High Impact Low Probability Risk:

Risk Management and Risk Governance of Potentially Hazardous Near Earth Objects.

Abstract

Though there have been extensive efforts to advance scientific understanding and comprehension and improve risk management approaches, we are nonetheless inadequately equipped and ill prepared to confront high impact low probability events. Current national risk management strategies may thus need to be reviewed and reconsidered. Policy makers will need to advance and implement measures which will allow us to be prepared for and respond to high impact low probability events through the establishment of a clear frameworks for making decisions prior to and in the event of a crisis. This paper will be discussing these high impact low probability risks, with a focus upon hazardous Near Earth Objects, in relation to risk management and risk governance processes.

This paper presents the risk of an asteroid collision with Earth as something that requires the participation and collaboration of policy makers and the wider international community as part of the process for reviewing the seriousness of this threat. It is inevitable that a Near Earth Object will impact Earth in the future, and whilst great uncertainty surrounds such an event, it is a case of '*when, not if*'. Such a statement is based on evidence from the many impact events that have taken place throughout the history of our planet and data of asteroid trajectories that are in orbit at present. It is therefore essential for Near Earth Objects to be part of the UK's National Risk Register and that we start advancing policy and developing approaches to tackle this risk. Through discussions and financial investment, both nationally and internationally, we can significantly improve our shared resistance to the catastrophic effects of Near Earth Objects.

1. Introduction

The frequency of high impact low probability events in the recent past indicates the emergence of a new normality. Events that were considered to be one-off high-profile catastrophes such as 9/11, Hurricane Katrina and the events at Fukushima are examples of mega-crises that necessitated swift responses on an international level. However, lower profile disasters have the potential for equally devastating impacts, if not more destructive outcomes. This raises newfound questions about how we perceive high impact low probability risks and prepare for such events.

Governments have a responsibility to address high impact risks that pose a threat to our society using the very best methodological approaches for identifying, assessing and mitigating risks. It can be incredibly challenging for a government to be certain that they have utilised the best available evidence and expert judgement to identify, assess and prioritise a representative array of plausible and threatening risk scenarios to enlighten decisions on capability planning. (*Government Office for Science*, 2011). When dealing with high impact low probability risks this is something that is noticeably difficult, as by their very nature, they only occur rarely and are not easy to identify.

There are far too many astronomy books and papers to cite who present the incorrect declaration that no one has ever been hurt or killed by an asteroid. Nonetheless, the qualitative risk of Near Earth Objects (NEOs) impacting our planet has been recorded since the earliest times. Many ancient sources from various cultures treat NEOs as literal, physical harbingers of doom. Phenomena such as the burning of cities and the upheaval of buildings and walls by aerial happenings have been mentioned numerous times in Chinese, Hebrew, Latin and Greek chronicles, yet there is no indication of any physical comprehension or understanding of the nature of the showering and bombarding objects or their effects until more recently. If these records originate from just baseless superstition and fantasy, from where did such ideas come from? Numerous accounts have been documented, noting the dangers and destruction that has come from NEO impacts. Thus, the aforementioned assertion is rather indefensible. Such a

statement would necessitate the highest standards of proof and would be disregarding countless eyewitness testimonies.[1]

So why is this incorrect assumption so readily accepted and universally believed, and why is such little attention paid to the very real and dangerous risks posed by NEOs and high impact low probability risks?

Noticeable NEO impact events as recent as 2013 challenge the view that asteroids are nonthreatening. Had previous impact sites been London or New York instead of rural Siberia, many millions of lives would have been jeopardised, as well as millions of pounds worth of damage to private and public property. The warning times for such events would have been grossly insufficient for governments to have implemented a coordinated evacuation plan and prepared their populace.

In order to be adequately prepared to respond to an impact event, it is essential that we identify and track all potentially hazardous NEOs. Whilst great progress has been made on this front, we are far from having discovered all the potentially threatening objects. New equipment to enhance ground-based and space-based telescopes is needed to enable more effective surveys of Near Earth Objects. These proposed new and improved telescopes will allow for the observation and discovery of over half a million NEOs. Several dozen of these identified NEOs will pose a substantial risk of colliding with Earth which will subsequently result in either local or regional devastation (*Schweickart et al*, 2008). Such outcomes can be further intensified by the presence of infrastructure installations, such as nuclear power stations and chemical plants, which are highly sensitive structures (*Nemchinov et al*, 2008). This amalgamation of hazards presents plenty of environmental, political, economic, societal and scientific repercussions. However, as of yet, the UK's strategy for the risk management of NEOs is yet to be deliberated and determined.

[1] John S. Lewis has compiled a list of 150 historical reports of injury, fatalities, damage and near misses from NEOs collected from Chinese, Latin, Greek, English, French, Japanese and other sources.
See J.S. Lewis. 1999. '*Comet and Asteroid Impact Hazards on a Populated Earth*: *Computer Modeling*.' Academic Press. P14-25.

In this paper I will attempt to distinguish how high impact low probability risks are often ignored and not credited with the significance that they should warrant. I hope to convey the extent of this and greatly emphasise that further attention should be given to the governance and management of these risks. Risk perception for high impact low probability events is something that is disturbingly low in spite of the possible outcomes and severity of these events. Such attitudes will need to be contested and greater awareness is something necessary and essential if we are to develop effective mitigatory strategies and protect people from devastating potential effects.

Additionally, I hope to convey the very real and serious threat of Near Earth Object Impacts, as well as understand why impact risks are not taken seriously and readily dismissed by mainstream policy makers. Furthermore, I hope to challenge such understandings and perceptions through my argument, making it clear that it is essential that this high impact low probability events needs to be mitigated and strategies for doing so need to be developed.

I would like to clarify that whilst solutions have been identified, further research, development and international collaboration is required if we are to establish effective strategies and policies for diminishing, if not entirely eradicating the associated risks with NEO impact events. In the United Kingdom, minimal government funding is attributed to this cause, and yet much more capital investment, as well as the investment of time, is fundamental to ensuring continued human survival. As a permanent member of United Nations Security Council, a member of the Group of 8 (G8) and as one of the world's strongest economies, the UK can have a significant influence on the international perception of NEO impact risk and how we manage and govern such risks.

Whilst asteroids colliding with Earth has been the plot of many a Hollywood blockbuster, such as *Armageddon* and *Deep Impact*, we need to develop our understanding beyond this and start appreciating the very real risk that is presented by Near Earth Objects. We are unable to predict when any other natural disaster will occur, but in acing this potentially existential threat, policy makers have the opportunity to thwart would could be a catastrophic incident. We now have

the ability to protect humanity from a most devastating event, and a failure to do to would be a great tragedy for Earth and its inhabitants.