An Analysis of an Offshore Accident: a Chaos Approach in Risk Assessment

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Risk and safety management theories and methods such as other scientific disciplines are fundamentally influenced by thinking paradigms under which theories and methods are developed. The reductionism (Newtonian) and chaos (Post-Newtonian) paradigms are different paradigms which can result in different risk and accident analysis methods. Taking into account Newton's rules of movement, reductionism assumes the entire world as a machine controlled by robust and predictable rules. Based on this paradigm, system identification is limited to its components identification and inter-components cause and effect relationships are ignored or assumed simple and linear.

Technology increasing growth, enhancement of the modern world's communications and interactions and the development of complex technological systems lead to the emergence of complexities that methods based on traditional Newtonian paradigm are not capable of comprehensive risk analysis and management in complex technological systems. Almost all traditional hazard or risk analysis techniques, such as FMEA, HAZOP, FTA, and PRA rely on a chain of linear cause and effect analysis. Specifically, they are not suited to handle complex systems with nonlinear cause and effect relationship, and emergent characteristic.

Considering traditional paradigm limitations, the scientific flow of risk and safety management should shift to a new paradigm. Chaos theory as the basis of this modern paradigm can provide us with a more accurate analysis of complex technological systems accidents. Based on chaos paradigm, systems' trajectories constantly fluctuate among various attractors and sometimes a micro change in a part of system can result in deep and macro changes in the whole system.

We propose a novel conceptual approach of risk assessment in complex technological systems based on the concept of chaos theory, evolution over time and taking into account nonlinear nature of cause and effect relationships. The main premise of the proposed approach claims that employing a non-classical thinking approach of risk assessment in will result in a higher and more accurate awareness of the overall system.

We analyze an offshore accident based on the chaos-based approach and its features consisting of sensitiveness to initial condition, nonlinearity, and dynamic adaptation. Finally, the challenges with which we may encounter in chaos-based accident analysis are discussed and its advantages and disadvantages are concluded.

Risk Assessment of Exposure to Bis(2 - ethylhexyl)Phthalate (DEHP)

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Bis(2-ethylhexyl)phthalate(DEHP) is a widely used plasticizer in polymer products and considered as an endocrine disruption and is associated with reproductive toxicity. Industrial release and migration of DEHP from plastic containers could lead to human exposures. In the past more than 10 years, environmental monitoring on DEHP has been conducted by Taiwan Environmental Protection Agency. These data was not systematically evaluated for environmental policy. Therefore, aggregate assessment of health risk for residents exposed to DEHP through multiple media and routes was conducted by using the CalTOX multimedia model. Local landscape properties and exposure factors were used with a continuous emission of DEHP to simulate environmental concentrations and compared with available DEHP data for validation. Two-dimensional Monte-Carlo simulation was operated by using the Crystal Ball software to calculate concentration, dose, hazard index (HI) and risk distributions. Preliminary results reveal that predicted concentrations of air, surface water and sediments from CalTOX are within the range of those in the collected environmental data. The estimated 95th percentile of the aggregate dose for the general population in Taiwan was 3.02 -day/kg and the corresponding hazard index (HI) is 0.17. These results should be considered as DEHP environmental exposure for the general Taiwanese residents under a continuous input rate and be taken into account for further assessments of specific exposure pathways.

The Development of A Physiologically Based Pharmacokinetic (PBPK) Model for Aristolochic acids (AAs) and Their Metabolites in Rats

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Consumption of Chinese herb (Aristolochia fangchi) containing aristolochic acids (AAs), a mixture of nitrophenanthrene carboxylic acid derivatives found primarily in the genus Aristolochia, is associated with a progressive renal interstitial fibrosis known as aristolochic acid nephropathy. The objective of this work was to develop a physiologically based pharmacokinetic (PBPK) model to predict levels of AAs and their active metabolite aristolactams (ALs) in targets organs of rats treated with a single dose of AAs at 0.5 and 5 mg/kg and to investigate the influence of dose-dependent metabolism on the predicted blood levels of AAs. The model will help to reduce the uncertainties associated with dose, route, and species extrapolations in the assessments of cancer risk of human exposure to AAs. The model structure for AAs and their metabolites was time-dependent and flow-limited and consisted of five essential compartments: liver as a specific tissue for the metabolism, richly perfused tissues, poorly perfused tissues, adipose, and kidney as a target tissue and for the excretion. Model development and simulation were performed by using software packages of MATLAB and Simulink graphical user interface (GUI). The model equations included the ordinary differential equations to explain the change in amount of AAs and ALs over time and algebraic equations. Some chemical specific model parameters, such as partition coefficients were predicted based on the method of unified algorithm developed by Peyret and his coworkers in 2010. In the model, Michaelis-Menten kinetic parameters were estimated by fitting the model and used to describe the saturable metabolism and renal excretion and reabsorption for both parent AAs and metabolite ALs. The performance of the model was evaluated by comparison of the predicted blood levels of AAs and ALs to the levels measured in rats after i.p injection of AAs mixture. Sensitivity analyses were implemented to indicate dose dependent influence of metabolic activities on model output.

Key words: Aristolochic acids, Aristolactams, PBPK model, metabolites, partition coefficients

Contextualising the origin of environmental, social and corporate governance risks: A conceptual model

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The complex nature of challenges, such as environmental conflicts and economic crises, compel companies to adopt measures, which include environmental, social and corporate governance (ESG) issues as risks. Although, companies are becoming increasingly more concerned with managing these risks, they are having problems doing so.

To find a possible cause of why companies are having problems in managing these kinds of risks, it is necessary to know the origin and in which they are used. For this, we conducted a literature review of the concept of risk, their elements and characteristics in the natural, social and economic systems using the ecological economics points of view. With this, we designed a conceptual model that shows the differences that have the concept of risk in the three systems studied, allowing contextualize the origin of ESG risks and their relationships with the different sciences involved in the study and management.

The results show that there are two main schools of thought that define the risk. A social line in which the risk is understood in terms of the individual's intrinsic state of mental perception, direct consequence of modernity and of our own decisions. The other line corresponds to a point of view mainly dominated by economists in that risk is conceived in terms of an attribute, which is external to the individual and exists when it can be measured and calculated.

The ESG risks originate in finance field that belongs to the economic system. The interest on these risks stems from the importance and the necessity to incorporate these non-financial risks in their analysis, with financial tools. However, the ESG risks include issues related to both the social system and the natural system making it difficult to manage with traditional financial tools.

Our approach, summarized in the conceptual model, could help to generate a new type of ESG risk management for organizations. This vision would leave a partial point of view, limited only to the financial field that tries unsuccessfully to manage these risks. For this type of ESG risks, a systemic vision, would understand the interdependencies between them, providing a possible solution to the difficulty in managing such risks.

Key words: ESG Risk, Risk Management, Ecological Economics.

Interpretations of Surprise Dimensions Applicable to Safety Studies

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As research in safety studies continually evolves, new theories and terminologies are used to describe, identify, and avoid surprising outcomes from critical accidents. While some studies refer to previously researched