teacher Shih-Ming Hsu	Shih-Ming Hsu	Fu-Zhuan-Shi-Zi No. 00459	
Wu-Zi. No.1202114 (Registered)	Sr ⁹⁰	3.7×10 ⁸ Bq	N.E.	2503/03	Rod source	Large 1	1	Room 138, Biomedical Engineering Building	Yi-Jang Lee	Yi-Jang Lee	Fu-An-Zheng-Zi No. 10569	

Department or institute: Institute of Environmental Health

Material license No.	Nuclide	Activity	Brand	No.	Spec.	Size	Qty	Equipment location of radiation source	Responsible teacher	Operator	Certificate No.	Remarks
Wu-Zi. No.1203855 (Registered)	Kr ⁸⁵	3.7×10 ⁸ Bq	TSI	3077A	Rod source	Large 1	1	Room 319, 2 nd Medical Building	Kuo-Pin Yu	Kuo-Pin Yu	Fu-Xun-Zi No. 98F504	
Wu-Zi. No.1202190 (Registered)	Kr ⁸⁵	Bq	TSI	3012	Rod source	Large 1	1	Room 319, 2 nd Medical Building	Kuo-Pin Yu	Kuo-Pin Yu	Fu-Xun-Zi No. 98F504	
Wu-Zi. No.1202191 (Registered)	Kr ⁸⁵	Bq	TSI	3077	Rod source	Large 1	1	Room 319, 2 nd Medical Building	Kuo-Pin Yu	Kuo-Pin Yu	Fu-Xun-Zi No. 98F504	

Guangfu Campus

Department or institute: Institute of Environment Engineering

Material license No.	Nuclide	Activity	Brand	No.	Spec.	Size	Qty	Equipment location of radiation source	Responsible teacher	Operator	Certificate No.	Remarks
Wu-Zi. No.1201220 (Registered)	⁸⁵ Kr	2mCi	TSI	1686T	Rod source	Small 1	1	Room 208, Environment Engineering Building	Chuen-Jinn Tsai	Yi-Hsuan Li	Yuan-Xun 10814035	
Wu-Zi. No.1201221 (Registered)	⁸⁵ Kr	2mCi	TSI	2116	Rod source	Small 1	1	Room 207, Environment Engineering Building	Chuen-Jinn Tsai	Yi-Hsuan Li	Yuan-Xun 10814035	
Wu-Zi. No.1201222 (Registered)	⁸⁵ Kr	2mCi	TSI	2105 2031	Rod source	Small	2	Room 208, Environment Engineering Building	Chuen-Jinn Tsai	Yi-Hsuan Li	Yuan-Xun 10814035	
Wu-Zi. No.1201223 (Registered)	⁸⁵ Kr	10 mCi	TSI	2097	Rod source	Large 1	1	Room 207, Environment Engineering Building	Chuen-Jinn Tsai	Yi-Hsuan Li	Yuan-Xun 10814035	
Wu-Zi. No.1202728 (Registered)	⁸⁵ Kr	2mCi	IPL	77-0457	Rod source	Small	1	Room 207, Environment Engineering Building	Chuen-Jinn Tsai	Yi-Hsuan Li	Yuan-Xun 10814035	
Wu-Zi. No.1203101 (Registered)	⁸⁵ Kr	10 mCi	Eckert&Ziegler	77A-0184	Rod source	Large 1	1	Room 207, Environment Engineering Building	Chuen-Jinn Tsai	Yi-Hsuan Li	Yuan-Xun 10814035	
Wu-Zi. No.1203209 (Registered)	⁸⁵ Kr	2mCi	TSI	1603T	Rod source	Small	1	Room 208, Environment Engineering Building	Chuen-Jinn Tsai	Yi-Hsuan Li	Yuan-Xun 10814035	

Boai Campus

Department or institute: Institute of Environment Engineering

Material license No.	Nuclide	Activity	Brand	Model	Qty	Equipment location of radiation source	Responsible teacher	Operator	Certificate No.	Remarks
				No.						
Wu-Zi. No.1205612	Ni-63 (GC-MS)	Ni-63 555 MBq	Eckert&Ziegler	NBCB12594	1	Room 321, Experimental Building	Chih-pin Huang	Lap-Cuong Hua	Yuan-Xun 10604004	Date of manufacturing calibration: October 7, 2016 ※Wiping test shall be conducted once every year.

Statistics Table of Radioactive Materials

Campus	Institute or department	Name of nuclide	Type	License number	Qty of radiation	License number
Yangming	Department of Biomedical Imaging and Radiological Sciences	Cs-137	Sealed (Licensed)	1	1	Wu-Zi. No.1101527
		Co-60	Sealed (Licensed)	1	1	Wu-Zi. No.1101530
		Sr-90	Registered (Licensed)	1	1	Wu-Zi. No.1202114
	Institute of Environmental Health	Kr-85	Registered (Licensed)	3	1	Wu-Zi. No.1203855
		Kr-85	Registered (Licensed)		1	Wu-Zi. No.1202190
		Kr-85	Registered (Licensed)		1	Wu-Zi. No.1202191
Guangfu	Institute of Environment Engineering	Kr-85	Registered (Licensed)	7	1	Wu-Zi. No.1201220
					1	Wu-Zi. No.1201221
					2	Wu-Zi. No.1201222
					1	Wu-Zi. No.1201223
					1	Wu-Zi. No.1202728
					1	Wu-Zi. No.1203101
					1	Wu-Zi. No.1203209
Boai		Ni-63	Registered (Licensed)	1	1	Wu-Zi. No.1205612
Statistics				17	17	

Appendix VI. Radiation Safety Code of Practice

(Unsealed Radioactive Material Workplaces)

- I. The radiation source table in the radiation laboratory must be paved with absorbent paper and the ground shall be paved with kraft paper, and transparent plastic cloth, and sprayed with yellow mesh lines to clearly mark the radiation area.
- II. Radiation warning signs (radiation area) must be placed at the entrance of the radiation laboratory.
- III. The radiation detection record form and table of accounts of radioactive materials must be provided in the radiation laboratory.
- IV. Detectors must be used to detect the operation areas in the front and at the back of the laboratory. Relevant values regarding contamination detected must be recorded for reference.
- V. Before entering radiation control areas, operators must wear a TLD.
- VI. Radioactive materials shall be immediately registered in the inventory record after receipt, and each use of such materials shall also be specified in the record. Radioactive materials and waste liquid must be centrally locked and managed by specially-assigned personnel.
- VII. Radioactive materials must be held in relevant containers during use, and damping paper shall be covered inside to facilitate treatment should the container fall on its side.
- VIII. Those entering the radiation laboratory shall wear protective clothing and special shoes. Waterproof gloves must also be worn during operation to avoid direct skin contact.
- IX. Drinking, eating, smoking, or engaging in other activities irrelevant to the experiments being conducted in the radiation laboratory are strictly prohibited.
- X. Gloves must be removed when leaving the laboratory. Experimental gloves may also not be worn when making contact with switches and door handles of the laboratory, public instruments, access control switches, or other public items. The advising professors of anyone in violation of this rule will be notified, and both the names of the teacher(s) and the student(s) will be recorded. Any student in violation of this rule will be prohibited from using radioactive materials for three months. If a student violates this rule again, they will be permanently prohibited from using the radiation laboratory. Three or more violations that occur in the same laboratory in a year will be reported to the Environmental Safety Committee.
- XI. In the event of contamination, the use of this laboratory shall be immediately stopped, and the incident shall be notified to the radiation protection management unit.

(Environmental Safety Center).

XII. The unsealed radioactive material workplaces of the University are listed below. Should a need to increase or decommission any of these places arise, please contact the Environmental Safety Center.

Material license No.	Nuclide	Workplace
Wu-Zi. No. 2100053	H-3, C-14, F-18, P-32, S-35, Cr-51, Cu-67, Ga-67, Ge-68, Y-90, Tc-99m, In-111, I-123, I-124, I-125, I-131, Lu-177, Re-188	Yangming Campus 1. Biomedical Engineering Building: Radioactive Waste Storage Room, Room 135, Chemoradiotherapy Lab 238, Room 249-1 and Room 132 2. Nursing Building: Room 210-1 3. Biomedical Building: Room 205-1 and Room 609-1

Appendix VII. Appendix 6 Radiation Safety Code of Practice (Sealed Radioactive Material Workplaces)

- I. Relevant radiation warning marks and safety operation standards shall be affixed to electrostatic neutralizers.
- II. Electrostatic neutralizers shall be accompanied with a radiation detection record form and table of accounts of radioactive materials.
- III. Although an electrostatic neutralizer is an enclosed instrument, it releases radiation rays; users must wear anti-radiation armbands to detect if the radiation dose exceeds the limit.
- IV. Drinking, eating, smoking, or engaging in other activities irrelevant to the experiments being conducted when using instruments is strictly prohibited.
- V. Since radioactive substances exist in electrostatic neutralizers, working times are limited to eight hours a day to avoid excessive radiation.
- VI. Unused electrostatic neutralizers shall be locked in the cabinet and properly stored.
- VII. The preservation temperature of electrostatic neutralizers is 22~50°C. They shall be placed horizontally and properly fixed during storage to prevent them from falling and damage resulting in the leakage of radioactive substances.
- VIII. In the event of leakage of radioactive materials, use of the relevant experiment shall be stopped immediately, and good ventilation shall be maintained to prevent further leakage.
- IX. Eating, drinking, and socializing in control areas is strictly prohibited. In the event of any injury of an operator, use of equipment shall cease.
- X. Operators shall undergo at least three hours of radiation safety lectures every five years, and operate under the guidance of eligible operators.

Appendix VIII. Measures and Instructions for the Assessment and Classification of Personnel Working with Radiation of National Yang Ming Chiao Tung University

- I. Personnel operating or using equipment capable of producing ionizing radiation or radioactive materials in radiation workplaces of the University listed for management should be listed as "personnel working with radiation". Such personnel shall be assessed and classified in accordance with the Standards for the Classification of Personnel Working with Radiation (Announcement Hui-Fu-Zi No. 0930020987) issued by the Atomic Energy Council, Executive Yuan, on June 28, 2004.
- II. The assessment methods and contents specified in the Assessment and Classification Form for Personnel Working with Radiation of the University are as follows:
 1. There are three assessment methods: (1) radiation safety test report, (2) annual accumulated dosage (monitoring record of individual radiation doses), and (3) representativeness method (individual dose or environment dose badge of representative personnel). Measurement method (1) above may be used for assessment independently or based on the result of contracted monitoring.
 2. The above-mentioned assessment method shall be implemented by personnel responsible for detecting and protecting against radiation as recognized by the competent authority, and the results shall be specified in writing. After assessment and classification, personnel working with radiation must be classified by assessment personnel, and the relevant documents shall be signed and retained for reference.
 3. If the annual accumulated dose is adopted as the assessment method of relevant personnel, those with annual dosage limit for ordinary people not exceeding 1mSv will be classified as personnel not working with radiation. On the contrary, those with an annual accumulated dosage exceeding 1mSv will be classified as personnel working with radiation.
 4. The rights and obligations of personnel working with radiation include:
 - (1) Personnel working with radiation shall undergo physical examinations before using radiation sources: regular health checkups shall be provided for in-service personnel working with radiation, and proper treatment shall be conducted based on the examination results.

- (2) Implementation of individual dose monitoring and notification of results: monitoring records shall be preserved for 30 years after the resignation of the individual or discontinuity of radiation work until the individual reaches the age of 75.
- (3) Personnel working with radiation shall undergo at least three hours of radiation protection education and training every year (school year).
5. Those obligated to undergo assessment include all personnel actually operating or using radiation sources (equipment or materials) of the University. After assessment and classification of personnel working with radiation, all personnel who have been assessed shall acknowledge and sign confirmation in person, and then submit the assessment and classification form to the Environmental Safety for reference. When new students, employees, or research personnel arrive at the University and actually operate or use radiation sources, the aforesaid assessment shall be adopted. Those who have already undergone assessment will not be required to undergo another assessment or verification while there is no change to the exposure conditions of radiation workplaces (e.g., no relocation, refitting of equipment, or parameter adjustment) or the work content of the individual.
6. The retention period of the assessment and classification form: (1) This form shall be retained for five years after graduation (or resignation) of an assessed individual classified as "personnel not working with radiation"; (2) This form shall be retained for 30 years after graduation (or resignation) of an assessed individual classified as "personnel working with radiation".

Appendix IX. Assessment and Classification Form for Personnel Working with Radiation of National Yang Ming Chiao Tung University

Unit: _____ Title: _____ Faculty member/Trainee code: _____ Name: _____
 Name of equipment or material/License number: _____

- I. This form is used for assessment and classification in accordance with the Standards for Classification of Personnel Working with Radiation (Announcement Hui-Fu-Zi No. 0930020987) issued by the Atomic Energy Council, Executive Yuan, on June 28, 2004. The assessment method and results are shown below.
- II. This assessment and classification form is deemed invalid in case of changes of exposure conditions of personnel working with radiation or the work content of the assessed individual. In case of changes, the individual shall be subject to re-assessment.

✱Evaluation methods:

☒ Radiation safety test report: Radiation safety test of equipment or material

Radiation safety test value (mSv)	Date of test	Tested by

◎If it is estimated according to the radiation safety test report, those with an annual accumulated dosage lower than 1mSv are not classified as personnel working with radiation.

◎Calculation method: Dose rate ($\mu\text{Sv/hr}$) * Annual working hours/1000 mSv/ μSv

☒ Annual accumulated dose: Record form for individual in vitro radiation dose test

Name	Annual accumulated dose (mSv)	Date of measurement in dose report

◎B represents a natural background value.

◎ $H_p(d)$, d represents depth of human tissue. Those with an annual accumulated dose at any depth lower than 1mSv are not classified as personnel working with radiation.

☒ Representativeness: Individual dose or environmental dose badge of representative personnel

Measuring method	Annual accumulated dose (mSv)	Date of measurement in dose report
<input type="checkbox"/> Representative personnel: _____ <input type="checkbox"/> Environmental badge		

◎In this evaluation method, representative personnel refers to personnel using or operating the same material or equipment. The actual operators or personnel with maximum hours of exposure to radiation sources are adopted as representatives. The number of hours of exposure of the assessed individual to radiation sources shall not exceed those of representative personnel.

◎Evaluated personnel with an annual accumulated dose at any depth in $H_p(d)$ lower than 1mSv are not classified as personnel working with radiation.

✕Assessment results:

☐ **Approve to classify the individual as personnel not working with radiation.**

☐ **Approve to classify the individual as personnel working with radiation.**

✕The assessed individual has read and understands the results of the assessment.

Signature of assessed person: _____ ID card number: _____ Date: _____

Lab manager: _____ (Signature and seal) Radiation protection personnel: _____ (Signature and seal)

Head of unit: _____ (Signature and seal) Radiation protection management unit: _____ (Signature and seal)

Note: This form must be retained until the date of resignation (or graduation) of the assessed individual.

Appendix X. List of Service Agencies for Radioactive Material Control or Radiation Protection

I. Atomic Energy Council, Executive Yuan

No. 80, Sec. 1, Chenggong Rd, Yonghe Dist., New Taipei City

TEL: (02)8231-7919

24h incident reporting hotline: 0800-088-928

II. AEC Institute of Nuclear Energy Research Health, Physics Division:

No. 1000, Wenhua Rd, Longtan Dist., Taoyuan City

TEL: 02-3651717-7606

III. AEC Institute of Nuclear Energy Research, Chemical Engineering Division (Nuclear Waste Treatment Plant):

No. 1000, Wenhua Rd, Longtan Dist., Taoyuan City

TEL: 02-3651717-5830/5831

03-4711400-5830/5831

IV. Radiation Monitoring Center, Atomic Energy Council:

No. 823, Chengqing Rd, Dahua Vil, Niasong Dist., Kaohsiung City

TEL: 07-3819206

V. National Tsing Hua University Nuclear Science and Technology Development Center, Health Physics Lab:

No. 101, Sec. 2, Guangfu Rd, Hsinchu City

TEL: 03-5715131-5443

VI. Radiation Protection Association, R.O.C.

15F-1, No. 295, Sec. 2, Guangfu Rd, Hsinchu City

TEL: 03-5722224

Appendix XI. Laboratory Radiation Incident Report Form

Notifying unit		Responsible teacher	
Type of radiation source	<input type="checkbox"/> Radioactive material <input type="checkbox"/> Equipment capable of producing ionizing radiation <input type="checkbox"/> Raw nuclear material	Name of radiation source	
Time of occurrence		Location of occurrence	
Type of incident	<input type="checkbox"/> Loss <input type="checkbox"/> Leakage <input type="checkbox"/> Others: _____	Contact person and Tel.	
Description of status:			
Status of disposal:			
Review and suggestion:			

Completed by: _____ Date of completed: _____ Lab manager: _____

Head of unit: _____ Environmental Safety Center: _____

Appendix XII. Procedure for Handling Fires in Radioactive Material Workplaces of National Yang Ming Chiao Tung University

I. Purpose

To strengthen the emergency handling capacity of the University upon the occurrence of fires in radioactive material workplaces, the Procedure for Handling of Fires in Radioactive Material Workplaces is hereby formulated and must be followed upon the occurrence of a fire.

II. Scope of application

This procedure applies to sealed and unsealed radioactive material workplaces, but does not cover workplaces with equipment capable of producing ionizing radiation.

III. Normal maintenance

(I) Laboratory management personnel and persons in charge of radiation protection of each unit shall execute the following matters:

1. In radioactive material workplaces, the locations and quantity of radioactive materials shall be clearly marked, and relevant safety data records shall be kept.
2. When purchasing radioactive materials, manufacturers shall be requested to provide precautions for handling fires, which shall be included in the handling procedure.
3. Radioactive materials in kind and accounts shall be counted on a regular basis, and independent management shall be reinforced.

(II) The radiation protection officers of the University, and radiation protection management personnel (Environmental Safety Center) shall execute the following matters:

1. Implement training and practice for the handling of fires in radioactive material workplaces regularly, or in coordination with fire drills for other incidents.
2. Include the Procedure for Handling Fires in Radioactive Material Workplaces in a radiation protection plan, and provide timely updates.
3. Conduct regular control of radioactive material laboratories and count the materials and accounts, as well as coach on how to improve relevant deficiencies.

IV. Operating procedure

1. When a fire occurs in a radioactive material workplace, the fire shall be extinguished and controlled immediately with reference to the **Safety Data Sheet**, and the incident shall be reported **to radiation management personnel of the**

Environmental Safety Center.

2. If a fire has not reached the place where radioactive materials are stored, the radioactive materials shall be promptly moved to a safe area along with containers, and relevant personnel shall be assigned to monitor such materials.
3. If a fire has already reached the place where radioactive materials are stored, the site HVAC system shall be promptly shut down and appropriate methods shall be adopted to put out the fire. If the fire is already at an uncontrollable stage, **relevant personnel shall be immediately notified to withdraw from the site, and the area shall be restricted. Individuals who are not staff are prohibited from approaching the site.**
4. When requesting support from the fire protection unit, relevant personnel shall **remind firefighting personnel arriving at the site of the relevant radiation information, e.g., nuclides, quantity, positions, and appearance of radioactive materials** as such radioactive materials have not been relocated to a safe area yet.
5. After a fire is put out, radiation protection personnel and radiation protection personnel of the University, or entrusted radiation detection specialists shall detect the site, radioactive materials, and containers, **check if there is any leakage of radioactive materials**, determine the radiation intensity, and assign control areas.
6. In case of leakage of radioactive materials, radiation protection (management) personnel of the University shall take appropriate measures to prevent or slow the leakage of radioactive materials, prevent the expansion of the contaminated area, and properly treat radioactive materials. Contaminated areas or objects shall be decontaminated, and contaminated waste shall be centrally disposed of as needed.
7. After a fire occurs to a radioactive material workplace, and containers or the radiation leakage prevention facilities are damaged as a result, and is therefore **a risk of radiation safety, the Atomic Energy Council must be notified within 24 hours after the occurrence of the incident.**

V. List of designated radiation protection personnel or radiation protection management personnel (including agents) and contact numbers

Campus		Name	Title	Unit	Contact number
Yangming	Radiation protection personnel	Yi-Hsuan Lee	Member of project group (Radiation protection personnel)	Environmental Safety Center	02-2826700-62295 Mobile phone: 0929937689
	Agent	Chien-Yu Huang	Member of project group		02-2826700-62295 Mobile phone:

			(Radiation protection personnel)		0933941919
Guangfu and Boai	Radiation protection personnel	Yu-Hsin Yu	Radiation protection personnel		03-5712121-51514 Mobile phone: 0921-281496
	Agent	Hui-Min Feng	Technical specialist (18h operator)		03-5712121-51522

Notes: 1. Radiation protection personnel refer to the radiation protection personnel mentioned in Article 7 of the Ionizing Radiation Protection Act, i.e., radiation protection technicians or radiation protection officers who are in charge of executing radiation management activities.

2. Radiation management personnel are relevant personnel designated by the facility operators to execute radiation protection management matters (after undergoing at least 18 hours of radiation protection training) when it is not required to allocate radiation protection technicians or radiation protection officers since the unit does meet the requirements to comply with the Standards for the Organization of Radiation Protection Management and Allocation of Radiation Protection Personnel.

24h reporting hotline of the AEC Nuclear Safety Duty Center: 0800-088-928

Appendix XIII. Procedure for Handling Occupational Radiation Incidents of National Yang Ming Chiao Tung University

Revised in 2021

This area is a radiation control area. If any of the following major radiation safety incidents occur, please initiate the process flow immediately:

- 1. Loss or damage of a radiation source**
- 2. Casualties involving personnel working with radiation in a control area**
- 3. Serious in vivo and in vitro radiation contamination due to leakage (release) of an unsealed radiation source**
- 4. In vitro exposure of a sealed radiation source due to the container falling**
- 5. Occupational safety incidents, such as fire**

Any fire that occurs on-site shall be handled according to the Procedure for Handling Fires in Radioactive Material Workplaces of National Yang Ming Chiao Tung University. Other incidents shall be handled as follows:

- I. When a radiation source is manually destroyed:
 1. Cordon off the site immediately.
 2. Utilize radiation detection instruments to confirm the correct location of the radiation. The site shall be controlled and non-essential personnel shall be prohibited from entering the site if abnormal radiation or radioactive material contamination is found.
 3. Use lead sheath or proper protection to cover the radiation source.
- II. When a radiation source is stolen or lost:
 1. Cordon off the site immediately.
 2. Quickly send personnel to search around the site where the radiation source was lost; radiation detection instruments shall be used to assist with the search for the radiation source.
 3. If the radiation source cannot be found, the quantity, specifications, appearance, radiation intensity, possible hazards, and other relevant data of the missing items shall be reported to the competent authority.
- III. When an unsealed radiation source has a serious leak in the workplace:
 1. Cordon off the site immediately, and notify radiation protection personnel or responsible personnel of the Environmental Safety Center.
 2. Personnel on-site may not leave the incident site without verifying the existence radioactive contamination (however, they may first leave the contaminated area), to prevent the contamination from spreading.
 3. Implement immediate contamination detection of the contaminated area, determine the scope of contamination, enclose, or cordon off the contaminated area, and post the relevant warning sign to prohibit entry of personnel.
 4. Radioactive contamination shall be covered by absorbent materials, and other

laboratory personnel around shall be instructed to leave the area.

5. When decontamination of contaminated clothes and tools cannot be implemented, they shall be disposed of as radioactive contamination waste, and then detected and packed by radiation protection personnel before being sent to their specific destination for storage or disposal.
6. If the contamination is serious and cannot be handled, ask a professional radiation protection unit or notify the Atomic Energy Council to conduct decontamination work.

Incident notification procedure (reporting level by level based on the severity of the situation):

1. Name of lab manager (tutor) of this control area: Tel: _____
2. Name of unit manager (person in charge of environmental safety of the unit):
Tel: _____
3. Environmental Safety Center
Yangming Campus Name: Yi-Hsuan Lee Tel: 02-28726496#62295
Guangfu and Boai Name: Yu-Hsin Yu Tel: 03-5712121#51514
4. 24h emergency reporting hotline of the Atomic Energy Council, Executive Yuan (Tel: 0800-088-928)