

## Use Of A Spar H Bayesian Network For Predicting Human

*The Standardized Plant Analysis Risk-Human Reliability Analysis (SPAR-H) method has proved to be a reliable, easy-to-use method for human reliability analysis. Calculation of human error probability (HEP) rates is especially straightforward, starting with pre-defined nominal error rates for cognitive vs. action oriented tasks, and incorporating performance shaping factor (PSF) multipliers upon those nominal error rates. SPAR-H uses eight PSFs with multipliers typically corresponding to nominal, degraded, and severely degraded human performance for individual PSFs. Additionally, some PSFs feature multipliers to reflect enhanced performance. Although SPAR-H enjoys widespread use among industry and regulators, current source documents on SPAR-H such as NUREG/CR-6883 do not provide a clear account of the origin of these multipliers. The present paper redresses this shortcoming and documents the historic development of the SPAR-H PSF multipliers, from the initial use of nominal error rates, to the selection of the eight PSFs, to the mapping of multipliers to available data sources such as a Technique for Human Error Rate Prediction (THERP). Where error rates were not readily derived from THERP and other sources, expert judgment was used to extrapolate appropriate values. In documenting key background information on the multipliers, this paper provides a much needed cross-reference for human reliability practitioners and researchers of SPAR-H to validate analyses and research findings. As part of the effort to develop the SPAR-H user guidance, particular attention was paid to the assessment of dependence in order to address user questions about proper application of dependence. This paper presents a discussion of dependence from a psychological perspective and provides guidance on applying this information during the qualitative analysis of dependence to ensure more realistic and appropriate dependence assessments with the SPAR-H method. While this guidance was developed with SPAR-H in mind, it may be informative to other human reliability analysis methods that also use a THERP-based dependence approach, particularly if applied at the human failure event level.*

*A continually evolving discipline, human reliability assessment (HRA) has elements of controversy from the definition of terms to the application of appropriate methods for the representation of human failure probability. The idea that human error is a random event is falling out of favor and the concept that humans can be set up to fail or succeed depending on context is gaining credibility. An in-depth exploration of current theories, Human Reliability Assessment Theory and Practice demonstrates how to model, change, and apply new approaches to a number of different high-risk industries. The book covers data and data sources, choice of methods, training of individuals, use of simulators for HRA purposes, and the relationship between psychology, human factors, accident analyses, and human reliability. Author Anthony Spurgin has been in the forefront of HRA development for the past 20 years and has contributed to developing human reliability methods and tools that have been applied to the enhancement of nuclear power plant and space vehicle safety. He explores reactor performance and the demands it makes on operators to ensure plant safety. He also covers the roles of plant management in the decision-making applied to both design and operation. The book includes a number of accident studies that illustrate the key roles of operators and managers in accident mitigation and control. The heart of HRA will always be to find creative ways of helping designers, management, operators, and authorities increase the safety and profitability of technological systems. Drawing on his personal experience, Spurgin reviews HRA from the viewpoint of the operator. The book uses examples from the nuclear industry, always on the forefront of safety, and translates how to apply the concepts to other high risk industries.*

Assessment and Application of Human Reliability Aanalysis to an Independent Spent Fuel Storage Installation Probabilistic Safety Assessment

Unusual Saturation-pressure Variations

Advances in Human Error, Reliability, Resilience, and Performance

Automation Challenges of Socio-technical Systems

Library of Congress Subject Headings

**Human Reliability is an issue that is increasingly discussed in the process and manufacturing industries to check factors that influence operator performance and trigger errors. Human Factor and Reliability Analysis to Prevent Losses in Industrial Processes: An Operational Culture Perspective provides a multidisciplinary analysis of work concepts and environments to reduce human error and prevent material, energy, image, and time losses. The book presents a methodology for the quantification and investigation of human reliability, and verification of the influence of human factors in the generation of process losses, consisting of the following steps: contextualization, data collection, and results; performing task and loss observation; socio-technical variable analyses; and data processing. Investigating human reliability, concepts, and models in situations of human error in practice, the book identifies where low reliability occurs and then visualizes where and how to perform an intervention. This guide is an excellent resource for professionals in chemical, petrochemical, oil, and nuclear industries for managing and analyzing safety and loss risks and for students in chemical and process engineering. Relates human reliability to the environment, leadership, decision models, possible mistakes and successes, mental map constructions, and organizational cultures Provides techniques for the diagnosis of human and operational reliability Gives examples of the application of methodologies in the stage of diagnosis and program construction Discusses competences for the analysis of process losses in industry Investigates real-life situations where human errors cause losses Includes practical examples and case studies**

**This book brings together studies broadly dealing with human error from different disciplines and perspectives. They concern human performance; human variability and reliability analysis; medical, driver and pilot error, as well as automation error; reports on root cause analyses; and the cognitive modeling of human error. In addition, they highlight 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 2017 International Conference on Human Error, Reliability, Resilience, and Performance, held on July 17–21, 2017 in Los Angeles, California, 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. "p>**

**Leading the way in this field, the Encyclopedia of Quantitative Risk Analysis and Assessment is the first publication to offer a modern, comprehensive and in-depth resource to the huge variety of disciplines involved. A truly international work, its coverage ranges across risk issues pertinent to life scientists, engineers, policy makers, healthcare professionals, the finance industry, the military and practising statisticians. Drawing on the expertise of world-renowned authors and editors in this field this title provides up-to-date material on drug safety, investment theory, public policy applications, transportation safety, public perception of risk, epidemiological risk, national defence and security, critical infrastructure, and program management. This major publication is easily accessible for all those involved in the field of risk assessment and analysis. For ease-of-use it is available in print and online.**

Plant Hazard Analysis and Safety Instrumentation Systems

Proceedings of ESREL 2018, June 17-21, 2018, Trondheim, Norway

1995-2000

Text-book of Seamanship

Advancing Usability Evaluation Through Human Reliability Analysis

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.

This guide provides step-by-step guidance on the use of the SPAR-H method for quantifying Human Failure Events (HFEs). This guide is intended to be used with the worksheets provided in: "The SPAR-H Human Reliability Analysis Method," NUREG/CR-6883, dated August 2005. Each step in the process of producing a Human Error Probability (HEP) is discussed. These steps are: Step-1, Categorizing the HFE as Diagnosis and/or Action; Step-2, Rate the Performance Shaping Factors; Step-3, Calculate PSF-Modified HEP; Step-4, Accounting for Dependence, and; Step-5, Minimum Value Cutoff. The discussions on dependence are extensive and include an appendix that describes insights obtained from the psychology literature.

Plant Hazard Analysis and Safety Instrumentation Systems is the first book to combine coverage of these two integral aspects of running a chemical processing plant. It helps engineers from various disciplines learn how various analysis techniques, international standards, and instrumentation and controls provide layers of protection for basic process control systems, and how, as a result, overall system reliability, availability, dependability, and maintainability can be increased. This step-by-step guide takes readers through the development of safety instrumented systems, also including discussions on cost impact, basics of statistics, and reliability. Swapan Basu brings more than 35 years of industrial experience to this book, using practical examples to demonstrate concepts. Basu links between the SIS requirements and process hazard analysis in order to complete SIS lifecycle implementation and covers safety analysis and realization in control systems, with up-to-date descriptions of modern concepts, such as SIL, SIS, and Fault Tolerance to name a few. In addition, the book addresses security issues that are particularly important for the programmable systems in modern plants, and discusses, at length, hazardous atmospheres and their impact on electrical enclosures and the use of IS circuits. Helps the reader identify which hazard analysis method is the most appropriate (covers ALARP, HAZOP, FMEA, LOPA) Provides tactics on how to implement standards, such as IEC 61508/61511 and ANSI/ISA 84 Presents information on how to conduct safety analysis and realization in control systems and safety instrumentation

Annual Report of the Commissioner of Patents

General Medical Chemistry for the Use of Practitioners of Medicine

A Journal Devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

Guidance on Dependence Assessment in SPAR-H.

Dictionary of Organic Compounds

**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**

**This evidence-based book serves as a clinical manual as well as a reference guide for the diagnosis and management of common nutritional issues in relation to gastrointestinal disease. Chapters cover nutrition assessment; macro- and micronutrient absorpction; malabsorption; food allergies; prebiotics and dietary fiber; probiotics and intestinal microflora; nutrition and GI cancer; nutritional management of reflux; nutrition in IBS and IBD; nutrition in acute and chronic pancreatitis; enteral nutrition; parenteral nutrition; medical and endoscopic therapy of obesity; surgical therapy of obesity; pharmacologic nutrition, and nutritional counseling.**

**This Master Thesis is framed within a collaboration agreement between the Nuclear Engineering Research Group (NERG) of Universitat Politècnica de Catalunya (UPC) and a Spanish Pressurized Water Reactor (PWR) Nuclear Power Plant (NPP). The main objective of the collaboration is to study and apply the Probabilistic Safety Assessment (PSA) methodology to risk-informed decision making. This study is part of the NPP Independent Spent Fuel Storage Installation (ISFSI) PSA requested by the Spanish NPP. It is the continuation of the final degree Project "Estudio piloto para el análisis del riesgo asociado a un Almacén Temporal Individualizado. Aplicación de la metodología APS" [1], which developed a pilot ISFSI's PSA model without Human Reliability Analysis (HRA). The objective of this thesis is to apply a HRA to the Spanish NPP Independent Spent Fuel Storage Installation and then implement the HRA results into the ISFSI's PSA model in order to evaluate the impact of human performance on the ISFSI's Risk. In consequence, the project is divided in two different parts, the HRA development and the HRA implementation into the PSA model. The first part is more research related. On the other hand, the second part is more engineering related. The ISFSI's HRA application is based on the methodology described in the regulatory guide NUREG-1880, "ATHEANA User's Guide Final Report", as recommended by several Nuclear Regulatory Commission (NRC) publications [2][3]. This methodology requires the participation of ISFSI's Subject-Matter Experts (SMEs). SMEs are not available since the Spanish NPP has little experience in ISFSI operations. Therefore, it has been decided to develop an HRA methodology which does not need SMEs to be carried out. To do so, the contribution of the SME's has been replaced with the use of other HRA methodologies, namely THERP and SPAR-H. In consequence, an experimental hybrid ATHEANA-based HRA methodology has been used to perform the analysis. The HRA results should be considered illustrative rather than definitive since several assumptions have been taken to apply the methodology and describe human actions. Furthermore, the HRA results cannot be compared with Nuclear Industry data since no ATHEANA-based ISFSI HRA has been published yet. The most important operations from a Risk point of view [1] are the human actions performed inside the Spent Fuel Storage Building (SFSB). Therefore, the HRA has been limited to the analysis of these human actions. Some examples are loading the canister with wrong Spent Fuel Elements (SFEs), also known as Misload, and different canister drop scenarios. The introduction of the HRA results as Human Error Probabilities into the PSA model implies the modification of the Initiating Events (IEs) treatment. Fault Tree (FT) models have been Fig. 2 Report developed to include both Human Failure Events (HFEs) and Crane components failure into the assessment of IEs frequency. These models have replaced all the Initiating Events previously included in the PSA model. The comparison of the PSA model results, with and without HRA, in terms of Risk yields that human performance has a substantial impact on the ISFSI's Risk. Namely, the implementation of the HFEs increases the overall ISFSI's Risk roughly 2 orders of magnitude. However, the results obtained in this thesis are illustrative since there are many uncertainties and assumptions in the HRA analysis. It cannot be directly concluded that human performance will actually have an important impact in the Risk. However, it is recommended to take into consideration that human performance could be of importance and that further studies should be carried out.**

The CERT Guide to System and Network Security Practices

Handbook of Human Factors and Ergonomics

Paradoxes and Conflicts

Safety and Reliability of Complex Engineered Systems

Flight

This 1906 issue of Architectural Annual, published by the Architectural League of America, contains an article on skyscraper architect Louis Sullivan.

Presents recent breakthroughs in the theory, methods, and applications of safety and risk analysis for safety engineers, risk analysts, and policy makers Safety principles are paramount to addressing structured handling of safety concerns in all technological systems. This handbook captures and discusses the multitude of safety principles in a practical and applicable manner. It is organized by five overarching categories of safety principles: Safety Reserves; Information and Control; Demonstrability; Optimization; and Control focus on the structured treatment of a large number of safety principles relevant to all related fields, each chapter defines the principle in question and discusses its application as well as how it relates to other principles and terms. This treatment includes the history, the underlying theory, and the limitations and criticism of the principle. Several chapters also problematize and critically discuss the very concept of a safety principle. The book treats issues such as: What are safety principles and what roles do they play? ever, should rules and principles be disobeyed? How do safety principles relate to the law: what is the status of principles in different domains? The book also features:
• Insights from leading international experts on safety and reliability
• Real-world applications and case studies including systems usability, verification and validation, human reliability, and safety barriers
• Different taxonomies for how safety principles are categorized
• Breakthroughs in safety and risk science that can significantly change, improve, and transform the treatment of safety principles relevant to numerous disciplines and application areas in industry and other sectors of society
• Comprehensive and practical coverage of the multitude of safety principles including maintenance optimization, substitution, safety automation, risk communication, precautionary approaches, non-quantitative safety analysis, safety culture, and many others
The Handbook of Safety Principles is an ideal reference and resource for professionals engaged in risk and safety analysis and graduate and PhD-level textbook for courses in risk and safety analysis, reliability, safety engineering, and risk management offered within mathematics, operations research, and engineering departments. NIKLAS MOLLER, PH.D, is Associate Professor at the Royal Institute of Technology in Sweden. The author of approximately 20 international journal articles, Dr. Moller's research interests include the philosophy of risk, metaethics, philosophy of science, and epistemology. SVEN OVE HANSSON, PH.D, is Professor of Philosophy at the Royal Institute of Technology in Sweden. He has authored over 300 articles in international journals and is a member of the Royal Swedish Academy of Engineering Sciences. Dr. Hansson is also a Topical Editor for the Wiley Encyclopedia of Operations Research and Management Science. JAN-ERIK HOLMBERG, PH.D, is Senior Consultant at Risk Pilot AB and Adjunct Professor of Probabilistic Riskand Safety Analysis at the Royal Institute of Technology. Dr. Holmberg received his PhD in Applied Mathematics from Helsinki University of Technology in 1997. CARL ROLL is a Senior Lecturer at the Royal Institute of Technology. Dr. Rollenhagen has performed extensive research in the field of human factors and MTO (Man, Technology, and Organization) with a specific emphasis on safety culture and climate, event investigation methods, and organizational safety assessment.

HANDBOOK OF HUMAN FACTORS AND ERGONOMICS discover the latest developments in ergonomics and human factors with the newest edition of this market leading reference in the newly revised Fifth Edition of Handbook of Human Factors and Ergonomics. Drs. Gavriel Salvendy and Waldemar Karwowski deliver a comprehensive exploration of workplace environment design, human-machine interfaces, and cutting-edge research on the reduction of health and safety risks. The editors have compiled practical material for ergonomists and human factors experts in ergonomics and human factors that will benefit specialists in the area, as well as safety engineers and human-computer interaction specialists. The Handbook includes information culled from over 7500 sources and features brand new coverage in areas like artificial intelligence, social media, information technology and cybersecurity, and data analytics. Numerous case studies demonstrate the real-world application of the concepts and methods discussed within and showcase the extraordinary development of ergonomics and human factors.

Edition in 2012. Readers will also benefit from the inclusion of: A thorough introduction to the human factors function, including the discipline of human factors and ergonomics and human systems design and integration An exploration of the fundamentals of human factors, including sensation and perception, selection and action control, information processing, and mental workload Discussions of the design of equipment, tasks, jobs, and environments, including workplace design, task analysis and design, and training health, safety, and comfort, including low-back and upper extremity musculoskeletal disorders and the use of personal protective equipment Perfect for ergonomics and human factors engineers at any level of their careers, Handbook of Human Factors and Ergonomics will also earn a place in the libraries of design engineers, applied psychologists, human-computer interaction specialists, engineering and technology managers, and safety professionals and industrial hygienists.

SPAR-H Step-by-Step Guidance

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

Handbook of Safety Principles

Dictionary of the English Language Exhibiting Orthography, Pronunciation and Definition of Words

Safety and Reliability – Safe Societies in a Changing World

This paper introduces a novel augmentation to the current heuristic usability evaluation methodology. The SPAR-H human reliability analysis method was developed for categorizing human performance in nuclear power plants. Despite the specialized use of SPAR-H for safety critical scenarios, the method also holds promise for use in commercial off-the-shelf software usability evaluations. The SPAR-H method shares task analysis underpinnings with human-computer interaction, and shaping factors. By assigning probabilistic modifiers to heuristics, it is possible to arrive at the usability error probability (UEP). This UEP is not a literal probability of error but nonetheless provides a quantitative basis to heuristic evaluation. When combined with a consequence matrix for usability errors, this method affords ready prioritization of usability issues.

In the past several years, several international agencies have begun to collect data on human performance in nuclear power plant simulators [1]. This data provides a valuable opportunity to improve human reliability analysis (HRA), but these improvements will not be realized without implementation of Bayesian methods. Bayesian methods are widely used in to incorporate sparse data into models in many parts of probabilistic risk assessment (PRA), but Bayesian methods have not been used in HRA methodology to formally use simulator data to refine the human error probabilities (HEPs) assigned by existing HRA methods. We demonstrate the methodology with a case study, wherein we use simulator data from the Halden Reactor Project to update the probability assignments from the SPAR-H method. The case study demonstrates the ability to use performance data, even sparse data, to improve existing HRA methods. Furthermore, this paper also serves as a demonstration of

Showing how to improve system and network security, this guide explores the practices and policies of deploying firewalls, securing network servers, securing desktop workstations, intrusion detection, response, and recovery.

Human Factor and Reliability Analysis to Prevent Losses in Industrial Processes

Water-resources Investigations Report

Proceedings of the AHFE 2017 International Conference on Human Error, Reliability, Resilience, and Performance, July 17–21,2017, The Westin Bonaventure Hotel,Los Angeles, California, USA

Human Reliability Assessment Theory and Practice

ESREL 2015

Prior to 1862, when the Department of Agriculture was established, the report on agriculture was prepared and published by the Commissioner of Patents, and forms volume or part of volume, of his annual reports, the first being that of 1840. Cf. Checklist of public documents ... Washington, 1895, p. 148.

The challenges of automating socio-technical systems are strongly linked to the strengths and limitations of technical and human resources, such as perceptual characteristics, cooperative capacities, job-sharing arrangements, modeling of human behavior and the contribution of innovative design approaches. Automation Challenges of Socio-technical Systems exposes the difficulties in implementing and sustaining symbiosis between humans and machines in both the short and long terms. Furthermore, it presents innovative solutions for achieving such symbiosis, drawing on skills from cognitive sciences, engineering sciences and the social sciences. It is aimed at researchers, academics and engineers in these fields.

Safety and Reliability – Safe Societies in a Changing World collects the papers presented at the 28th European Safety and Reliability Conference, ESREL 2018 in Trondheim, Norway, June 17-21, 2018. The contributions cover a wide range of methodologies and application areas for safety and reliability that contribute to safe societies in a changing world. These methodologies and applications include:
- foundations of risk and reliability assessment and management
- mathematical methods in reliability and safety
- risk assessment
- risk management
- system reliability
- uncertainty analysis
- digitalization and big data
- prognostics and system health management
- occupational safety
- accident and incident modeling
- maintenance modeling and applications
- simulation for safety and reliability analysis
- dynamic risk and barrier management
- organizational factors and safety culture
- human factors and human reliability
- resilience engineering
- structural reliability
- natural hazards
- security
- economic analysis in risk management
Safety and Reliability – Safe Societies in a Changing World will be invaluable to academics and professionals working in a wide range of industrial and governmental sectors: offshore oil and gas, nuclear engineering, aeronautics and aerospace, marine transport and engineering, railways, road transport, automotive engineering, civil engineering, critical infrastructures, electrical and electronic engineering, energy production and distribution, environmental engineering, information technology and telecommunications, insurance and finance, manufacturing, marine transport, mechanical engineering, security and protection, and policy making.

Flight International

User's Guide to PHREEQC

Senate Documents, Otherwise Publ. as Public Documents and Executive Documents

The Wind Power Aerogenerator,twin-wheel Type; a Study by Percy H. Thomas, Office of the Cheif Engineer, March 1946

The Origins of the SPAR-H Method's Performance Shaping Factor Multipliers

*It has been argued that human reliability analysis (HRA) has expended considerable energy on creating detailed representations of human performance through an increasingly long list of performance shaping factors (PSFs). It is not clear, however, to what extent this refinement and expansion of PSFs has enhanced the quality of HRA. Indeed, there is considerable range in the number of PSFs provided by individual HRA methods, ranging from single factor models such as time-reliability curves, up to 50 or more PSFs in some current HRA models. The US Nuclear Regulatory Commission advocates 15 PSFs in its HRA Good Practices (NUREG-1792), while its SPAR-H method (NUREG/CR-6883) espouses the use of eight PSFs and its ATHEANA method (NUREG-1624) features an open-ended number of PSFs. The apparent differences in the optimal number of PSFs can be explained in terms of the diverse functions of PSFs in HRA. The purpose of this paper is to explore the role of PSFs across different stages of HRA, including identification of potential human errors, modeling of these errors into an overall probabilistic risk assessment, quantifying errors, and preventing errors.*

*A Bayesian Method for Using Simulator Data to Enhance Human Error Probabilities Assigned by Existing HRA Methods*

*The Equipping and Handling of Vessels Under Sail Or Steam. For the Use of the United States Naval Academy*

*Commissioner of Patents Annual Report*

*Flying Magazine*

*A Computer Program for Speciation, Reaction-path, Advective-transport, and Inverse Geochemical Calculations*