Risk Based Design of Containment Cacilities

U. U. Mueller-Doblies[1]

Any containment facility catering for novel risks will have to satisfy internal *and* external stakeholders that it is safe. This can only be achieved on the basis of a good characterization of the physicochemical properties of the potential hazards to be handled and the activities to be carried out on these. With material that is extraterrestrial the range of known terrestrial hazards has to be extended to include biological, chemical and physical properties that would not be realistic on earth but are feasible to develop in the different environment of a remote astronomical object. Systematic prospective risk analysis is a powerful tool [1] to inform the safety case for such a novel risk activity while containing the cost. Due to the bespoke and unique design of such a facility, a lot of new development will be required to establish the suitability of existing engineering, architectural and (bio)safety standards and to develop new construction standards that will satisfy the barrier requirements. Regardless of how careful such a design is, it will never be able to reduce the risk to zero, and the residual risk will need a broad societal support across more than one generation.

Dealing with poorly characterized hazards and creating equally uncharacterized risks requires robust and well accepted risk assessment and management models.

A challenge in developing appropriate risk control models is the need for exploring the full spectrum of event trees and integrating these into the risk control model in a way that is simple enough not to fail through human error in the implementation and maintenance of the facility. Methodologies from other high hazard industries may help with this development including layer of protection analysis (LOPA); Hazard and Operability Studies (HAZOP); Failure Mode Effect

Analyses (FMEA), Bowtie Biological Risk Assessments (BBRA). How these approaches can be used for unknown biological risks will be discussed.

References:

1) Brodsky, B. and U. Mueller-Doblies. *Future Development of Biorisk Management – Challenges and Opportunities*. In **Laboratory Biorisk Management.** J. Gaudioso and R. Salerno, Editors. 2015. CRC Press: Boca Raton p. 207-230

Keywords: Quantitative Risk Assessment (QRA), Layer of Protection Analysis (LOPA), Bowtie Biological Risk Assessments (BBRA), Risk communication, Risk live cycle management

[1] Dr Uwe Mueller-Doblies
Epibiosafe Ltd
Chancery House, 30 St Johns Street
Woking, Surrey, GU21 7SA, U.K.
uwemd@epibiosafe.cim