Lecture 9: Physical & Chemical Hazards – Student Notes

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Physical Hazards

Physical hazards refer to environmental or workplace factors that pose a risk of harm to individuals due to their physical properties or interactions. These hazards can result in injuries, illnesses, or other health-related issues. Common examples include:

- **Noise**: Excessive sound levels that can cause hearing damage over time (e.g., in industrial settings or construction sites).
- **Vibration**: Exposure to mechanical vibration can lead to health conditions such as Hand-Arm Vibration Syndrome (HAVS).
- **Radiation**: Both ionising (e.g., X-rays) and non-ionising radiation (e.g., UV light) can lead to severe health issues depending on the intensity and duration of exposure.
- **Temperature Extremes**: High or low temperatures may result in conditions like heat stress, dehydration, hypothermia, or frostbite.
- **Tripping and Slipping Hazards**: Uneven surfaces, spills, or misplaced objects can lead to injuries such as sprains or fractures.
- **Working at Height**: Activities conducted above ground level can result in falls, which are a leading cause of workplace injuries.
- **Other Factors**: Includes hazards like confined spaces, manual handling etc...

Chemical Hazards

Chemical hazards encompass harmful substances that can cause adverse health effects, depending on their properties and the level of exposure. These include:

- **Toxicity**: Substances that can cause poisoning, organ damage, or long-term health conditions (e.g., lead or mercury exposure).
- **Reactivity**: Chemicals that can react violently with other substances or environmental factors, leading to explosions or the release of dangerous gases.
- **Flammability**: Highly combustible materials pose fire or explosion risks (e.g., solvents, petrol, or gases like hydrogen).

- **Corrosivity**: Chemicals such as acids or alkalis can cause severe burns or damage to materials.

Overlap

Overlap occurs when hazards intersect, creating compounded risks. For instance:

- A **chemical spill** can introduce **slip hazards** if the substance spreads on a smooth surface, leading to falls.
- Additionally, the same spill might release **toxic vapours**, increasing the risk of inhalation-related injuries.
- **High temperatures** in a poorly ventilated area with flammable chemicals might exacerbate the risk of fire or explosion.

Such overlaps demand comprehensive risk assessments and integrated mitigation strategies to manage both individual and combined risks effectively.

Chemical Hazards

Here is a detailed explanation of the Malta Regulations and their corresponding EU Directives as outlined in the image:

1. Protection of Workers from the Risks Related to Exposure to Asbestos at Work Regulations (LN 323 of 2006)

- **Malta Regulation:** These regulations aim to protect workers from the health risks associated with asbestos exposure, including mesothelioma, asbestosis, and lung cancer. The regulation mandates measures such as the assessment of risks, employee training, and safe handling and removal of asbestos-containing materials.
- **EU Directive:** Directive 2009/148/EC governs the protection of workers from risks related to asbestos exposure at the European level. It sets out minimum safety standards and risk assessment requirements, including banning the use of asbestos and enforcing strict guidelines for its management.

2. Protection of the Health and Safety of Workers from the Risks Related to Chemical Agents at Work Regulations (LN 227 of 2003)

- **Malta Regulation:** These regulations focus on safeguarding workers from chemical-related hazards by requiring employers to conduct risk assessments, provide information and training, and implement control measures such as ventilation, personal protective equipment (PPE), and substitution of hazardous chemicals with safer alternatives.
- **EU Directive:** Directive 98/24/EC establishes a framework for protecting workers from chemical agents' risks across the EU. It includes provisions on exposure limits, labelling, and classification to ensure consistent safety measures across Member States.

3. Protection of Workers from the Risks Related to Exposure to Carcinogens, Mutagens, or Reprotoxic Substances at Work Regulations (LN 228 of 2003)

- **Malta Regulation:** These regulations aim to prevent and control worker exposure to substances known to cause cancer, genetic mutations, or reproductive harm.

They require monitoring, controlled environments, and medical surveillance for employees handling these substances.

- **EU Directive:** Directive 2004/37/EC addresses the same concerns at an EU level, mandating specific measures like substitution of hazardous substances, exposure monitoring, and setting occupational exposure limit values.

4. Control of Major Accident Hazards Regulations (LN 179 of 2015)

- **Malta Regulation:** This regulation aligns with the Seveso III Directive and focuses on preventing major industrial accidents involving dangerous substances. It includes requirements for safety management systems, emergency planning, and communication with local authorities and the public.
- **EU Directive:** Directive 2012/18/EU (Seveso III Directive) lays out comprehensive measures to control major accident hazards. It establishes safety thresholds for hazardous substances and requires risk assessment and reporting by industrial operators.

Each of these regulations and directives forms part of a comprehensive framework ensuring worker safety and health in high-risk industries, particularly those involving asbestos, chemicals, carcinogens, and major accident hazards. This alignment between Maltese regulations and EU directives ensures consistent safety standards across all Member States.

Exposure Routes of Chemical Hazards

Chemical hazards can enter the human body through various exposure routes, each presenting unique risks and requiring specific control measures. The four primary exposure routes are **inhalation**, **skin absorption**, **ingestion**, and **injection (or intravenous exposure)**. These routes are critical considerations in assessing chemical risks in the workplace.

1. Inhalation

- **Definition:** Inhalation is the most common route of exposure for chemical hazards, occurring when airborne chemicals are breathed into the respiratory system.
- **Examples:**
    - **Volatile Organic Compounds (VOCs):** Solvents such as toluene or acetone can cause dizziness, headaches, or respiratory irritation.
    - **Toxic Gases:** Chlorine gas exposure can lead to severe lung damage and respiratory failure.
    - **Dusts and Particulates:** Silica or asbestos dust can cause chronic conditions like silicosis or mesothelioma.
- **Risks:** The impact depends on the chemical concentration, particle size (e.g., fine dust penetrates deeper into the lungs), and exposure duration.
- **Control Measures:**
    - Local exhaust ventilation systems to remove harmful vapours and fumes.
    - Use of appropriate respiratory protective equipment (e.g., masks or respirators).
    - Regular air quality monitoring to ensure compliance with permissible exposure limits.

2. Skin Absorption

- **Definition:** Certain chemicals can penetrate the skin and enter the bloodstream, causing localised or systemic effects.
- **Examples:**

    - **Corrosive Substances:** Acids (e.g., hydrofluoric acid) and alkalis (e.g., sodium hydroxide) can cause chemical burns and tissue damage.
    - **Organic Solvents:** Benzene and phenol can pass through the skin, potentially damaging internal organs like the liver or kidneys.
    - **Pesticides:** Prolonged handling without protection can lead to poisoning.
- **Risks:** The rate of absorption depends on the chemical's solubility, concentration, and the skin's condition (e.g., cuts or abrasions increase vulnerability).
- **Control Measures:**
    - Wearing protective gloves, aprons, or chemical-resistant clothing.
    - Implementing proper handwashing protocols after handling chemicals.
    - Using barrier creams in low-risk scenarios.

3. Ingestion

- **Definition:** Ingestion occurs when chemicals are swallowed, either accidentally or through poor hygiene practices.
- **Examples:**
    - **Chemical Residues:** Contaminated hands touching food can result in ingesting harmful substances like lead or pesticides.
    - **Laboratory Settings:** Improper labelling or storage of chemicals in containers resembling food or drink can lead to accidental consumption.
    - **Toxic Contaminants:** Ingesting small amounts of industrial chemicals like methanol can lead to severe poisoning or even death.
- **Risks:** The severity depends on the chemical's toxicity, quantity ingested, and whether it interacts with other substances in the digestive system.
- **Control Measures:**
    - Establishing no-eating, drinking, or smoking zones in areas where chemicals are used.
    - Proper labelling and storage of chemicals.
    - Training on hygiene practices, such as washing hands before meals.

4. Injection (or Intravenous Exposure)

- **Definition:** Injection occurs when chemicals directly penetrate the skin and enter the bloodstream, often due to sharp objects or high-pressure equipment.
- **Examples:**
    - **Needlestick Injuries:** Exposure to hazardous drugs or chemicals used in healthcare settings.
    - **High-Pressure Fluid Systems:** Accidental injection of hydraulic fluids or other pressurised chemicals can cause severe tissue damage.
- **Risks:** Injection can deliver chemicals directly to vital organs, bypassing the body's natural defence mechanisms, leading to severe or even fatal effects.
- **Control Measures:**
    - Proper handling and disposal of sharps or needles.
    - Regular maintenance and training on high-pressure equipment.
    - Immediate medical attention in the event of accidental injection.

Health Effects of Chemical Exposure

Short-Term (Acute) Effects

- **Burns:** Contact with corrosive chemicals like sulphuric acid can result in severe tissue damage.
- **Poisoning:** Acute exposure to cyanide or organophosphate pesticides can cause rapid poisoning, symptoms including seizures, vomiting, or respiratory distress.

Long-Term (Chronic) Effects

- **Cancer:** Prolonged exposure to carcinogens like benzene or formaldehyde may result in cancers such as leukaemia or lung cancer.
- **Organ Damage:** Chronic exposure to chemicals like mercury or lead can cause irreversible damage to the nervous system, liver, or kidneys.
- **Reproductive Issues:** Chemicals such as phthalates or certain solvents can affect fertility or cause birth defects.

Potential Instant Fatalities

- Exposure to **toxic gases** (e.g., hydrogen cyanide or hydrogen sulphide) or highly reactive chemicals can result in immediate fatalities, often due to respiratory failure, cardiac arrest, or systemic poisoning.

Conclusion

Understanding the exposure routes of chemical hazards and their associated health effects is vital in preventing chemical-related injuries and illnesses. Employers must implement robust controls, including engineering solutions, PPE, and strict workplace policies, to safeguard workers. Regular training and risk assessments further ensure a safer environment for handling hazardous chemicals.

Transport of Hazardous Chemicals – IMDG Code

The **International Maritime Dangerous Goods (IMDG) Code** is a comprehensive framework designed to ensure the safe transport of hazardous goods by sea. It is developed by the **International Maritime Organisation (IMO)** and focuses on protecting crew, ships, and the environment.

What is the IMDG Code?

The IMDG Code is a globally recognised set of guidelines for the safe transport of dangerous goods via maritime routes. It:

- **Protects personnel and the environment** by addressing the risks associated with the handling and movement of hazardous chemicals.
- Provides **internationally uniform standards** to categorise, package, label, stow, and respond to hazardous material incidents.

Key Principles

1. **Classification of Dangerous Goods**:
    - Chemicals and substances are categorised into hazard classes, such as:
        - **Flammable liquids** (e.g., petrol, ethanol).
        - **Toxic gases** (e.g., chlorine, ammonia).
        - **Corrosive materials** (e.g., sulphuric acid).
    - Classification ensures clear identification of risks during handling and transportation.
2. **Packaging and Labelling Requirements**:
    - Mandates the use of UN-certified packaging.
    - Requires proper labelling, such as:
        - Hazard symbols.
        - UN numbers (unique identifiers for dangerous goods).
3. **Stowage and Segregation Rules**:
    - Defines specific areas for storing goods on ships to prevent chemical reactions or accidental leaks.

    - Includes rules for separating incompatible substances (e.g., oxidisers and flammables).

4. **Emergency Response**:
    - Outlines procedures for managing spills, leaks, or accidents at sea.
    - Includes communication protocols, firefighting measures, and medical responses.

Relevance to Workplace Safety

- Employers involved in the shipment of hazardous chemicals must comply with the IMDG Code to prevent maritime incidents.
- Workers handling logistics or shipping tasks require training on IMDG protocols to manage chemical risks and emergency scenarios effectively.
- Workplace adherence ensures both regulatory compliance and the safety of personnel involved in chemical handling.

Link to REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals)

- Safety Data Sheets (SDS) required by REACH include transportation information relevant to IMDG Code compliance.
- Information on chemical properties, hazard classifications, and handling precautions supports seamless integration with IMDG requirements.

CLP Regulation (Classification, Labelling, and Packaging)

The **CLP Regulation** is a critical EU framework aimed at ensuring the safe classification, labelling, and packaging of chemical substances and mixtures. It aligns with the **Globally Harmonised System (GHS)** and is governed by **EU Regulation (EC) No 1272/2008**.

What is CLP?

- The CLP Regulation standardises the classification, labelling, and packaging of chemicals across the European Union.
- It integrates the **Globally Harmonised System (GHS)** to provide consistency in chemical hazard communication worldwide.
- It ensures that hazards are clearly identified and communicated to workers, consumers, and other stakeholders to promote safety and environmental protection.

Purpose of CLP

- To **protect human health and the environment** by clearly communicating chemical hazards.
- To provide a **uniform system** for classifying and labelling chemicals, making it easier for businesses to comply with EU standards.
- To enable **safe handling, storage, and transport** of hazardous substances.

Key Components

1. **Hazard Classification**
    - Substances and mixtures are classified based on their potential risks, such as:
        - **Physical Hazards:** Flammability, explosiveness.
        - **Health Hazards:** Toxicity, carcinogenicity, or skin/eye irritation.
        - **Environmental Hazards:** Aquatic toxicity or ozone depletion.

2. **Labelling Requirements**
    - **Pictograms:** Standard hazard symbols to visually represent risks (e.g., a flame for flammable substances or a skull for toxicity).
    - **Signal Words:** "Danger" (for severe hazards) or "Warning" (for less severe hazards).
    - **Hazard Statements:** Short phrases describing the risks (e.g., "May cause cancer").
    - **Precautionary Statements:** Guidance on safety measures to reduce risks (e.g., "Wear protective gloves" or "Keep away from heat sources").
3. **Packaging**
    - Packaging must be designed to:
        - Contain the substance securely and prevent leaks or spills.
        - Include clear hazard labels and safety information.
        - Protect users during handling and storage.

Importance of CLP in Workplace Safety

- The CLP Regulation ensures that workers are **fully informed** about the hazards associated with chemicals they handle.
- It supports risk assessment processes by providing critical information on chemical properties.
- Proper labelling and packaging reduce the likelihood of accidents or mismanagement during transport, use, or disposal.

Integration with Other Regulations

- **Link to REACH:** CLP works in tandem with REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals) to ensure a comprehensive chemical safety framework. Safety Data Sheets (SDS) provided under REACH support the implementation of CLP labelling.
- **Global Alignment:** The adoption of GHS principles ensures global consistency, facilitating international trade and cooperation on chemical safety.

Safety Data Sheets (SDS)

Safety Data Sheets (SDS) are essential documents that provide detailed information about hazardous substances or mixtures. They are mandatory under the **CLP Regulation** and **REACH Regulation** in the European Union and are crucial for ensuring workplace safety and compliance with chemical safety laws.

What is an SDS?

- An **SDS** is a document that contains comprehensive information on the hazards, handling, storage, and disposal of a chemical substance or mixture.
- Required by both **CLP (Classification, Labelling, and Packaging)** and **REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals)** regulations.
- It ensures that those handling hazardous chemicals, such as workers, emergency responders, and consumers, have the necessary knowledge to work safely.

Purpose of SDS

- To **support workplace risk assessment** by providing essential hazard and safety information.
- To guide the **safe handling, storage, and use** of hazardous chemicals.
- To ensure proper **emergency responses** in case of spills, leaks, or accidents.
- To assist in **regulatory compliance** for manufacturers, suppliers, and end-users.

Key Sections in an SDS

An SDS is divided into 16 sections, each providing specific information:

1. **Identification of the Substance/Mixture and Company**:
    - Product name, chemical identifier, and supplier details.
    - Emergency contact information.
2. **Hazard Identification**:
    - Description of hazards (e.g., toxicity, flammability) as per CLP classification.

- Hazard symbols, signal words, and hazard statements.

3. **Composition/Information on Ingredients**:
    - Details of the chemical composition.
    - Information on hazardous components and their concentrations.
4. **First-Aid Measures**:
    - Instructions for responding to exposure via inhalation, skin contact, ingestion, or eye contact.
5. **Firefighting Measures**:
    - Guidance on extinguishing methods and fire hazards.
6. **Accidental Release Measures**:
    - Procedures for containing and cleaning up chemical spills.
    - Recommendations for environmental protection and personal safety.
7. **Handling and Storage Requirements**:
    - Safe handling practices.
    - Storage conditions, including temperature, humidity, and incompatibilities.
8. **Exposure Controls/PPE Recommendations**:
    - Exposure limits and personal protective equipment (PPE) requirements.
9. **Physical and Chemical Properties**:
    - Characteristics such as boiling point, melting point, solubility, and vapour pressure.
10. **Stability and Reactivity**:
    - Information on chemical stability and potential hazardous reactions.
11. **Toxicological Information**:
    - Details on health effects from acute or chronic exposure.
12. **Ecological Information**:
    - Impact on the environment, including aquatic toxicity and biodegradability.
13. **Disposal Considerations**:

- Guidance on safe disposal of chemicals and their containers.

14. **Transport Information**:
    - Details required for transportation compliance (e.g., IMDG, ADR classifications).
15. **Regulatory Information**:
    - Applicable regulations and restrictions under REACH, CLP, or other laws.
16. **Other Information**:
    - Includes the date of issue or revision and additional relevant details.

Importance of SDS in Workplace Safety

- SDS serves as the cornerstone for **chemical risk management** in the workplace.
- It ensures that employees are informed about hazards and safety measures through **accessible and standardised information**.
- It plays a critical role in **training workers** and enabling compliance with workplace health and safety laws.

Conclusion

Safety Data Sheets (SDS) are indispensable tools for managing hazardous chemicals safely. By providing comprehensive details on a substance's hazards and handling requirements, they ensure that both workers and employers can mitigate risks and comply with regulatory standards effectively.

Introduction to Physical Hazards

Physical hazards are environmental factors or conditions that pose risks of harm to workers due to their physical properties. These hazards are not chemical or biological in nature but arise from exposure to elements such as noise, vibration, temperature extremes, radiation, and mechanical risks. Common in various industries, they can lead to injuries, illnesses, or long-term health issues.

Examples include:

- **Noise**: Prolonged exposure to high decibel levels, causing hearing loss.
- **Vibration**: Use of vibrating tools leading to conditions like Hand-Arm Vibration Syndrome (HAVS).
- **Radiation**: Ionising (e.g., X-rays) or non-ionising (e.g., UV radiation) exposures affecting skin or internal organs.
- **Temperature Extremes**: Risks of heat stress, burns, or frostbite.
- **Mechanical Risks**: Tripping, falling, or being struck by moving machinery.

Managing physical hazards involves risk assessments, engineering controls, personal protective equipment (PPE), and worker training to minimise exposure and ensure safety.

The Legal Framework for Physical Hazards

Physical hazards are governed by a robust legal framework at both the national (Malta) and EU levels, ensuring the health and safety of workers. Below is an overview of relevant Malta Regulations and corresponding EU Directives addressing key physical hazards.

1. Protection of Workers from the Risks Related to Noise

- **Malta Regulation:** LN 158 of 2006
- **EU Directive:** Directive 2003/10/EC
    - Specifies minimum health and safety requirements regarding exposure to noise at work.
    - Aims to prevent hearing loss and other noise-related health effects.
    - Includes measures such as exposure limits, risk assessments, and the provision of hearing protection.

2. Protection of Workers from the Risks Related to Vibration

- **Malta Regulation:** LN 371 of 2005
- **EU Directive:** Directive 2002/44/EC
    - Focuses on minimum requirements for protecting workers from exposure to vibration.
    - Covers both hand-arm vibration (e.g., from power tools) and whole-body vibration (e.g., from machinery or vehicles).
    - Requires employers to assess risks and implement control measures like equipment maintenance and worker rotation.

3. Protection of Workers from the Risks Related to Electromagnetic Fields (EMF)

- **Malta Regulation:** LN 257 of 2016
- **EU Directive:** Directive 2013/35/EU
    - Sets guidelines for managing health and safety risks from electromagnetic fields.
    - Covers potential effects such as tissue heating or nerve stimulation.

- Includes risk assessments and monitoring of exposure levels.

4. Protection of Workers from the Risks Related to Optical Radiation

- **Malta Regulation:** LN 250 of 2010
- **EU Directive:** Directive 2006/25/EC
    - Regulates exposure to artificial optical radiation (e.g., lasers or welding arcs).
    - Requires measures to protect against skin and eye damage caused by ultraviolet (UV), infrared (IR), and visible radiation.

5. Basic Safety Standards for Ionising Radiation

- **Malta Regulation:** LN 210 of 2018
- **EU Directive:** Directive 2013/59/Euratom
    - Establishes standards for protection against ionising radiation, such as X-rays or radioactive materials.
    - Includes dose limits, monitoring requirements, and guidelines for safe handling and storage.
    - Note: **This regulation is not under OHSA jurisdiction** but is critical for radiation safety.

Protection of Workers from the Risks Related to Exposure to Noise at Work Regulations (LN 158 of 2006)

This regulation implements **Directive 2003/10/EC** and aims to safeguard workers from the adverse effects of occupational noise exposure, including hearing damage and stress.

Sources of Noise

Noise in the workplace can arise from various activities and equipment, including:

- **Machinery**: Compressors, drills, saws, and other industrial equipment.
- **Transportation**: Noise from heavy vehicles, airplanes, and shipping operations.
- **Construction Activities**: Pile driving, demolition, and machinery operations.
- **Manufacturing**: Processes such as metal pressing, assembly lines, and grinding.
- **Recreational or Public Events**: Concerts, sports events, and entertainment venues.

Health Effects

Exposure to excessive noise can result in:

- **Hearing Loss**: Temporary or permanent damage to hearing capacity.
- **Tinnitus**: Persistent ringing or buzzing in the ears.
- **Stress and Fatigue**: Noise contributes to physical and mental strain, reducing productivity and increasing the risk of errors.

Legal Exposure Limits

The regulations establish clear action values for noise exposure:

- **Lower Action Value**: 80 dB(A).
- **Upper Action Value**: 85 dB(A).
- **Peak Sound Level**: 137 dB(C). Employers must assess and control risks when these limits are exceeded.

Control Measures

The regulations require employers to implement a hierarchy of control measures:

1. **Engineering Controls**:
    - Soundproofing workplaces.
    - Using quieter machinery or retrofitting equipment with noise-dampening technology.
2. **Administrative Controls**:
    - Rotating workers to reduce individual exposure.
    - Scheduling quiet periods during operations.
3. **Personal Protective Equipment (PPE)**:
    - Providing earplugs or earmuffs to workers exposed to high noise levels.

Protection of Workers from the Risks Related to Exposure to Vibration at Work Regulations (LN 371 of 2005)

This regulation implements **Directive 2002/44/EC** and establishes measures to protect workers from health risks caused by exposure to mechanical vibration in workplaces.

Sources of Vibration

Vibration can originate from a variety of workplace activities and equipment, including:

- **Hand Tools**: Jackhammers, grinders, drills, and sanders.
- **Heavy Machinery**: Bulldozers, forklifts, and other construction or industrial equipment.
- **Transportation**: Trucks, trains, and boats, contributing to whole-body vibration.
- **Manufacturing Processes**: Conveyor systems and vibrating machinery.

Health Effects

Prolonged exposure to vibration can lead to:

- **Hand-Arm Vibration Syndrome (HAVS)**: A condition affecting blood vessels, nerves, and muscles in the hands and arms.
- **Musculoskeletal Disorders**: Including joint and back pain from whole-body vibration.
- **Circulatory and Nerve Damage**: Resulting in reduced grip strength, tingling, and chronic pain.

Legal Exposure Limits

The regulation sets specific thresholds for vibration exposure:

- **Hand-Arm Vibration**:
    - Action Level: 2.5 m/s^2
    - Limit Value: 5 m/s^2
- **Whole-Body Vibration**:
    - Action Level: 0.5 m/s^2
    - Limit Value: 1.15 m/s^2

Employers must take action if the exposure exceeds the action level and must ensure the limit value is not surpassed.

Control Measures

Employers are required to implement a hierarchy of controls to mitigate vibration risks:

1. **Engineering Controls**:
    - Use anti-vibration tools and machinery.
    - Install dampeners and vibration-isolating mounts on equipment.
2. **Administrative Controls**:
    - Schedule rest breaks to reduce exposure duration.
    - Rotate workers between tasks to minimise individual exposure.
3. **Personal Protective Equipment (PPE)**:
    - Provide vibration-dampening gloves.
    - Use padded seats and vibration-absorbing mats for operators.

Non-Ionising Radiation (NIR)

Definition:

Non-ionising radiation refers to radiation that lacks the energy required to ionise atoms or molecules, meaning it cannot remove tightly bound electrons from atoms. It interacts with matter primarily by causing vibrations or heating, rather than directly altering atomic structures.

Spectrum:

Non-ionising radiation encompasses the entire range of electromagnetic radiation except for ionising types like X-rays and gamma rays. It includes a broad range of frequencies and wavelengths.

Examples of Non-Ionising Radiation:

1. **Electromagnetic Fields (EMFs)**:
    - Found in the low-frequency part of the spectrum, such as power lines and electrical appliances.
2. **Optical Radiation**:
    - Covers visible light, infrared (IR), and ultraviolet (UV) radiation. High-intensity UV, while still non-ionising, poses significant health risks like skin burns.
3. **Radiofrequency (RF) Radiation**:
    - Includes microwaves, used in telecommunications and cooking appliances.
4. **Infrared Radiation (IR)**:
    - Emitted by heat sources like furnaces or heaters.
5. **Microwaves**:
    - Used in radar, microwave ovens, and wireless communication systems.

Key Characteristics:

- Non-ionising radiation is **not energetic enough** to directly damage DNA or cause ionisation.
- **Health Effects**:
    - **Thermal effects**: Prolonged exposure can cause heating and burns, as with microwaves or infrared radiation.
    - **Tissue damage**: High-intensity exposure can result in long-term health issues, such as cataracts from infrared exposure or skin burns from ultraviolet (UV) radiation.
    - **Potential neurological and physiological effects**: Prolonged exposure to EMFs may contribute to stress and fatigue, though direct evidence remains under investigation.

Relevance to Workplace Safety:

- **Risk Assessment**: Workers in industries involving high exposure to EMFs, RF radiation, or UV light must be assessed for potential health risks.
- **Control Measures**:
    - Shielding and distance from high-intensity sources.
    - Personal protective equipment (PPE) such as UV-blocking goggles and heat-resistant clothing.
    - Monitoring and compliance with exposure limits set by regulations.

Non-ionising radiation, while less hazardous than ionising types, still requires proactive management to ensure worker safety.

Basic Safety Standards for Ionising Radiation Regulations (LN 210 of 2018)

The **LN 210 of 2018** regulation enforces basic safety standards to protect workers and the public from risks associated with ionising radiation. It aligns with **Directive 2013/59/Euratom**, ensuring the safe use and management of radiation in various sectors.

Content:

Sources of Ionising Radiation

Ionising radiation originates from activities and equipment that emit high-energy radiation capable of altering atomic structures. Key sources include:

1. **Medical Imaging**: X-rays, CT scans, and other diagnostic procedures.
2. **Nuclear Facilities**: Reactors and power plants involved in energy generation.
3. **Industrial Radiography**: Inspections such as pipeline integrity checks.
4. **Research Facilities**: Use of radioactive isotopes and materials for scientific studies.

Health Effects

1. **Acute Exposure**:
    - Symptoms of **radiation sickness**: Nausea, vomiting, and fatigue from high-dose, short-term exposure.
    - Severe cases may cause skin burns, organ damage, or death.
2. **Chronic Exposure**:
    - Long-term risks such as **cancer** (e.g., leukaemia) and **genetic mutations**.
    - Persistent low-dose exposure increases cumulative risk.

Control Measures

To minimise the risks of ionising radiation, the regulations mandate a hierarchy of control measures:

1. **Engineering Controls**:
    - Use of **lead shielding** around radiation sources.

- Containment of radioactive materials in secure, sealed systems.

2. **Administrative Controls**:
    - Implementing radiation **dose monitoring** through personal dosimeters.
    - Clear **signage** and barriers to restrict access to radiation zones.
    - Regular risk assessments and training for workers.
3. **Personal Protective Equipment (PPE)**:
    - **Lead aprons** for medical personnel and workers in radiographic environments.
    - **Thyroid shields** to protect sensitive organs from scattered radiation.

Conclusion

The **LN 210 of 2018** regulation ensures comprehensive protection against ionising radiation through robust safety standards. By addressing exposure limits, health risks, and control measures, it safeguards workers, the public, and the environment while enabling the safe use of ionising radiation in medical, industrial, and research settings.

Physical Hazards – Other Examples

Physical hazards encompass various environmental and workplace conditions that pose risks of harm to workers. Below is an outline of key examples of physical hazards and their potential effects:

1. Temperature Extremes

- **Heat Stress**: Exposure to high temperatures, such as in industrial furnaces, can lead to dehydration, heat stroke, or burns.
- **Cold Stress**: Prolonged work in freezing environments, such as outdoor winter settings, may result in hypothermia or frostbite.

2. Pressure Hazards

- **High-Pressure Systems**: Risks from gas cylinders or high-pressure equipment, which can lead to explosions or injuries if mishandled.
- **Vacuum Environments**: Laboratory chambers or vacuum systems can cause implosions or pressure-related injuries.

3. Confined Spaces

- **Examples**: Tanks, silos, and crawl spaces.
- **Risks**: Limited ventilation, risk of asphyxiation, and difficulty in evacuation during emergencies.

4. Mechanical Hazards

- **Examples**: Moving machinery, rotating parts, and conveyors.
- **Risks**: Cuts, amputations, or entanglement in machinery due to inadequate safeguards.

5. Ergonomic Hazards

- **Examples**: Repetitive motions, awkward postures, and manual handling tasks.
- **Risks**: Musculoskeletal disorders, such as carpal tunnel syndrome or back pain.

6. Slips, Trips, and Falls

- **Examples**: Uneven surfaces, wet floors, or working at heights.
- **Risks**: Sprains, fractures, or head injuries.

7. Electrical Hazards

- **Examples**: Exposure to shocks, burns, or arc flashes from electrical equipment.
- **Risks**: Severe burns, electrocution, or fires caused by faulty wiring.

8. Explosive Atmospheres

- **Examples**: Dust clouds, such as flour or coal dust, and flammable gases.
- **Risks**: Fires or explosions in poorly ventilated or improperly managed environments.

9. Fire and Thermal Hazards

- **Examples**: Open flames, flammable liquids, or hot surfaces.
- **Risks**: Burns, smoke inhalation, or structural fires.

10. Weather-Related Hazards

- **Examples**: Storms, strong winds, or lightning in outdoor workplaces.
- **Risks**: Falling objects, structural damage, or direct exposure to lightning strikes.

Conclusion

Physical hazards vary widely but share the potential to cause significant harm if not adequately controlled. Mitigating these risks involves a combination of risk assessments, proper equipment, training, and implementation of control measures such as engineering solutions, administrative policies, and personal protective equipment (PPE).
