

MODULE 1

UNIT 1: THE STRUCTURE OF THE MATTER

1. Atomic structure
2. Electrons
3. Protons and Neutrons
4. Isotopes
5. Chart of the nuclides
6. Nuclear forces and models

UNIT 2: RADIOACTIVITY AND RADIATION

1. Radioactivity and the chart of the nuclides
2. Alpha radiation
3. Beta radiation
4. Gamma radiation
5. The electron volt
6. Interaction of radiation with matter
7. Range of radiation in matter
8. Sources of radiation : Mining
9. Radioactive decay

UNIT 3: RADIATION UNITS

UNIT 4: BIOLOGICAL EFFECTS OF RADIATION

1. Cellular radiation damage
2. Acute radiation effects
3. Chronic radiation effects

UNIT 5: NATURAL – AND MAN –MADE RADIATION

1. Natural sources of radiation
2. Man made sources of radiation

UNIT 6: RADIATION DETECTION AND MEASUREMENT

1. Basic circuit
2. The 6 – Region curve
3. Detector characteristics
4. Scintillation detectors
5. Semi conductor detection systems
6. Personal dosimetry
7. Discrimination
8. Portable survey instruments

UNIT 7: EXTERNAL RADIATION HAZARDS

1. Time
2. Distance
3. Shielding

UNIT 8: INTERNAL RADIATION HAZARD

1. Sources and Types of airborne contaminants
2. Control of the internal hazard

UNIT 9: RADIOACTIVE MATERIAL CONTROL

- 1 Contamination
- 2 Protection against contamination
- 3 Radioactive waste
- 4 Atmospheric dispersion

MODULE 2

UNIT 1: Radon and airborne long lived alphas

- 1.1 Radon / Thoron and progeny
- 1.2 Behaviour of radon and its progeny
- 1.3 Radioactive equilibrium
- 1.4 Radon in mines: control and mitigation
- 1.5 Potential alpha energy
- 1.6 Equilibrium Factor & Equilibrium Equivalent Concentration
- 1.7 Biological effects from radon in mining
- 1.8 Long lived alphas (LLA)

UNIT 2: Exposure of the human population to natural & man-made background radiation

- 2.1 Terrestrial radiation
- 2.2 Extraterrestrial radiation
- 2.3 Man-made background radiation
- 2.4 Technologically enhanced natural radiation arising from MIMP activities

UNIT 3: Minerals, Ores & geology associated with Uranium & Thorium

- 3.1 Uranium mines
- 3.2 Thorium mines
- 3.3 Mineralisation
- 3.4 Geology of Uranium and Thorium in South Africa
- 3.5 Non Uranium Producing Mines Associated with Uranium and Thorium

UNIT 4: Human Exposure pathways to ionising radiation

- 4.1 Uranium Decay chain
- 4.2 Thorium Decay chain
- 4.3 Radiological implications

UNIT 5: Occupational Exposures in MIMP activities

- 5.1 Lung Disease in Miners
- 5.2 Review of radiation exposures in the nuclear fuel cycle
- 5.3 Review of radiation exposures in non-uranium mines
- 5.4 Review of radiation exposures During Processing

UNIT 6: Contamination

- 6.1 Sources of contamination
- 6.2 Protection against contamination
- 6.3 Sources & types of airborne contaminants in MIMP Facilities
- 6.4 Hazards associated with airborne contamination

UNIT 7: Radiation hazards in the South African MIMP Facilities

- 7.1 The development of the Uranium mining industry in South Africa

- 7.2 Radiation hazards in the Metallurgy complexes of South African Gold Mines
- 7.3 Radiation hazards in underground gold mines in South Africa
- 7.4 Radiation hazards associated with contaminated equipment

UNIT 8: Radioactive Effluent discharges and exposure of the public

- 8.1 Assessments
- 8.2 Exposure Pathways
- 8.3 Dose Limits
- 8.4 Authorised Discharges
- 8.5 Licensing Requirements

UNIT 9: Radioactive Waste

- 9.1 Publications relevant to Radwaste in Mining & Minerals Processing
- 9.2 Sources and types of radioactive waste
- 9.3 Sources and Types of RadWaste in Processing Plants and Activities/Industries Associated with Mines
- 9.4 Industries and Activities Associated with Mines
- 9.5 Radwaste management (General)
- 9.6 Handling & Disposal of Radwaste from the mining industry
- 9.7 Licensing requirements

MODULE 3

UNIT 1: Introduction & Overview

UNIT 2: Licensing & Legislation

- 2.1 History & legal aspects of the Nuclear Energy Act
- 2.2 The license and its conditions
- 2.3 The work and functions of the NNR

UNIT 3: International Organisations responsible for radiation protection philosophy & Standards

- 3.1 The ICRP and the development and evolution of radiation protection philosophy and standards
- 3.2 The International Atomic Energy Agency
- 3.3 Other Organisations involved in radiation protection

UNIT 4: Radiation Protection Programme: Workforce

UNIT 5: Radiation Protection Programme: Public

UNIT 6: Radiological Surveillance

UNIT 7: Surveys & Hazard Assessments

UNIT 8: Waste Management Programme

UNIT 9: Transport of Radioactive Materials on Public Roads

UNIT 10: Occurrences, Notifications & Emergency Plans

UNIT 11: Training

UNIT 12: Records & Record Keeping

UNIT 13: Physical Security provisions at licenced MIMP facilities

UNIT 14: Quality Management

UNIT 15: Accreditation & Approvals

UNIT 16: License Schedules