

Post-Hearing Submission (OFH2):

Dr Edmund Fordham  
Dated: 16<sup>th</sup> December 2022

Annexes EF43 and EF44 uploaded separately

THE PLANNING INSPECTORATE

EN010106 – Sunnica Energy Farm

**APPLICATION BY SUNNICA Ltd for an Order Granting Development Consent  
for the Sunnica Energy Farm Project pursuant to The Planning Act 2008**

**To the Examining Authority (ExA)**

**POST-HEARING SUBMISSION:**

**OFH2: Need for involvement of the Regulator and Scheme Benefits**

**Eurlng Dr Edmund John Fordham MA PhD CPhys CEng FInstP**

**Interested Party – Unique Reference: 20030698**

Please note:

1. These comments are being submitted as required by Deadline 4 (16 December 2022).

2. This Post-Hearing Submission is largely confined to a transcript of my timed and recorded remarks at the OFH2. I also Annex a transcript of the interview with the late Professor Sir David MacKay from which I quoted. Further remarks by the late Sir David, specific to solar energy, are highlighted for the benefit of the ExA.

## SUMMARY

1. The agenda allocation to BESS Safety issues at ISH3 was inadequate to the seriousness of the public health and safety hazard presented by BESS of a size (and therefore hazard) without precedent in the world. A specific request for an ISH dedicated specifically to BESS safety issues, made in my very first Written Submission prior to the resumed Preliminary Meeting, was disregarded.

2. The conduct of the BESS Safety section of the ISH3 was unsatisfactory and largely occupied with an unfocussed conversation between Mr Rigby for the ExA, and Mr Gregory, introduced by the Applicant.

3. Although probably the only person remaining present with the technical competence to question the major industrial safety issues presented by Giant BESS, I was not permitted adequate space to highlight more than handful of the very serious safety issues identified.

However many of the technical issues had already been highlighted in my "Comments on Applicant Responses to ExA Questions" submitted by Deadline 3A. The Summary of these should be consulted.

4. The ExA lacks the necessary skill set to perform a complete safety appraisal of the multiple technical issues. Hence the full and active engagement of the Health and Safety Executive is essential going forward, and clearly mandated by policy in NPS EN-1.

5. The benefits of the Sunnica scheme were evaluated by a simple calculation based on the Applicant's own figures for expected energy generation in their PEIR. The figures presented for energy output (in MWh) over 40 years are equivalent to an *annual average* power of about 67 MW, less than 1/7 of the claimed 500 MW capacity. Mr Munro made a remote submission using updated figures in which he reported a very similar estimate of 65 MW annual average power.

6. Against a national electricity demand of the order of 35 GW (or 35,000 MW), Sunnica therefore represents a wholly insignificant 1/500 of current electricity demand, and less in winter. With subsequent reductions in panelled area, the contribution from solar electricity generated is even less significant than for the originally published scheme.

7. Mr Griffiths for the Applicant, responding to the OFH2 submissions, said that this was not so and the scheme would be capable of delivering 500 MW year-round.

This is at least disingenuous. Whilst the "battery energy trading" activities of the scheme would indeed be capable of delivering 500 MW at any given time, my point (and Mr Munro's) was how much *solar electric generation* would be achieved. 500 MW in winter is only possible if the energy comes from elsewhere on the grid beforehand. That is not *generation*. 500 MW of solar electric generation in winter is

impossible; indeed with an annual *average* of 67 MW, winter generation must be significantly *less* than 67 MW, or that figure could not be an *average*.

**8.** The sacrifice of over 2500 acres of productive farmland, amenity and wildlife habitat, measured against such an insignificant benefit in terms of solar electric generation, thus represents folly of a very high order.

**9.** Sunnica is an example of what the late Professor Sir David MacKay FRS, former Chief Scientist at the Dept of Energy and Climate Change, referred to in a deathbed interview as “the appalling delusion”.

**10.** The ExA has already been given sufficient technical, legal and policy reasons to reject the scheme unconditionally.

(523 words) EJF 16/12/2022

## **Additional Notes**

1. A transcript of my contribution at OFH2 is Annexed as Annex EF43. This is an edited version of the notes from which I spoke and may not be strictly verbatim but I have endeavoured to make it as close as possible to my speech as delivered.

## **Comparison with nuclear reactor technology**

2. My experience in nuclear reactor safety dates from 1978 when employed by a fluids engineering consultancy on the campus of Cranfield University. Our client was the then Nuclear Installations Inspectorate (NII) (now the Office for Nuclear Regulation, ONR), the statutory regulator for nuclear power installations.

The assignment was part of the safety case for the Commercial Demonstration Fast Reactor (CDFR) being put forward by the United Kingdom Atomic Energy Authority (UKAEA). The CDFR (in the end never built, but for economic and political reasons) was intended as a full-scale demonstration of fast breeder reactor technology in commercial power generation, with liquid metal (sodium) as the coolant and a very high power density in the reactor core of 0.33 MW per *litre* of volume.

The stringency of the safety engineering required in the design and operation of such a reactor is clearly very high, and the reasons for it will be appreciated by most laymen.

3. I referred in my remarks to the professionalism and integrity of the engineering experts at NII at the time, preparing their overview of the safety case for the CDFR.

4. The safety issues surrounding Giant BESS, never before contemplated at the scale (and therefore hazard level) proposed for Sunnica, represent the most serious industrial safety issue encountered in my life and professional career, not excluding a novel type of nuclear power reactor at commercial scale.

## **Reasons for the efficacy of the regulatory regime**

5. The reasons for the success of the regulatory apparatus during my experience in the nuclear sector lay in the active engagement of an independent statutory regulator (the NII), staffed by technical professionals well-versed in the engineering issues, and therefore able to question and examine the proposal put forward by the "Applicant" (in that case the UKAEA).

Placing two independent organisations, not in a hostile standoff, but in intellectual and technical debate, toward the common goal of safety, concentrates minds. Sloppy thinking and blatant technical errors are simply not good enough, because another expert will catch them.

## **Lack of involvement of the statutory regulator in the present Application**

6. The reason I view the Giant BESS in Sunnica as the most serious industrial safety issue seen in my career, is primarily because of the *lack* of involvement with an independent statutory regulator (i.e. the HSE).

7. In any large engineering project involving a large scale of potential hazard, it is the human systems, regulatory law, and the institutional structures that are quite as important as the engineering controls, in guaranteeing an acceptable degree of safety to the public and the environment.

8. I am obliged to contrast (i) my experience as a young graduate working in nuclear power, where a technically expert regulator, governed by professionalism and integrity, was indeed present, with (ii) the present Application, where the regulators (i.e. HSE and the EA) are conspicuous by their absence.

Placing the responsibility for exercising the high-level scientific and engineering expertise expected from regulators, upon the local Fire and Rescue Services, who are still unsure of how to tackle BESS fires, is not an acceptable substitution. It is unfair on the local FRSS, and dangerous to the public.

9. I have already set out in my WR the overarching policy requirements in NFS EN-1 for consideration of major accident prevention and mitigation, by early involvement of the COMAH Competent Authority.

10. The above are the reasons for my belief that it is now essential to seek the active engagement of the HSE with the Examination.

Mr Kean's indication that the ExA would consider this is noted and appreciated.

## Further comments from the late Prof Sir David MacKay FRS

11. A transcript of an interview with the late Professor Sir David MacKay, from which I quoted, is Annexed as Annex EF44. Professor MacKay died tragically young, a matter of days after this interview.

12. Professor MacKay was the author of *Sustainable Energy: without the Hot Air*, published in 2009, which earned him appointment as Chief Scientist at the then Dept Energy and Climate Change (DECC). His book is an open-minded, generous but realistic appraisal of various renewable energy options in the UK context.

13. Subsequently Professor MacKay was appointed as the first Regius Professor of Engineering at Cambridge University, one of the first Regius Professorships to be established at Cambridge in centuries, reflecting the esteem in which his achievements were regarded.

14. His final interview, as well as poignantly portraying the wisdom of someone who must have known he was dying, is also extremely revealing. For most of his career he wisely avoided making direct prescriptions of “what we should do”, leaving his readers to come to their own conclusions. As he said in his interview: *I genuinely would be content with any plan [for energy supply] that adds up.*

The problem he perceived was that even multiple so-called renewable sources, available in the UK context, do not “add up”, by a very wide margin. Most could realistically deliver around 2 kWh per person per day. Total UK consumption (which is not just electricity) is around 125 kWh per person per day. As MacKay says:

*Arithmetic says that 2 plus 2 plus 2 ... plus 2 plus 2 ... is not 125 !*

15. His “appalling delusion” remark which I quoted is in full:

*There is this appalling delusion that people have that, oh yes, we can take this thing which we are currently using to deliver 1% of all our energy and we can just scale it up. And oh, if there's a slight issue of it not adding up, oh yes we'll do energy efficiency.*

16. MacKay perceived acutely the extreme greed for land involved in most renewable energy proposals:

*And it isn't just the land area issue which I bang on about quite a lot in the book – that's one of the themes – but there's the intermittency issue as well ...*

The Sunnica Examination is a predictable example of this extreme greed for land, correctly predicted by MacKay, for minimal benefit, in the context of ground-based solar PV.

17. MacKay identifies a “new delusion”:

*And again there's a new delusion spreading through the world at the moment which is oh yes Solar is coming down in price, Wind is coming down in price, and Batteries are coming down in price as well, and people seem satisfied*

*with [just] these simple statements that the prices are coming down, so it's all going to be fine.*

18. Then he explains why it is delusional:

*But they haven't done the numbers to think through actually how big the Batteries would need to be if you wanted to do a Solar and Batteries-only solution - there is this phenomenon called winter and in some places you know it's a real thing ... in Britain the average intensity of sunshine is 9 times smaller than it is in the summer. Winter is 9 times darker, and so the size of Batteries you actually need for this magical free Solar and free Batteries – you need just absurdly large Batteries and what actually needs to happen to the price of the Batteries for that to become a realistic option is that they've got to come down by a factor of 100 or so.*

There is currently not the remotest chance that batteries will fall in price by a factor of 100 or so, not least because of world-wide resource limits on exotic materials such as the cobalt used in NMC cells.

19. Examples of this kind of “magical thinking” have been declared or implied throughout the present Application.

#### **Further views of MacKay on solar energy**

20. Pressed by his interviewer to give his outline prescription for UK energy (something MacKay had avoided doing throughout his career) he finally did so, in the last few days of his life:

*The Wind and the Solar are intermittent; the Solar's timing is not well-matched to demand, in this country, and you just cost-optimize and say it has to keep working in the winter even if there's no wind for 7 days at a time and obviously no sun.*

*... the sensible thing to do for a country like the UK I think is to focus on Carbon Capture and Storage – which the world needs anyway – and Nuclear. And then if you ask well what is the optimum amount of Wind and Solar to add in as well, then the answer is going to be: **almost zero**, because if you can make it through the winter with your CCS and your Nuclear, getting through the bits of no wind ...*

*... there's actually no point in having **any** Wind or Solar ...*

21. MacKay's reason is simple; duplication is always wasteful:

*If you have got a low-carbon solution that gets you through the winter when there's no wind going, it's a waste of money to then build some additional beautiful wind turbines. Just because, when the wind blows you're going either to have to turn those wind turbines down, or to turn something else down that you've already paid for, like the nukes or the CCS.*

22. MacKay's experience in Government (as Chief Scientist at DECC) explains why he hesitated to be prescriptive:

*Having spent 5 years in Government seeing how difficult it is to get some types of policies through, seeing how important money is, and cost is, I now have views on what I think would be a good outcome.*

*But if I were to nail my colours to the mast and say ok I advocate this solution: lots of this, lots of this, a little bit of this and none of that, then the way human dynamics works is you lose the trust of a whole load of people ...*

23. At the end of the interview MacKay provides further revealing insight, specifically on solar energy:

*... to the credit of the civil servants who I worked with when I went to Government – I may have indicated that they had some bad policies – but when it came to whether Solar should be in the mix they had done the numbers for that already and Solar just wasn't on the table at all.*

*And the only reason that Solar got on the table was because of democracy, that the MPs wanted to have a Solar Feed-In Tariff. And so in spite of the civil servants advising the Ministers No, we shouldn't subsidise Solar, we ended up having this policy – and there was very successful lobbying by the solar lobbyists as well – so now there's this widespread belief that Solar is a wonderful thing, even though it's highly intermittent and mainly produces energy in July and in December produces 9 times less than it does in July.*

*You know, Britain's one of the darkest countries in the world.*

23. MacKay is also clear that solar energy has major potential in other parts of the world:

*Anywhere where you have got a correlation between solar and demand then it definitely looks like Solar is going to be a really really good idea, and Batteries are cheap enough that you can store energy overnight. So a battery solution in a place like Las Vegas, I can definitely see it playing a large role.*

24. The fallacy of Sunnica lies in supposing that solutions that might work in Las Vegas will also work at much higher latitudes and in a cloudy climate. Cloudy, dark, England is not the Sahara Desert, nor even Nevada. That is why the projected benefits of Sunnica are so insignificant: there simply is not enough solar energy to be had, and it is anti-correlated with demand.

25. I commend to the ExA further study of MacKay's interview.

(2,030 words)

EJF 16/12/22

Glossary, and updated list of Annexes referred to follows; Annexes uploaded separately

## GLOSSARY

Abbreviations used in the interests of brevity.

### Legislation and statutory permissions:

CLP	– the Classification, Labelling and Packaging Regulation
COMAH Regs 2015	– the Control of Major Accident Hazards Regulations 2015
CQ	– Controlled Quantity (of a HS as defined in P(HS)Regs 2015)
DCO	– Development Consent Order
dDCO	– draft Development Consent Order
HS	– Hazardous Substance (as defined in the Schedule to P(HS)Regs 2015)
HSC	– Hazardous Substances Consent
PA 2008	– The Planning Act 2008
P(HS)A 1990	– The Planning (Hazardous Substances) Act 1990
P(HS)Regs 2015	– The Planning (Hazardous Substances) Regulations 2015
QQ	– Qualifying Quantity (of a “dangerous” substance) in the COMAH Regs 2015; similar to CQ in the P(HS)Reg 2015
S or “S”	– any “substance used in processes” which on its own or in combination with others may generate HS defined in Parts 1 or 2 of the Schedule to the P(HS)Regs 2015
Seveso	– the “Seveso III Directive” 2012/18/EU of 4 July 2012
UN MTC	– United Nations Manual of Tests and Criteria

Direct quotations from legislation are shown in blue

### Policy documents:

NPPF	– National Planning Policy Framework
NPS	– National Policy Statement
EN-1	– Overarching National Policy Statement for Energy (EN-1)

Direct quotations from policy documents are shown in magenta

### Competent authorities:

CA	– COMAH Competent Authority
DHCLG	– Department for Housing Communities and Local Government
DECC	– Department of Energy and Climate Change
EA	– Environment Agency
ECDC	– East Cambridgeshire District Council (LPA)
ExA	– Examining Authority
FRS	– Fire and Rescue Service
HSA	– Hazardous Substances Authority
HSE	– Health and Safety Executive
HSE(NI)	– Health and Safety Executive for Northern Ireland
LPA	– Local Planning Authority
NII	– Nuclear Installations Inspectorate

ONR	– Office for Nuclear Regulation
SoS	– Secretary of State
WSC	– West Suffolk Council (LPA)
UKAEA	– United Kingdom Atomic Energy Authority

**Parties:**

Sunnica	– the Applicant, or the proposal under Examination
SNTSAG	– Say No To Sunnica Action Group Ltd (continued)

**Documents**

OBFSMP	– Outline Battery Fire Safety Management Plan
BFSMP	– Battery Fire Safety Management Plan
LIR	– Local Impact Report

**Technical:**

AEGL-3	– Acute Exposure Guideline Levels
BESS	– Battery Energy Storage System(s)
CAS	– Chemical Abstracts Service, maintains a catalogue of unique chemical substances with reference numbers
CDFR	– Commercial Demonstration Fast Reactor
GCMS	– Gas Chromatography Mass Spectrometry
IDLH	– Imminent Danger to Life and Health
IUPAC	– International Union of Pure and Applied Chemistry
Li-ion	– Lithium-ion
M-factor	– Multiplying Factor used for certain substances Toxic to the Aquatic Environment in eco-toxicity classifications
SoC	– State Of Charge of cells, usually given as percentage, between fully charged (100%) and completely discharged ( 0% )
SLOT	– Specified Level of Toxicity
SLOD	– Significant Likelihood of Death
STEL	– Short Term Exposure Limit, i.e. limiting allowed concentration for short-term exposures (typically 15 minutes)
VCE	– Vapour Cloud Explosion
UHI	– Urban Heat Island

## GLOSSARY (cont.)

### Chemical substances:

CH <sub>4</sub>	– Methane
C <sub>2</sub> H <sub>4</sub>	– Ethylene
C <sub>2</sub> H <sub>6</sub>	– Ethane
CO	– Carbon Monoxide
CO <sub>2</sub>	– Carbon Dioxide
Co	– Cobalt (as metal) ( not to be confused with CO )
CoO	– Cobalt (II) Oxide
Cu	– Copper (as metal)
CuO	– Cupric ( or Copper (II) ) Oxide
Cu <sub>2</sub> O	– Cuprous ( or Copper (I) ) Oxide
H <sub>2</sub>	– Hydrogen
HCN	– Hydrogen Cyanide
HF	– Hydrogen Fluoride
Mn	– Manganese (as metal)
MnO	– Manganese (II) Oxide
Ni	– Nickel (as metal)
NiO	– Nickel Monoxide
ONiO	– Nickel Dioxide
Ni <sub>2</sub> O <sub>3</sub>	– diNickel triOxide
POF <sub>3</sub>	– Phosphoryl Fluoride

### Li-ion cell types:

NMC	– Nickel – Manganese – Cobalt; a popular Li-ion cell type, with cathodes based on complex oxides of those elements
LFP	– Lithium – Iron [ chemical symbol Fe, hence “F” ] – Phosphate; another type of Li-ion cathode chemistry
LCO, NCA, LATP	– other cell cathode chemistries mentioned in text
LMO	– Lithium Manganese Oxide
LNO	– Lithium Nickel Oxide

### Measurement units:

GW	– gigawatt, or one billion watts, or one thousand megawatts 1000 MW
MW	– megawatt, or one million watts, a unit of <i>power</i> , i.e. <i>rate</i> of transfer of <i>energy</i>
MWh	– megawatt- <i>hour</i> , or one million watt-hours, a unit of <i>energy</i> e.g. the <i>energy</i> transferred by a <i>power</i> of 1 MW acting for 1 <i>hour</i>
m <sup>2</sup>	– square metre (area)
ha	– 1 hectare = 10,000 m <sup>2</sup>
MWh ha <sup>-1</sup>	– energy storage density (on the land) in the BESS compounds, as MWh energy storage capacity, per hectare of land allocated
MWh / tonne or MWh tonne <sup>-1</sup>	– energy density of the BESS cells themselves, as MWh energy storage capacity, per tonne of cells
Wh / kg or Wh kg <sup>-1</sup>	– energy density of the BESS cells themselves, as Wh energy storage capacity, per kg of cells 1 MWh / tonne = 1000 Wh / kg
mg / Wh or mg (Wh) <sup>-1</sup>	– gas generation from cells in failure, in milligrams gas per watt-hours of energy storage capacity
tonne	– 1 metric tonne or 1000 kg or 1 Mg
µg m <sup>-3</sup>	– trace concentrations of highly toxic gases, in micrograms of toxic contaminant per cubic metre of air

**List of Annexes referred to: –**

Post-Hearing submission: OFH2  
Dr Edmund Fordham  
( dated 16<sup>th</sup> December 2022 )

EF1 – Personal details

EF2 – “Safety of Grid Scale Lithium-ion Battery Energy Storage Systems”  
by E J Fordham (Interested Party), with  
Professor Wade Allison DPhil and  
Professor Sir David Melville CBE CPhys FInstP

EF3 – “Hazardous substances (Planning) Common Framework”  
CP 508 Presented to Parliament by the SoS for DHCLG August 2021

EF4 – Directive 2012/18/EU of the European Parliament and of the Council  
on the Control of Major-Accident Hazards involving dangerous substances  
commonly known as the “Seveso III Directive”

EF5 – The Planning (Hazardous Substances) Regulations 2015

EF6 – Explanatory Memorandum to the P(HS)Regs 2015

EF7 – The Planning (Hazardous Substances) Act 1990

EF8 – Overarching National Policy Statement for Energy (NPS EN-1)

EF9 – Speech of Dame Maria Miller MP, House of Commons, 7 September 2022  
*Hansard*, (House of Commons) Volume 719, Columns 275-277

EF10 – Battery Storage Guidance Note 1: Battery Storage Planning. Energy  
Institute, August 2019, ISBN 978 1 78725 122 9

EF11 – D. Hill (2020).  
“McMicken BESS event: Technical Analysis and Recommendations”  
Technical support for APS related to McMicken thermal runaway and  
explosion.  
Arizona Public Service. Document 10209302-HOU-R-01  
Report by DNV-GL to Arizona Public Service, 18 July 2020.

EF12 – Underwriters Laboratories incident report into McMicken explosion

EF13 – (5 items) News items and English translation from Chinese of official  
accident investigation into April 2021 BESS fire and explosion in Beijing

EF14 – (3 items) Reports from Merseyside Fire and Rescue Service into September  
2020 BESS fire and explosion in urban Liverpool

EF15 – Larsson *et al.* (2017), *Scientific Reports*, **7**, 10018,  
DOI 10.1038/s41598-017-09784-z

- EF16 – Paper with Professor Sir David Melville CBE: “Hazardous Substances potentially generated in “loss of control” accidents in Li-ion Battery Energy Storage systems (BESS): storage capacities implying Hazardous Substances Consent obligations.
- In public domain on *Research Gate* preprint server  
DOI 10.13140/RG.2.2.35893.76005
- EF17 – Golubkov *et al* (2014) *RSC Advances* DOI 10.1039/c3ra4578f
- EF18 – Research Technical Report by *FM Global*: Flammability characterization of Li-ion batteries in bulk storage”
- EF19 – Bergström *et al* (2015) Vented Gases and Aerosol of Automotive Li-ion LFP and NMC Batteries in Humidified Nitrogen under Thermal Load
- EF20 – (2 items) Victorian Big Battery Fire, July 2021. Report of technical findings. Also compendium of news items with aerial photography.
- EF21 – (2 items) Letter from Commissioner Sandra D. Kennedy, Arizona Public Service Company, August 2019, regarding McMicken explosion.
- Also letter with Fire Department report into earlier 2012 BESS fire with eye-witness reports on flame length.
- EF22 – Technical Memorandum from Golder Associates re composition of BESS at Kells, Northern Ireland
- EF23 – Ouyang *et al.* (2018), *J. Thermal Analysis and Calorimetry*, DOI: 10.1007/s10973-018-7891-6
- EF24 – Essl *et al.* (2020), *Batteries*, **6**, 30 DOI: 10.3390/batteries6020030
- EF25 – Chen *et al.* (2020), *J. Hazardous Materials*, **400**, 123169  
DOI: 10.1016/j.jhazmat.2020.123169 (Citation only: article copyright)
- EF26 – Held *et al.* (2022) *Renewable and Sustainable Energy Reviews*, **165**, 112474  
DOI: 10.1016/j.rser.2022.112474
- EF27 – Wang *et al.* (2019) *Energy Science and Engineering*, **7**, 411-419  
DOI: 10.1002/ese3.283
- EF28 – Hazard Assessment of BESS, Technical Report by Atkins (Consulting Engineers) for Health and Safety Executive for Northern Ireland HSE(NI)
- EF29 – Letter 13/05/2022 from HSE(NI) to Ards and North Down Borough Council
- EF30 – Letter 22/09/2022 from HSE(NI) to Derry City and Strabane District Council
- EF31 – Letter 10/09/2021 from HSE(NI) to Armagh City, Banbridge & Craigavon Local Planning Office
- EF32 – Letter 18/07/2022 from HSE(NI) to Derry City and Strabane District Council
- EF33 – Letter 20/05/2021 from HSE(NI) to to Armagh City, Banbridge & Craigavon Local Planning Office

EF34 – Research Technical Report by *FM Global*: “Development of sprinkler protection guidance for Lithium-ion based energy storage systems”

EF35 – P. Andersson *et alia*, “Investigation of fire emissions from Li-ion batteries”, SP Technical Research Institute of Sweden, 2013.

EF36 – Barron-Gafford *et al.* (2016). The photovoltaic heat island effect: Larger solar power plants increase local temperatures. *Scientific Reports* **6**, 35070, DOI: 10.1038/srep35070

EF37 – Armstrong *et al.* (2016). Solar park microclimate and vegetation management effects on grassland carbon cycling. *Environmental Research Letters* **11**(7) 074016 DOI: 10.1088/1748-9326/11/7/074016

EF38 – Parliamentary answer

EF39 – BAILII case

EF40 – Fordham and Swords (2022). Application of the COMAH and Hazardous Substances Consents Regulations to Battery Energy Storage Systems (BESS): Does classification as “articles” exempt a technology ?

EF41 – Letter 17 December 2015 from Occupational Safety and Health Administration (OSHA) of the USA regarding classification of Li-ion batteries.

EF42 – Paper by Mr Pat Swords (2009) “Implementing EU industrial safety legislation in Central and Eastern Europe” Symposium Series No. 155, Hazards XXI, Institution of Chemical Engineers, 2009 pp 256 – 262.

**New Annexes added this submission (16 December 2022)**

EF43 – transcript of timed and recorded remarks made at OFH2

EF44 – transcript of final interview with the late Professor Sir David MacKay FRS, April 2016