# Richard Allarton objections to the Great North Road Solar Park photovoltaic system

I would like to raise concern regarding the development of the Great North Road Solar and Biodiversity Park (GNR Solar) by Elements Green (Trent) (EG). In particular, I would like to explain in greater detail the concerns presented in my open Hearing presentation regarding the flood risk analysis of the Moorhouse area on behalf of Laxton and Moorhouse Solar Concerns.

## Summary

### Flooding

Conflicting evidence gives concern that placing solar panels adjacent to Moorhouse Beck could exacerbate flooding in the Moorhouse area. This has not been disproved.

EG's removal of panels originally adjacent to the Beck and their Preliminary Risk Analysis demonstrate acknowledgement.

Proposals for riparian planting to replace removed panels will, by their own analysis, exacerbate flooding in the village if the Beck overflows in this area.

### Risk Assessment

The format and quantity of the presented risk analysis gives concern over the breadth and level of the level of assessment applied to this project.

The risk analysis primarily carried out is conceptual and not suitable to allow progression to the implementation phase.

The lack of hazard identification before risk assessment prevents assurance all risks has been identified or by what criteria they are assessed.

No methodology is defined or apparent, that would combine this rudimentary safety evidence provided into a compelling and coherent argument of the acceptable level of safety achieved.

Lack of document structure, with no mapping document provides no hierarchy or linking of the multiple documents that contain flood risk data.

This lack of co-ordination prevents a clear and compelling picture of full capture, appropriate analysis or mitigation.

No evidence of post mitigation analysis is provided.

The data provided is tightly bounded to a specific subset of proper concerns and remains largely at the conceptual stage of the project lifecycle.

Investigation into all aspects of the project, including the Battery Energy Storage System (BESS) would also need rigorous safety assurance if this project is to be considered acceptable to progress.

Examples of appropriate analysis are readily available from sister industries. The reliance on 'industry norms' is not something they example and would not be defendable in a court of law.

The tragic yet inevitable outcome of the 'dash for gas' of the 1970's seems set to be relived in the pursuit of profit within this emergent energy domain.

## Introduction

As per my precis, I would like to expand on points made at the Open Hearing regarding local flooding issues and the lack of appropriate analysis that has been carried out to assess such concerns.

It is worthy of note that the scope of this objection is bounded simply to flooding concerns in the Moorhouse area. For the project to be acceptably safety to continue all aspects of the project, in particular the BESS should have been assured, and with a greater level of rigour than appears for this objected aspect.

### Flooding and its Risk Analysis

The position of Moorhouse and its subjectivity to flooding has been addressed in our submission to the Inspectorate by Laxton & Moorhouse Solar Concerns (LMSC) and will not be repeated. However, a more detailed analysis of Elements Green's submissions on this matter drew significant concerns regarding their approach to flooding risk assessment.

They are not bound to take a risk-based approach, though other energy industries (nuclear, oil and gas) do. However, there is a veneer of adherence through the use of Preliminary Risk Analysis of the flooding issue. (e.g. EN010162/APP/6.4.10.7) There is also recognisable, if

incomplete use of a Hazard Risk Matrix and a rudimentary Hazard Log (though no tracking system) in Flood Risk Assessment (EN010162/APP/6.4.9.1A). The analysis is tightly bounded by the consultant and acknowledged as being Desktop (no site visits) and consists of a series of documents that describe flood risk in differing areas of the project. The risk assessed is tightly bounded to the solar plant itself, which is only a single element of the classic 'human, environment, plant' domains on which risk is usually considered.

### *The Risk Analysis Role*

To help assure a commonality of understanding I provide my perspective of safety assurance, as applicable to this project, and gained from a lifetime first working and then lecturing in the safety critical domain.

### Risk Analysis Hierarchy

Risk assessment is but a single (if important) element of safety analysis. In order to assess the risk, we first have to identify the hazard that generates this risk. (Classic example: trip hazard from cabling on floor, risk is of injury from trip, normally assessed on probability and severity of outcome. Think of the Hazard as an entity and Risk as it's quality.) Having identified the Hazard, the risks associated with it can then be assessed. However, without recognising the concept of Hazard, it is difficult to ascertain whether all the hazards have been identified and thereby whether all the risks associated with each hazard have been assessed. Simply listing risks is incoherent. Without a convincing method of identifying all the Hazards and their associated risks (and by what criteria) it is not possible to give a convincing understanding of the totality of the project risk, much less its acceptability. Even then, you are left only with evidence. To assess whether the project is suitable to propose or continue, you need to provide a series of credible arguments that the project is acceptably safe using the risk analysis as evidence. If you then bound the limits in which the arguments are valid, the assumptions made, argue that all hazards have been identified and mitigated to as low as reasonably practicable, that regulatory requirements are met and by what criteria the level of acceptable risk is defined, you begin to have the makings of a credible safety case that assures that the project is acceptably safe to continue. (Please see Appendix A.) Where mitigation is carried out, a tracking system should be employed to include reassessment and potentially further mitigation. A this point the concept of As Low As Reasonably Practicable (ALARP) or some other acceptability measure should arise, but this does not occur in the presented documentation.

### Risk Lifecycle

The University of York (pre-eminent in this field for more than 30 years) base their safety lifecycle on the 'Vee lifecycle' developed by Fosberg (Please see Appendix B). They describe a series of safety cases being developed and evolving at each project stage, typically covering the initial concept, design and development, manufacture, operation and decommissioning. At the conceptual level, much of the detail is not yet finalised and the safety case is basically assuring nothing is fundamentally wrong conceptually. As the project continues more detailed assurance is developed with project gates for both project development and safety development being required to be passed through simultaneously. The process is iterative, with revisiting of initial assumptions and assurance that future stages remain valid. (You must understand that decommissioning is acceptably safe before carrying out commissioning!)

### Safety Case Use

Many industries do this activity well. The Nuclear and Chemical industries, the Military (Def-Stan 00-56), the Railway (The Yellow Book) all use recognised processes mirroring the Health and Safety Executive practices. All recognise the prime importance of the Safety Case, the identification of Hazards and use of a Hazard Risk Matrix and a Hazard Risk Index. All apply the concept of As Low As Reasonably Practical, tested in law, in arguing the acceptability of their designs and operations. Even the gas and oil industry, which this industry seeks to replace, has North Sea Ordinances that mandate the use of Safety Cases with a copy to be held on each oil/gas platform. It is therefore disappointing that this industry seems oblivious to the processes so bitterly forged through tragic experiences, such as Flixborough, Piper Alpha, or Nimrod XV230. (All are a result of the failure to properly assess risks that should have been reasonably foreseen.)

## Elements Green's Use of Risk

A series of documents are provided that have risk in their title, but there appears to be no introductory document that provides a hierarchy or structure to the data provided in these documents. There is no indication of their role or relative value and so the reader is left to ascertain their purpose. The role of a Safety Case in their risk assessment, for any stage of the lifecycle, is therefore unfulfilled and the purpose or value of the data collected and presented remains undefined.

Elements Green provide much of its data in a series of Preliminary Risk Assessments (PRA), but only on the flooding aspect, and then limited to risks associated with the plant equipment

rather than the overall environment or habitants. These are included in a series of documents with the Area 7 document covering the Moorhouse area. (EN010162/APP/6.4.10.7)

Elements Green explicitly acknowledge this limitation in their Climate Change Resilience document EN010162/APP/6.2.15, citing National Policy Statement EN-3 that 'applicants should consider, in particular, how plant will be resilient to increased risk of flooding' in justifying their constrained focus.

The PRA Methodology (Please see Appendix C) also acknowledges the limited scope of the investigations. The Area 7 document (EN010162/APP/6.4.10.7) provides a background descriptions of the area. An Outline Conceptual Site Model, which could potentially be considered as a preliminary Hazard Log, is then generated, but with no methodology or evidence of the qualitive Risk Assessment provided, or a definition of the qualitative terms used, it is hard to assess the credibility or value of this brief table. The lack of an identified Preliminary Hazard Identification activity limits assurance that all significant hazards, and therefore the risks associated with them, have been identified. The recommendation that no further risk assessment is carried out is damning.

Further PRAs are provided for different areas of the total solar array.

### Flood Risk Assessment (EN010162/APP/6.4.9.1A)

A document entitled Flood Risk Assessment (FRA) includes further assessment and analysis, but does not reference the PRAs provided elsewhere. As such, it does not act as a co-ordinating document, much less a safety case type document and so the arguments of overall safety, even from just the flooding perspective, remain unresolved.

The document does reference a series of regulatory requirements and guidance, but these are often regarded as a baseline, automatically adhered to. Whilst compliance should be evidenced, they do replace the safety arguments and evidence required to provide confidence in the project.

The document describes on-site research pertaining to the Moorhouse area, though yet again it is constrained solely to effects on the plant equipment. (Presumably resulting in the major project revision that saw panels originally placed on the Beck flood plain being removed, but leaving the panels that were above the perceived flood line.) These investigations did highlight when 'Moorhouse Beck overtop its banks then floodwater will spread over a wide flat area to shallow depths'. A concern raised with regard to the planned riparian planting in this area which would inhibit the overflow and flood back into the village.

In para. A9.1.3 -Solar PV Surface Water Management, a description of Rural Sustainable Drainage Systems is given, but no usage plan is provided and would be detrimental if used within the planning limits, downstream of the Moorhouse area.

## Quoted Research

Several papers are quoted in the FRA. The American research on arid area run-off cannot be considered particularly pertinent, however, the Milazzo et al paper refers to more temperate climates. Its use to claim that it provides quantification that permanent grassland mitigates better runoff than arable land is not fully justified. Several papers including this one, acknowledge the lack of empirical evidence on the topic (hence my quoted paper in the LMSC submission to the Inspectorate, which is empirical) and this assessment is also desktop. However, the Conclusions are less categoric than claimed, the meta research is qualified with: "these general indicators are limited in scope. A second, broader review showed how European permanent grasslands suffer from additional land degradation hazards" the most relevant being compaction, surely a concern for EG regarding grazing the areas.

Natural England TIN 101 is also provided as evidence, but the document is from 2011 and no longer a live document on their site. The original contains 3 short paragraphs on Protecting Watercourses, and whilst its contentions quoted by EG are accepted, there is simply no evidence of planned implementation by EG, particularly in conjunction with their agri-voltaic claims. Both the above references used by EG emphasise the threats from compaction and provides contradiction to their arguments regarding panel run-off flooding.

## Beyond the Conceptual Phase

Some consideration is given in the FRA to the operational phase with a series of options for water control. It is unclear which hazards these might be applied to, with what effect, and whether it is simply plant (the focus of the preliminary risk listed) or a wider context. A series of techniques are described generically, but their value within specific areas is largely undefined because the original risks are largely undefined. This part of the analysis may superficially have moved into the design phase, with consideration of operational concerns, though actually its quality remains abstract, as a conceptual look forward to the future phase. However, due to the lack of detail in the application documents and an unclear structure to the safety arguments, it remains impossible to confirm that all hazards have been identified and mitigated to an acceptable level. In essence, the failure to provide detailed design precludes the development of an effective design safety case, yet at the examination stage, both should be prerequisites. The evidence that is provided remains qualitative rather than quantitative, which again for this

stage in the project's progression is not really acceptable and certainly unconvincing. This evidence has to be available before the project can move to the implementation (manufacture) phase.

### Press 'Marketing'

Press cuttings (https://www.bbc.co.uk/news/articles/cn8e0l1kmeeo) quote Mark Turner as 'insisted the project will not increase the risk of flooding.' "Solar farms have grass underneath the panels and grass acts as a sponge," he said. "That will slow the movement of water out of the field and into the drains." However, Elements Green also claim for 'agri-voltaic' considerations, that sheep will graze under the panels. The lack of detail in the planning and analysis at this acceptance stage can neither corroborate nor contradict such statements, though their researched evidence highlights the criticality of compaction to water run-off. At this stage it should be unequivocal.

## Conclusion

Conflicting evidence gives, at the very least, rise for concern that placing solar panels along the Moorhouse Beck could exacerbate flooding in the Moorhouse area. Elements Green implicitly acknowledge this by the removal of panels on the Beck flood plain whist leaving them in place above the flood line. They explicitly acknowledge the fooding risk in their assessment of the area but do nothing to alleviate that which does not directly affect their equipment. The limitations of the analysis have resulted in proposals for riparian planting on the flood plain, which by their own analysis will exacerbate upstream flooding if the Beck overflows in this area.

However, assessment of this risk analysis has given rise to greater concerns regarding the overall approach to identifying and mitigating the risks associated with such a major project. The risk analysis carried out is primarily conceptual and certainly not at a level of abstraction that would allow progression through to an implementation phase.

The lack of any explicit hazard identification methodology gives concern that not all hazards have been considered and therefore the risk associated with them has not been assessed. No methodology is explicitly defined or apparent, that would weave the provided safety data into coherent arguments to compellingly assure the acceptable safety of this project, even within the unacceptably tight bounds of the risk analysis.

The data provided is spread across multiple documents with no lead document to provide structure or coherence, inhibiting the confidence of both authors and readers that all risks within defined bounds has been captured. This lack of co-ordination prevents a clear and

compelling picture of a full and complete analysis and mitigation. Where this achievable, it would still not be at the right level for the current stage of this project.

The levels of assurance achieved in sister industries, such as nuclear, gas and oil only highlight the severe weaknesses in this project. The fact that this analysis claims 'industry norms' from other projects suggests a fundamental failure in its regulation. Companies made spectacular profits in the 'dash for gas' of the 1970's, but ultimately this led to the Piper Alpha disaster. We appear to be treading that time pressured path again with potential predictable results. They may not be as spectacular as Piper Alpha, effects on the farming industry may be even more significant.

This consideration highlights the lack of rigour in but one aspect of the project. An overarching safety case should have been provided to consider all aspects of risk, now and in the future. In particular, the specific risks associated with the BESS. Without a far higher level of assurance it would not be acceptable for the project to progress.

## Appendix A

Some Safety Case Slides, by kind permission of Rev. Professor Tim Kelly

# Safety Case Contents 1

- Exact contents depends on regulatory environment
- The following are key elements of most standards:
  - Scope
  - System Description
  - System Hazards
  - Safety Requirements
  - Risk Assessment
  - Hazard Control / Risk Reduction Measures
  - Safety Analysis / Test
  - Safety Management System
  - Development Process Justification
  - Conclusions

# Safety Arguments

- The Safety Case is not just a collection of disparate pieces of information
- The Safety Argument should form the 'spine' of the Safety Case showing how these elements are related and combined to provide assurance of safety
  - within the limits defined [*Scope*], the system [*System Description*] is SAFE because all identified hazards [*System Hazards*] and requirements [*Safety Requirements*] have been addressed. Hazards have been sufficiently controlled and mitigated [*Hazard Control / Risk Reduction Measures*] according to the safety risk posed [*Risk Assessment*]. Evidence [*Safety Analysis / Test*] is provided that demonstrates the effectiveness and sufficiency of these measures. Appropriate roles, responsibilities and methods were defined throughout the development of this system [*Development Process Justification*] [*Safety Management System*] and defined future operation

N.B. The red line shows path of coherency, not crossings out!

# Safety Arguments – Text Example

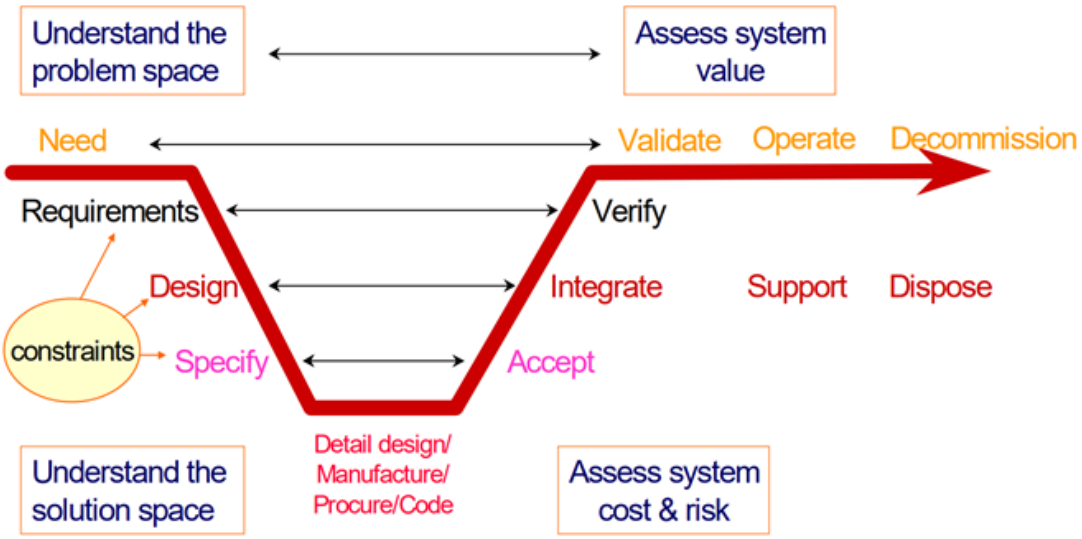
```
The Defence in Depth principle (P65) has been
addressed in this system through the provision of
the following:
 Multiple physical barriers between hazard source
  and the environment (see Section X)
 A protection system to prevent breach of these
  barriers and to mitigate the effects of a barrier
  being breached (see Section Y)
...
```

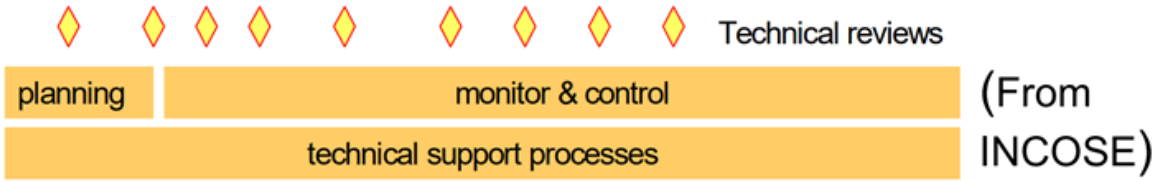
- Safety Arguments should clearly describe how a safety objective / requirement / claim has been achieved in the system as proposed
  - how it has been interpreted
  - ultimately, what evidence supports the requirements

## Appendix B

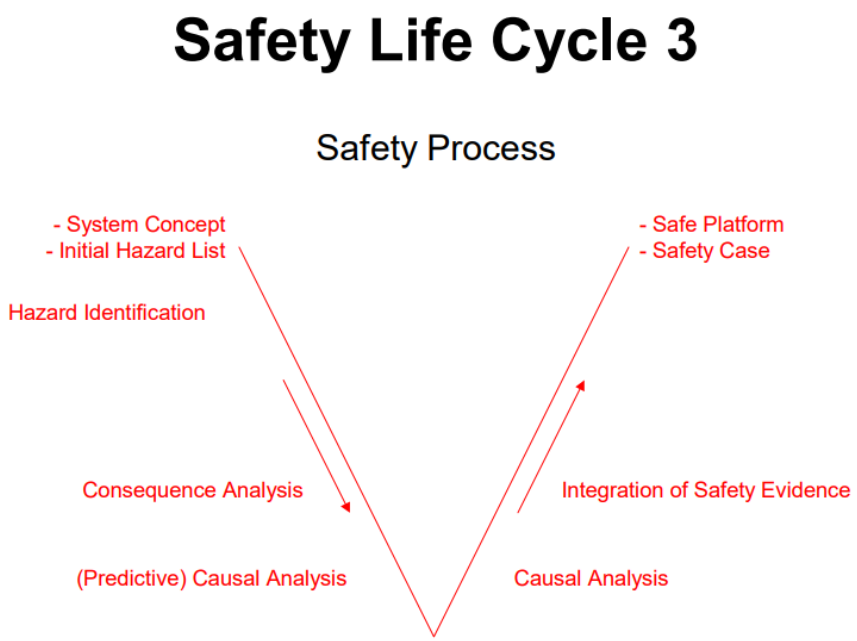
Some Safety Lifecycle Slides, by kind permission of Rev. Professor Tim Kelly

Fosberg's Vee lifecycle, interpreted by International Council on Systems Engineering

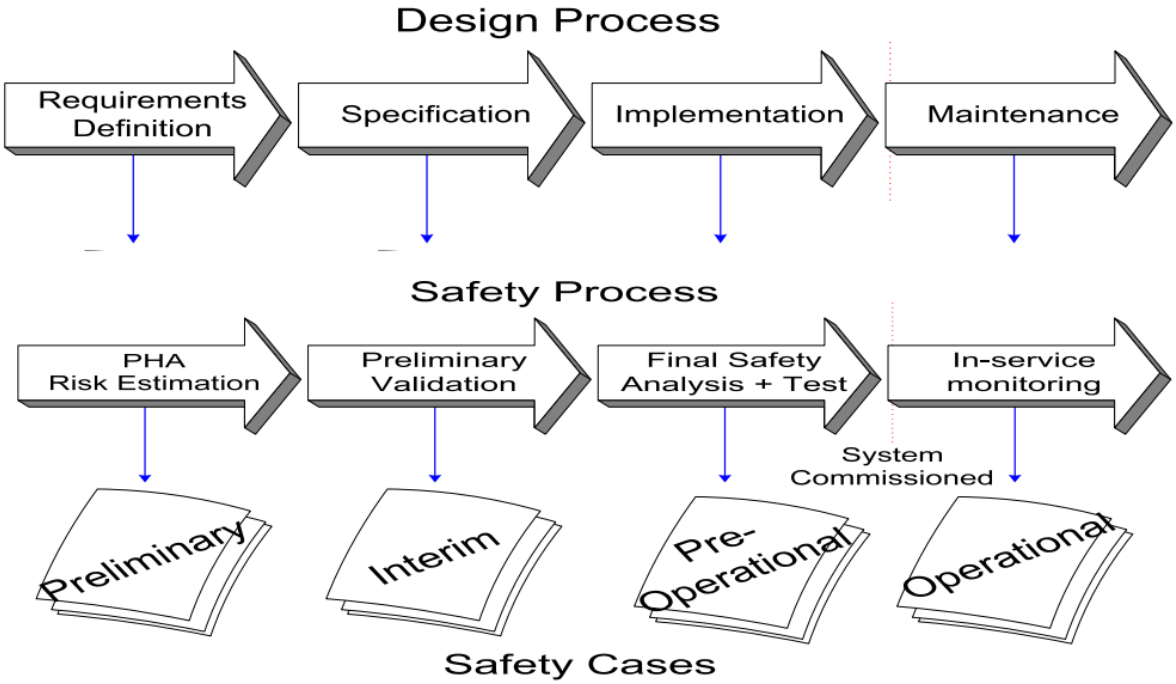



(From INCOSE)



# Safety Cases with the Design and Safety Processes



# Appendix C

## PRA limitations from EN010162/APP/6.4.10.7

ANNEX B - PRA METHODOLOGY

Introduction

89 This report provides available factual data for the site obtained only from the sources described below and related to the site on the basis of the location provided by the Applicant. The desk study information is not necessarily exhaustive and further information relevant to the site may be available from other sources.

90 This report is written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information and changes in legislation may necessitate a re-interpretation of the report in whole or in part after its original submission. The report is provided for sole use by the client and is confidential to them and their professional advisors. No reliance whatsoever is provided to any party other than the Applicant unless otherwise agreed.

ANNEX C – ASSUMPTIONS AND LIMITATIONS

100 A "desk study" means that no site visits have been carried out as part of an assessment, unless otherwise specified.

101 This report provides available factual data for the Study Area obtained only from the sources described in the text and related to the Study Area and a250 m radius, where relevant, on the basis of the location information provided by the Applicant.

102 The desk study information is not necessarily exhaustive and further information relevant to the Study Area may be available from other sources.

103 The accuracy of maps cannot be guaranteed, and it should be recognised that different conditions within the Study Area may have existed between and subsequent to the various map surveys.

104 No sampling or analysis has been undertaken in relation to this desk study.

105 Any borehole data from British Geological Survey sources is included on the basis that: "The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this maybe old or obtained from non-BGS sources and may not represent current interpretation".

106 Where any data supplied by the Applicant or from other sources, including that from previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by RPS for inaccuracies in the data supplied by any other party.

107 This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a re-interpretation of the report in whole or in part after its original submission.