

# Human Reliability Analysis A Critique And Review For Managers

Session Summary

Volume 1

An Overview of the Evolution of Human Reliability Analysis in the Context of Probabilistic Risk Assessment

Safety and Reliability: Methodology and Applications

Human Reliability Analysis for Design

Proceedings of ESREL 2016 (Glasgow, Scotland, 25-29 September 2016)

Peer Review Study of the Draft Handbook for Human Reliability Analysis with Emphasis on Nuclear Power Plant Applications, NUREG/CR-1278

Applicability of Current Methods

ESREL 2015

Advances in Human Error, Reliability, Resilience, and Performance

Safety and Reliability of Complex Engineered Systems

Human Reliability Assessment Theory and Practice

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Human Reliability Analysis

Bridging Human Reliability Analysis and Psychology, Part 1

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Human Reliability Analysis of Errors of Commission

A Literature Review

Simulation and Non-Simulation Based Human Reliability Analysis Approaches

The Psychological Literature Review for the IDHEAS Method

Reliability, Safety and Hazard Assessment for Risk-Based Technologies

Safety, Reliability and Risk Analysis

A Review and Critique

Proceedings of ICRESH 2019

A Review of Methods and Applications

Advances in Human Error, Reliability, Resilience, and Performance

Proceedings of the AHFE 2019 International Conference on Human Error, Reliability, Resilience, and Performance, July 24-28, 2019, Washington D.C., USA

Individual Differences in Human Reliability Analysis

People, Organisations, and Systems

Peer-review Study of the Draft Handbook for Human-reliability Analysis with Emphasis on Nuclear-power-plant Applications, NUREG/CR-1278

*Human Reliability Analysis A Critique And Review For Managers*

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**TIANA HAILEY**

**Session Summary** Springer Science & Business Media

Within the last fifty years the performance requirements for technical objects and systems were supplemented with: customer expectations (quality), abilities to prevent the loss of the object properties in operation time (reliability and maintainability), protection against the effects of undesirable events (safety and security) and the ability to

**Volume 1** Springer

The prevalence of human erroneous actions as the major cause of accidents in man-machine systems has created a need for better descriptions of human performance, both for accident analysis and system design purposes. Models and methods are therefore required to assess human reliability, identify potential erroneous actions, and specify ways of preventing them from happening. This book discusses how modelling of cognition is applied to the analysis of human

reliability and performance in complex technical domains. It provides a critique of existing approaches to modelling of cognition, and offers an alternative which recognises that the control of human actions is determined by the context as well as cognitive functions. This approach produces an improved qualitative analysis of human performance as a basis for later quantitative reliability assessment. Human Reliability Analysis will be essential reading for practitioners of human reliability analysis as well as students of cognitive psychology and ergonomics at advanced undergraduate and graduate level. Computers and People Series: this series is concerned with all aspects of person-computer relationships, including interaction, interfacing, modelling and artificial intelligence. The volumes are interdisciplinary, communicating results derived in one area of study to workers in another. Applied, experimental, theoretical and tutorial studies are included.

**An Overview of the Evolution of Human Reliability Analysis in the Context of Probabilistic Risk Assessment** CRC Press

"This report describes a peer review of the draft Handbook for Human Reliability Analysis with Emphasis on Nuclear Power Plant Applications, NUREG/CR-1278".

*Safety and Reliability: Methodology and Applications* Elsevier

Risk, Reliability and Safety contains papers describing innovations in theory and practice contributed to the scientific programme of the European Safety and Reliability conference (ESREL 2016), held at the University of Strathclyde in Glasgow, Scotland (25–29 September 2016). Authors include scientists, academics, practitioners, regulators and other key individuals with expertise and experience relevant to specific areas. Papers include domain specific applications as well as general modelling methods. Papers cover evaluation of contemporary solutions, exploration of future challenges, and exposition of concepts, methods and processes. Topics include human factors, occupational health and safety, dynamic and systems reliability modelling, maintenance optimisation, uncertainty analysis, resilience assessment, risk and crisis management.

*Human Reliability Analysis for Design* Springer

In the Fourth Edition of Scale Development, Robert F. DeVellis demystifies measurement by emphasizing a logical rather than strictly mathematical understanding of concepts. The text supports readers in comprehending newer approaches to measurement, comparing them to classical approaches, and grasping more clearly the relative merits of each. This edition addresses new topics pertinent to modern measurement approaches and includes additional exercises and

topics for class discussion. Available with Perusal—an eBook that makes it easier to prepare for class Perusal is an award-winning eBook platform featuring social annotation tools that allow students and instructors to collaboratively mark up and discuss their SAGE textbook. Backed by research and supported by technological innovations developed at Harvard University, this process of learning through collaborative annotation keeps your students engaged and makes teaching easier and more effective. Learn more.

**Proceedings of ESREL 2016 (Glasgow, Scotland, 25-29 September 2016)** Springer Science & Business Media

This paper provides a characterization of human reliability analysis (HRA) issues for computerized procedures in nuclear power plant control rooms. It is beyond the scope of this paper to propose a new HRA approach or to recommend specific methods or refinements to those methods. Rather, this paper provides a review of HRA as applied to traditional paper-based procedures, followed by a discussion of what specific factors should additionally be considered in HRAs for computerized procedures. Performance shaping factors and failure modes unique to computerized procedures are highlighted. Since there is no definitive guide to HRA for paper-based procedures, this paper also serves to clarify the existing guidance on paper-based procedures before delving into the unique aspects of computerized procedures.

*Peer Review Study of the Draft Handbook for Human Reliability Analysis with Emphasis on Nuclear Power Plant Applications, NUREG/CR-1278* Gulf Professional Publishing

This book reviews and presents a number of approaches to Fuzzy-based system safety and reliability assessment. For each proposed approach, it provides case studies demonstrating their applicability, which will enable readers to implement them into their own risk analysis process. The book begins by giving a review of using linguistic terms in system safety and reliability analysis methods and their extension by fuzzy sets. It then progresses in a logical fashion, dedicating a chapter to each approach, including the 2-tuple fuzzy-based linguistic term set approach, fuzzy bow-tie analysis, optimizing the allocation of risk control measures using fuzzy MCDM approach, fuzzy sets theory and human reliability, and emergency decision making fuzzy-expert aided disaster management system. This book will be of interest to professionals and researchers working in the field of system safety and reliability, as well as postgraduate and undergraduate students studying applications of fuzzy systems.

**Applicability of Current Methods** CRC Press

While human reliability analysis (HRA) methods include uncertainty in quantification, the nominal model of human error in HRA typically assumes that operator performance does not vary significantly when they are given the same initiating event, indicators, procedures, and training, and that any differences in operator performance are simply aleatory (i.e., random). While this assumption generally holds true when performing routine actions, variability in operator response has been observed in multiple studies, especially in complex situations that go beyond training and procedures. As such, complexity can lead to differences in operator performance (e.g., operator understanding and decision-making). Furthermore, psychological research has shown that there are a number of known antecedents (i.e., attributable causes) that consistently contribute to observable and systematically measurable (i.e., not random) differences in behavior. This paper reviews examples of individual differences taken from operational experience and the psychological literature. The impact of these differences in human behavior and their implications for HRA are then discussed. We propose that individual differences should not be treated as aleatory, but rather as epistemic. Ultimately, by understanding the sources of individual differences, it is possible to remove some epistemic uncertainty from analyses.

**ESREL 2015** BoD - Books on Demand

*Safety and Reliability of Complex Engineered Systems* contains the Proceedings of the 25th European Safety and Reliability Conference, ESREL 2015, held 7-10 September 2015 in Zurich, Switzerland. It includes about 570 papers accepted for presentation at the conference. These contributions focus on theories and methods in the area of risk, safety and [Advances in Human Error, Reliability, Resilience, and Performance](#) CRC Press

In response to Staff Requirements Memorandum (SRM) SRM-M061020, the U.S. Nuclear Regulatory Commission (NRC) is sponsoring work to update the technical basis underlying human reliability analysis (HRA) in an effort to improve the robustness of HRA. The ultimate goal of this work is to develop a hybrid of existing methods addressing limitations of current HRA models and in particular issues related to intra- and inter-method variabilities and results. This hybrid method is now known as the Integrated Decision-tree Human Event Analysis System (IDHEAS). Existing HRA

methods have looked at elements of the psychological literature, but there has not previously been a systematic attempt to translate the complete span of cognition from perception to action into mechanisms that can inform HRA. Therefore, a first step of this effort was to perform a literature search of psychology, cognition, behavioral science, teamwork, and operating performance to incorporate current understanding of human performance in operating environments, thus affording an improved technical foundation for HRA. However, this literature review went one step further by mining the literature findings to establish causal relationships and explicit links between the different types of human failures, performance drivers and associated performance measures ultimately used for quantification. This is the first of two papers that detail the literature review (paper 1) and its product (paper 2). This paper describes the literature review and the high-level architecture used to organize the literature review, and the second paper (Whaley, Hendrickson, Boring, & Xing, these proceedings) describes the resultant cognitive framework.

*Safety and Reliability of Complex Engineered Systems* CRC Press

Industry underestimates the extent to which behaviour at work is influenced by the design of the working environment. Designing for Human Reliability argues that greater awareness of the contribution of design to human error can significantly enhance HSE performance and improve return on investment. Illustrated with many examples, Designing for Human Reliability explores why work systems are designed and implemented such that "design-induced human error" becomes more-or-less inevitable. McLeod demonstrates how well understood psychological processes can lead people to make decisions and to take actions that otherwise seem impossible to understand. Designing for Human Reliability sets out thirteen key elements to deliver the levels of human reliability expected to achieve the return on investment sought when decisions are made to invest in projects. And it demonstrates how investigation of the human contribution to incidents can be improved by focusing on what companies expected and intended when they chose to rely on human performance as a barrier, or control, against incidents. Recognise some 'hard truths' of human performance and learn about the importance of applying the principles of Human Factors Engineering on capital projects Learn from analysis of real-world incidents how differences between 'fast' and 'slow' styles of thinking can lead to human error in industrial processes Learn how controls and barrier against major incidents that rely on human performance can be strengthened throughout the design and development of assets and equipment

*Human Reliability Assessment Theory and Practice* CRC Press

Each year billions of dollars are being spent in the area of nuclear power generation to design, construct, manufacture, operate, and maintain various types of systems around the globe. Many times these systems fail due to safety, reliability, human factors, and human error related problems. The main objective of this book is to combine nuclear power plant safety, reliability, human factors, and human error into a single volume for those individuals that work closely during the nuclear power plant design phase, as well as other phases, thus eliminating the need to consult many different and diverse sources in obtaining the desired information.

[Current Human Reliability Analysis Methods Applied to Computerized Procedures](#) CRC Press

This book brings together studies broadly addressing human error from different disciplines and perspectives. It discusses topics such as human performance; human variability and reliability analysis; medical, driver and pilot error, as well as automation error; root cause analyses; and the cognitive modeling of human error. In addition, it highlights cutting-edge applications in safety management, defense, security, transportation, process controls, and medicine, as well as more traditional fields of application. Based on the AHFE 2019 International Conference on Human Error, Reliability, Resilience, and Performance, held on July 24-28, 2019, Washington D.C., USA, the book includes experimental papers, original reviews, and reports on case studies, as well as meta-analyses, technical guidelines, best practice and methodological papers. It offers a timely reference guide for researchers and practitioners dealing with human error in a diverse range of fields.

[Context and Control](#) Springer Nature

Computerized procedures (CPs) are an emerging technology within nuclear power plant control rooms. While CPs have been implemented internationally in advanced control rooms, to date no US nuclear power plant has implemented CPs in its main control room. Yet, CPs are a reality of new plant builds and are an area of considerable interest to existing plants, which see advantages in terms of easier records management by omitting the need for updating hardcopy procedures. The overall intent of this paper is to provide a characterization of human reliability analysis (HRA) issues for computerized procedures. It is beyond the scope of this document to propose a new HRA

approach or to recommend specific methods or refinements to those methods. Rather, this paper serves as a review of current HRA as it may be used for the analysis and review of computerized procedures.

[Human Reliability Analysis](#) Human Reliability AnalysisA Review and CritiqueHuman Reliability AnalysisContext and ControlThe prevalence of human erroneous actions as the major cause of accidents in man-machine systems has created a need for better descriptions of human performance, both for accident analysis and system design purposes. Models and methods are therefore required to assess human reliability, identify potential erroneous actions, and specify ways of preventing them from happening. This book discusses how modelling of cognition is applied to the analysis of human reliability and performance in complex technical domains. It provides a critique of existing approaches to modelling of cognition, and offers an alternative which recognises that the control of human actions is determined by the context as well as cognitive functions. This approach produces an improved qualitative analysis of human performance as a basis for later quantitative reliability assessment. Human Reliability Analysis will be essential reading for practitioners of human reliability analysis as well as students of cognitive psychology and ergonomics at advanced undergraduate and graduate level. Computers and People Series: this series is concerned with all aspects of person-computer relationships, including interaction, interfacing, modelling and artificial intelligence. The volumes are interdisciplinary, communicating results derived in one area of study to workers in another. Applied, experimental, theoretical and tutorial studies are included.Human Reliability Analysis of Errors of CommissionA Review of Methods and ApplicationsIssues in Benchmarking Human Reliability Analysis MethodsA Literature ReviewThere is a diversity of human reliability analysis (HRA) methods available for use in assessing human performance within probabilistic risk assessment (PRA). Due to the significant differences in the methods, including the scope, approach, and underlying models, there is a need for an empirical comparison investigating the validity and reliability of the methods. To accomplish this empirical comparison, a benchmarking study is currently underway that compares HRA methods with each other and against operator performance in simulator studies. In order to account for as many effects as possible in the construction of this benchmarking study, a literature review was conducted, reviewing past benchmarking studies in the areas of psychology and risk assessment. A number of lessons learned through these studies are presented in order to aid in the design of future HRA benchmarking endeavors.Bridging Human Reliability Analysis and Psychology, Part 1The Psychological Literature Review for the IDHEAS MethodIn response to Staff Requirements Memorandum (SRM) SRM-M061020, the U.S. Nuclear Regulatory Commission (NRC) is sponsoring work to update the technical basis underlying human reliability analysis (HRA) in an effort to improve the robustness of HRA. The ultimate goal of this work is to develop a hybrid of existing methods addressing limitations of current HRA models and in particular issues related to intra- and inter-method variabilities and results. This hybrid method is now known as the Integrated Decision-tree Human Event Analysis System (IDHEAS). Existing HRA methods have looked at elements of the psychological literature, but there has not previously been a systematic attempt to translate the complete span of cognition from perception to action into mechanisms that can inform HRA. Therefore, a first step of this effort was to perform a literature search of psychology, cognition, behavioral science, teamwork, and operating performance to incorporate current understanding of human performance in operating environments, thus affording an improved technical foundation for HRA. However, this literature review went one step further by mining the literature findings to establish causal relationships and explicit links between the different types of human failures, performance drivers and associated performance measures ultimately used for quantification. This is the first of two papers that detail the literature review (paper 1) and its product (paper 2). This paper describes the literature review and the high-level architecture used to organize the literature review, and the second paper (Whaley, Hendrickson, Boring, & Xing, these proceedings) describes the resultant cognitive framework.Human Factor and Reliability Analysis to Prevent Losses in Industrial ProcessesAn Operational Culture Perspective In this survey, 34 subject matter experts from the U.S. nuclear industry were interviewed to determine specific needs for human reliability analysis (HRA). Conclusions from the interviews are detailed in this article. A summary of the findings includes: (1) The need for improved guidance on the use of HRA methods generally and for specific applications. (2) The need for additional training in HRA to provide more hands-on experience in the application of HRA methods. (3) The development of HRA approaches suitable for advanced reactors, severe accident situations, and low-power and shutdown applications. (4) The refinement of HRA methods to account

for factors such as crew variability, latent errors, more sophisticated dependency modeling, and errors of commission. (5) The continued need for simplified HRA methods appropriate for field applications. (6) The need for tighter coupling of HRA and human factors. (7) The need for improvements in the quantitative basis of HRA methods. These findings suggest the field of HRA is mature but still benefits from refinements.

*Human Factors Engineering in the Oil, Gas, and Process Industries* CRC Press

This paper reviews the application of human reliability analysis methods to human factors design issues. An application framework is sketched in which aspects of modeling typically found in human reliability analysis are used in a complementary fashion to the existing human factors phases of design and testing. The paper provides best achievable practices for design, testing, and modeling. Such best achievable practices may be used to evaluate and human system interface in the context of design safety certifications.

*Theory and Applications* Springer Nature

The use of Human Reliability Analysis (HRA) to identify and resolve human factors issues has significantly increased over the past two years. Today, utilities, research institutions, consulting firms, and the regulatory agency have found a common application of HRA tools and Probabilistic Risk Assessment (PRA). The "1985 IEEE Third Conference on Human Factors and Power Plants"

devoted three sessions to the discussion of these applications and a review of the insights so gained. This paper summarizes the three sessions and presents those common conclusions that were discussed during the meeting. The paper concludes that session participants supported the use of an adequately documented "living PRA" to address human factors issues in design and procedural changes, regulatory compliance, and training and that the techniques can produce cost effective qualitative results that are complementary to more classical human factors methods. *Scale Development* SAGE Publications

This book contains the results of the latest research on energy-related topics in transportation, economics, and management. The book is composed of select research proceedings of the EMMFT 2019 conference, and covers such issues as energy efficiency in the transport sector, infrastructure, mobile equipment, rail transportation safety and reliability assessment methods, communication and signal, traction power supply, operation organization, and modeling unique transport scenarios. This book also gathers cutting-edge studies on the relationship between energy innovations and economic growth, the impacts of globalization and energy policies of countries on economics and environmental quality, and design and analysis of energy management systems. This book is of considerable interest to engineers, scientists, graduate

students, and researchers in the field of transportation engineering, as well as to professionals working in the energy industries. It is also of use to employees and investors concerned with energy management, including utilities and industry professionals, and regulators.

**Considerations for the Treatment of Computerized Procedures in Human Reliability Analysis** Springer

Human Reliability Analysis A Review and Critique Human Reliability Analysis Context and Control Springer

There is a diversity of human reliability analysis (HRA) methods available for use in assessing human performance within probabilistic risk assessment (PRA). Due to the significant differences in the methods, including the scope, approach, and underlying models, there is a need for an empirical comparison investigating the validity and reliability of the methods. To accomplish this empirical comparison, a benchmarking study is currently underway that compares HRA methods with each other and against operator performance in simulator studies. In order to account for as many effects as possible in the construction of this benchmarking study, a literature review was conducted, reviewing past benchmarking studies in the areas of psychology and risk assessment. A number of lessons learned through these studies are presented in order to aid in the design of future HRA benchmarking endeavors.

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