
Graduate Certificate in Human Factors in Process Safety Management

Human Factors in Incident Investigation

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Incident investigation is a crucial process in understanding the root causes of accidents, near misses, and other safety-related incidents within an organization. Human factors play a significant role in incident investigation as they focus on understanding how people interact with their work environment and equipment, leading to errors or unsafe behaviors. This course, Graduate Certificate in Human Factors in Process Safety Management, delves into the importance of human factors in incident investigation and how they can be applied to enhance safety within industrial settings.

Key Terms and Vocabulary

1. **Incident Investigation:** The systematic process of identifying the causes of an incident, analyzing what went wrong, and implementing corrective actions to prevent similar incidents from occurring in the future.
2. **Root Cause Analysis:** A methodical approach used to identify the underlying causes of an incident rather than just focusing on the immediate or surface-level factors.
3. **Human Error:** Mistakes made by individuals that result in undesired outcomes. Human errors can be categorized into slips, lapses, mistakes, and violations.
4. **Unsafe Acts:** Actions or behaviors by individuals that deviate from safe operating procedures or standards, leading to an increased risk of incidents.
5. **Organizational Factors:** Aspects within an organization that can influence human performance, such as leadership, communication, culture, policies, procedures, and resource allocation.
6. **Safety Culture:** The shared values, beliefs, attitudes, and behaviors related to safety within an organization. A positive safety culture promotes open communication, learning from mistakes, and continuous improvement.
7. **Hazard Identification:** The process of recognizing potential sources of harm or danger within a system, process, or environment.
8. **Risk Assessment:** The systematic evaluation of potential risks associated with a particular activity or process to determine the likelihood and consequences of incidents.
9. **Human Factors Engineering:** The discipline that focuses on designing systems, tools, and environments to optimize human performance, reduce errors, and enhance safety.

10. **Workload:** The amount of mental and physical effort required to perform a task or job. High workload levels can lead to fatigue, stress, and decreased performance.
11. **Situational Awareness:** The perception and understanding of current conditions, events, and potential hazards in the environment. Situational awareness is crucial for making informed decisions and taking appropriate actions.
12. **Human Reliability:** The likelihood of individuals performing tasks accurately and consistently without errors. Factors influencing human reliability include training, experience, workload, distractions, and stress.
13. **Operator Error:** Mistakes or incorrect actions made by operators while performing tasks, often due to factors such as inadequate training, poor communication, or confusing procedures.
14. **Barrier Analysis:** A method used to identify and assess barriers (e.g., physical, procedural, administrative) that can prevent or mitigate incidents in a system.
15. **Event Tree Analysis:** A graphical method used to analyze the sequence of events leading to an incident and assess the potential outcomes based on different scenarios.
16. **Human Performance Factors:** Individual characteristics, capabilities, limitations, and behaviors that influence human performance in the workplace. These factors include cognitive abilities, physical skills, decision-making, and teamwork.
17. **Task Analysis:** The systematic examination of tasks, processes, or activities to understand the requirements, steps, and potential hazards involved. Task analysis helps identify opportunities for improvement and error prevention.
18. **Control Room Design:** The layout, ergonomics, and technology used in control rooms to optimize operator performance, situational awareness, and decision-making. Effective control room design can reduce errors and enhance safety.
19. **Communication Skills:** The ability to convey information clearly, listen effectively, and exchange feedback with others. Strong communication skills are essential for safe and efficient operations.
20. **Human Error Models:** Theoretical frameworks used to explain the cognitive processes, mechanisms, and factors that contribute to human errors. Examples of human error models include the Swiss cheese model, the SHELL model, and the human factors analysis and classification system (HFACS).
21. **Workplace Fatigue:** The state of mental or physical exhaustion caused by prolonged work hours, inadequate rest, or demanding tasks. Fatigue can impair cognitive functions, decision-making, and reaction times, increasing the risk of errors and incidents.
22. **Crew Resource Management:** A training program designed to improve teamwork, communication,

decision-making, and situational awareness among crew members in high-risk environments such as aviation, healthcare, and nuclear power.

23. Human Error Reduction Techniques: Strategies and interventions aimed at minimizing human errors and improving safety performance. Examples of error reduction techniques include automation, standardization, training, checklists, and feedback mechanisms.

24. Procedural Compliance: The extent to which individuals follow established procedures, rules, and guidelines when performing tasks. Procedural compliance is essential for maintaining consistency, safety, and quality in operations.

25. Incident Reporting and Investigation: The process of documenting and analyzing incidents, near misses, or unsafe conditions to identify trends, lessons learned, and opportunities for prevention. Effective incident reporting and investigation systems are essential for continuous improvement and risk management.

26. Human Factors Integration: The systematic incorporation of human factors principles, methods, and considerations into the design, development, implementation, and evaluation of systems, products, or services. Human factors integration aims to optimize performance, safety, and user experience.

27. Decision-making Process: The cognitive process of evaluating options, considering consequences, and selecting a course of action. Factors influencing decision-making include cognitive biases, emotions, time pressure, and information availability.

28. Workplace Ergonomics: The science of designing workspaces, tools, equipment, and tasks to fit the capabilities and limitations of individuals. Ergonomics aims to optimize comfort, efficiency, and safety in the workplace.

29. Teamwork and Collaboration: The ability of individuals to work together effectively, communicate openly, share information, and coordinate activities to achieve common goals. Strong teamwork and collaboration are essential for safe and efficient operations.

30. Change Management: The process of planning, implementing, and monitoring changes within an organization to achieve desired outcomes. Effective change management involves considering human factors, communication, training, and stakeholder engagement.

31. Training and Competence: The process of providing individuals with the knowledge, skills, and abilities required to perform tasks safely and effectively. Training and competence management are essential for ensuring workforce readiness and performance.

32. Leadership and Management: The ability of individuals in supervisory or managerial roles to inspire, motivate, and guide others toward achieving organizational goals. Effective leadership and management are crucial for promoting safety culture, accountability, and continuous improvement.

33. **Environmental Factors:** Physical conditions and external influences in the workplace that can impact human performance and safety. Environmental factors include noise, lighting, temperature, ventilation, and layout.

34. **Regulatory Compliance:** The adherence to laws, regulations, standards, and best practices governing safety, health, and environmental protection. Regulatory compliance is essential for preventing incidents, avoiding penalties, and maintaining organizational reputation.

35. **Resilience Engineering:** An approach that focuses on building adaptive, flexible, and robust systems that can anticipate, respond to, and recover from unexpected events, disturbances, or failures. Resilience engineering aims to enhance safety, reliability, and performance in complex and dynamic environments.

36. **Human Factors Training:** Educational programs, workshops, or courses that provide individuals with knowledge, skills, and tools to understand and apply human factors principles in their work. Human factors training can help improve awareness, decision-making, and safety performance.

37. **System Safety Analysis:** The process of identifying, assessing, and mitigating safety risks associated with complex systems, processes, or technologies. System safety analysis aims to prevent incidents, minimize consequences, and ensure the overall safety of operations.

38. **Incident Response Plan:** A structured and coordinated approach for responding to incidents, emergencies, or crises in a timely and effective manner. Incident response plans outline roles, responsibilities, procedures, and communication channels to manage incidents and minimize impacts.

39. **Human Factors Assessment:** The evaluation of how human factors influence the design, operation, or performance of systems, processes, or technologies. Human factors assessments help identify strengths, weaknesses, opportunities, and threats related to human performance and safety.

40. **Continuous Improvement:** The ongoing process of identifying, analyzing, and implementing improvements in safety, operations, and performance. Continuous improvement involves learning from experiences, feedback, data, and best practices to enhance organizational effectiveness.

Practical Applications

1. **Incident Investigation Case Studies:** Analyzing real-life incidents and near misses to understand the role of human factors in incident causation, prevention, and mitigation. Case studies help participants apply human factors concepts, tools, and techniques in a practical context.

2. **Root Cause Analysis Workshops:** Engaging participants in interactive workshops to practice root cause analysis techniques, such as fishbone diagrams, fault tree analysis, or the five whys. Root cause analysis workshops help participants identify underlying causes, contributing factors, and corrective actions.

3. **Simulation Exercises:** Conducting simulated scenarios or tabletop exercises to assess human performance,

decision-making, communication, and teamwork under realistic conditions. Simulation exercises help participants develop critical skills, test responses, and improve readiness for incidents.

4. Human Factors Audits: Conducting audits or assessments of workspaces, procedures, equipment, and behaviors to identify opportunities for human factors improvements. Human factors audits help organizations identify gaps, risks, and areas for enhancement in safety performance.

5. Safety Culture Surveys: Administering surveys or assessments to evaluate the perceptions, attitudes, and behaviors related to safety culture within an organization. Safety culture surveys help organizations measure safety climate, identify strengths, weaknesses, and prioritize improvement initiatives.

Challenges and Considerations

1. Complexity of Human Factors: Human factors are multi-dimensional and dynamic, involving cognitive, physical, social, organizational, and environmental factors. Understanding the interactions and influences of human factors can be challenging and requires a holistic approach.

2. Subjectivity and Bias: Assessing human factors in incident investigation can be subjective and influenced by individual perceptions, experiences, and biases. Participants need to be aware of their biases and strive for objectivity in analyzing human performance and behaviors.

3. Data Collection and Analysis: Gathering reliable and accurate data on human factors can be challenging due to the complexity of human behaviors, interactions, and influences. Data collection methods, tools, and techniques should be carefully selected and validated to ensure robust analysis.

4. Integration of Human Factors: Integrating human factors principles, methods, and considerations into existing processes, systems, and practices may require cultural, organizational, and technological changes. Effective integration of human factors requires leadership support, stakeholder engagement, and continuous improvement efforts.

5. Training and Development: Building human factors competencies, skills, and awareness among employees, managers, and leaders is essential for enhancing safety performance. Providing ongoing training, coaching, and feedback on human factors can be challenging but is critical for sustaining improvements.

6. Communication and Collaboration: Fostering open communication, collaboration, and teamwork among individuals with diverse backgrounds, roles, and perspectives is essential for addressing human factors challenges. Building a culture of trust, respect, and transparency can support effective incident investigation and prevention efforts.

7. Regulatory Compliance: Meeting regulatory requirements and industry standards related to human factors in incident investigation is essential for ensuring legal compliance, risk management, and stakeholder trust. Organizations need to stay informed about evolving regulations, guidelines, and best

practices in human factors.

8. Measurement and Evaluation: Establishing key performance indicators (KPIs), metrics, and benchmarks to assess the effectiveness of human factors initiatives and interventions is crucial for tracking progress, identifying trends, and demonstrating impact. Measuring the outcomes of human factors efforts can be complex but is necessary for continuous improvement.

9. Resilience and Adaptability: Building resilience, adaptability, and flexibility in systems, processes, and teams is critical for responding to unexpected events, disruptions, or changes. Organizations need to foster a culture of learning, innovation, and agility to enhance their ability to manage human factors challenges.

10. Leadership and Commitment: Demonstrating visible leadership, commitment, and accountability for human factors in incident investigation is essential for driving change, motivating employees, and sustaining safety improvements. Leaders play a key role in setting the tone, priorities, and expectations for human factors integration.

In conclusion, understanding key terms and vocabulary related to human factors in incident investigation is essential for professionals working in safety, risk management, and process industries. By applying human factors principles, tools, and techniques, organizations can enhance safety performance, prevent incidents, and promote a culture of continuous improvement. Effective incident investigation requires a multidisciplinary approach that considers human factors alongside technical, operational, and organizational factors to achieve sustainable safety outcomes.