

Post-Hearing Submission – ISH3: BESS Safety and Consenting Requirements  
Dr Edmund Fordham

Dated: 16<sup>th</sup> December 2022

Annexes EF38 to EF41 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:  
ISH3: BESS Safety and Consenting Requirements**

**Eurling 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. Agenda allocation to BESS safety issues was made at the subsequent OFH2. However many of the technical issues had been already made in writing in my Comments on the Applicant Responses to the ExA Questions submitted by Deadline 3A. The most serious issues are noted in the Summary of that document which should be consulted in conjunction with this submission.
3. The commentary on the interpretation on the law regarding the consenting regime for Hazardous Substances is new and submitted at the request of Mr Kean for the ExA at the ISH3.

Conventions for colour highlighting:

Direct quotations from legislation are shown in blue

Quotations from policy documents, court judgments, or competent authorities are shown in magenta

Quotations from Applicant are shown in ochre

## SUMMARY

*[ Please refer to the Glossary following, for a list of abbreviations. ]*

1. The agenda at ISH3 did not permit oral discussion of many safety issues which I had intended to raise. However most were already made in writing in my “Comments on Applicant Responses to ExA Questions” submitted by Deadline 3A.

The Summary section of that document should be consulted.

2. A recap of the most serious issues is provided in Para. 3 herein; the topics covered are:

a. The incorrect claim that there are “few differences” between cell types “from a fire risk perspective”. This quite wrong as discussed in detail in my Annex EF16 and as Professor Christensen’s reports endorse;

b. The known ineffectiveness of water sprinkler systems at controlling BESS fires of the NMC cell type;

c. The lack of any Explosion assessment, though available in an assessment made for HSE(NI) annexed as Annex EF28, and the lack of any Prevention measures addressing Explosion risk (an explosion cannot be “managed”);

d. The complete absence of any assessment of the environmental risks of contaminated water run-off from sprinkler or other firefighting action, though raised in the Liverpool report and known from the technical literature already Annexed;

e. The complete inadequacy of the proposed water tank volumes to control even the known fire and explosion of a very small 1 MWh BESS at Drogenbos (2017);

f. The total neglect of toxic gas hazards other than Hydrogen Fluoride, and the incorrect assertion that particulate emissions are not a risk when Ni, Mn and Co oxides are produced as smoke or dust in fires of BESS of the NMC type. Nickel oxides “in inhalable powder form” are Named Hazardous Substances in Part 2 of the Schedule to the COMAH and P(HS)Regs 2015 and rigorously controlled;

g. The under-statement by a factor of 70, of the credible worst case loading of Hydrogen Fluoride in the air-quality assessment of Appendix 16D, and its under-statement by a factor of 500 against the more prudent reference case of complete destruction of a 5 MWh BESS. This derived from reliance on a 2013 “lab report” with neglect of a 2017 peer-reviewed paper by the same authors now used by HSE(NI);

h. The complete lack appreciation of the critical importance of prevention of cabin-to-cabin escalation of BESS fires, known from several BESS incidents;

j. The lack of appreciation that as the total system becomes larger and larger, the more likely a cell failure somewhere will become.

3. The Applicant has responded to my WR on the “almost certain” requirement for HSC by an assertion that HSC and COMAH do not apply because batteries are considered “articles” under the CLP Regulation. A Parliamentary Written Answer from the DWP is cited in support. However no legal authority for this claim is given.

4. We show that the Applicant's assertion (that batteries are "articles" in the scope of the CLP Regulation) is

- (i) not the case;
- (ii) irrelevant to the scope of the COMAH and P(HS)Regs.

5. We show that Li-ion BESS cells (which are never consumer items) may be categorised in the scope of the CLP Regulation as follows:

- (i) "substances or mixtures", by direct application of the CLP Definitions;
- (ii) "articles with integral substance(s)", under the REACH Regulation, which recognises that 'objects' may have characteristics of both "articles" and "substance(s)" simultaneously, and with which Regulation the CLP requires consistency, by Recital (12) of the CLP Regulation itself;
- (iii) "cannot be considered articles", by a specific ruling of the OSHA in the USA, whose definitions are used by the UN GHS, and with which system (GHS) the CLP Regulation similarly requires consistency.

Under no reading can a Li-ion BESS cell be simply an "article". Any such reading would violate commitments to international consistency and to definitions at UN level that are made within the CLP Regulation itself.

6. The scope of the CLP Regulation is irrelevant to the scope of the COMAH and P(HS)Regs 2015 because both those Regulations explicitly *include* "[substances which are not covered by the CLP Regulation, including waste,](#)" (which frequently contains "articles") by Schedule 1, Part 2, Note 5, COMAH Regs 2015, and the parallel provisions in Schedule 1, Part 4, Note 6, P(HS)Regs 2015.

7. The key "loss of control" provisions of the COMAH Regs 2015 contain no restriction whatsoever on the nature of the "installations" *before* the loss of control has occurred.

8. The "loss of control" provisions of Schedule 1 Part 3 of P(HS)Regs 2015 do refer to "substances used in processes" but the definition of "substance" is very broad, not excluded by any of the readings in Item 5, and in any case not restricted by the CLP Regulation, by Note 6.

9. There is therefore no legal basis for the applicant's Assertion that the CLP categorisation of batteries is as "articles"; moreover there is no reason that this would restrict the scope of the COMAH and P(HS)Regs 2015, even if that CLP categorisation were correct.

10. The Applicant is invited to supply the exact clause, or other authority, in

- (i) statute;
- (ii) regulation; or
- (iii) a decided case;

– which restricts the scope of the COMAH and P(HS)Regs 2015 from application to BESS.

11. A detailed paper exhaustively examining the issues summarised here was co-authored with Mr Pat Swords FICHEM PPSE. This was submitted in evidence in an application for Judicial Review in the High Court of Northern Ireland and has been in the public domain since May 2022. This paper is annexed as Annex EF40.

12. The Judicial Review application was in the event withdrawn as out of time for a reviewable decision. The substantive issues in the case have therefore not (to my knowledge) been adjudicated in any UK jurisdiction.

13. HSE(NI) has issued notifications that:

“Large scale battery facilities, also known as BESS (Battery Energy Storage Systems) have the potential to require a Hazardous Substance Consent and be subject to the COMAH Regulations”<sup>1</sup>

– and similar other notifications in Planning Applications in Northern Ireland (more examples in my WR) clearly recognising that in principle the COMAH and P(HS)Regs 2015 *do* apply to BESS, and that applicants must consider substances generated in loss of control accidents.

14. The position taken by the Applicant, apparently endorsed the DWP, is therefore the exact opposite of that apparently taken by HSE(NI). The Northern Irish Regulations being materially identical to the Regulations applicable in England, both positions cannot be legally correct.

15. Without the legal authorities requested in Item 10, the Applicant’s claim:

Under the European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP) ... batteries are classified as articles, rather than substances and are therefore outside the scope of the COMAH and Hazardous Substances Consent

– is simply assertion. Lacking a legal basis it is believed to be unsustainable at law.

(1117 words) EJP, 16/12/22

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<sup>1</sup> Annex EF29

## 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
GHS	– Globally Harmonised System (see UN GHS)
HS	– Hazardous Substance (as defined in the Schedule to P(HS)Regs 2015)
HCS	– Hazard Communication Standard (USA)
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
REACH	– Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation
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 GHS	– United Nations Globally Harmonised System
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

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## **GLOSSARY (cont.)**

### **Competent authorities:**

CA	– COMAH Competent Authority
DHCLG	– Department for Housing Communities and Local Government
DECC	– Department of Energy and Climate Change
DWP	– Department for Work and Pensions
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
OSHA	– Occupational Safety and Health Administration (USA)
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

### **Documents**

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

(continued)

## GLOSSARY (cont.)

### 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
ICChemE	– Institution of Chemical Engineers
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
NFPA	– National Fire Protection Association (USA)
PPSE	– Professional Process Safety Engineer
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)
SVHC	– Substance of Very High Concern
VCE	– Vapour Cloud Explosion
UHI	– Urban Heat Island

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## 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

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## GLOSSARY (cont.)

### 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

## Comments at ISH3 regarding BESS safety issues

1. The setting of the agenda and timetable was such that I was not able to raise more than a handful of the errors and omissions on major health and safety issues, concerning which I had attended ISH3, fully prepared to speak to.
2. Nevertheless most of the issues I had intended to raise at the ISH3 were in fact addressed by my Comments on Applicant's Responses to the ExA Questions submitted by Deadline 3A. The Summary of that document should be consulted for the principal safety issues.
3. To recap the most serious issues here:
  - a. It is quite wrong that "there a few differences between Li-ion cell chemistries from a fire risk perspective". My Annex EF16 and other Annexes EF23 to EF28 document this. Professor Christensen's latest report on the revised OBFSMP also endorses this. The ExA appeared unaware of Professor Christensen's latest report although it had been uploaded several days previously, as Mr Kozelko for SNTSAG made clear.
  - b. Water sprinkler systems have been shown in a major study by the NFPA in the USA to be (i) helpful in BESS fires involving LFP cells (ii) ineffective in fires involving cells of the "metal-oxide" type (of which NMC cells are one). The Applicant is thus proposing to rely upon a fire suppression method already known to be ineffective in one of the two types of cell under consideration. Professor Christensen's first report into the OBFSMP (Annexed with the original WR of SNTSAG) also made this point.  
One of the key documents was Annexed by me as Annex EF34 though others from the NFPA are available.
  - c. No appraisal at all has been made of the Explosion hazard, although at least 6 Vapour Cloud Explosions in BESS have been confirmed worldwide. Professor Christensen's second report explains why LFP cells, though frequently described as "safer" than NMC cells, failing less aggressively in thermal runaway, facilitate the build-up of combustible gases and aerosols *without* internal generation of free oxygen in the early stages, leading to delayed ignition of what, by the ignition point, is a large volume of flammables. An Explosion assessment is made by the consulting engineers Atkins for HSE(NI) annexed as Annex EF28. It is not possible to "manage" an Explosion, yet no clear proposals are made for its Prevention.
  - d. Hazards to the Aquatic Environment are an obvious hazard generated by sprinkler action or other water use in fire-fighting. Contaminated runoff was an explicit concern in the reports into the Liverpool Explosion and BESS fire of September 2020 (Annex EF14) that remains un-analysed. However, this obvious hazard did not even appear on the agenda. Contaminants from heavy metal compounds of Nickel, Manganese and Cobalt are obvious toxic concerns to the aquatic environment and Cobalt compounds have been listed as Substances of Very High Concern (SVHC) under the REACH evaluations.

- e. The water volumes allowed for in the BESS compound water tanks are wholly insufficient to control a fire even in a small 1 MWh BESS, based on the experience at Drogenbos (2017). Whatever the still-undetermined storage capacity of a Sunnica cabin may be, based on quoted volumes and the data from the Arizona BESS in Annex EF11, I continue to believe that a capacity of at least 5 MWh per cabin at Sunnica is credible. A BESS fire in even a single cabin would be likely uncontrollable based on these water volumes and would not have controlled the fire at Drogenbos.
- f. Many toxic gases, including Carbon Monoxide, Hydrogen Cyanide, Hydrogen Chloride and unstable highly toxic fluorides such as Phosphoryl Fluoride have been completely ignored, as has the generation of Nickel Oxides “in inhalable powder form”, a highly controlled Named Hazardous Substance in Part 2 of the P(HS)Regs 2015. The Applicant has wrongly asserted that there are no hazardous particulates of concern. The technical literature e.g. Annex EF24, EF26 is crystal clear that such inhalable particulates are generated from fires in NMC cells. There is no mention anywhere of the generation of analogues of outlawed chemical weapons recorded in a Swedish Government agency report (Annex EF19).
- g. Even in the evaluation of Hydrogen Fluoride emissions in the Applicant’s Appendix 16D, the exercise understates generation of HF gas by a factor of 70 even upon their own terms; on the basis of the credible reference case of complete destruction of a 5 MWh BESS cabin, Appendix 16D understates HF emissions by about 500-fold. Appendix 16D is thus wholly incredible as a serious air quality assessment. The primary source used by me is in Annex EF15 (2017) which is a properly peer-reviewed paper by the same author team as the 2013 report relied upon by the Applicant, even though its technical shortcomings are recognised and noted. It is inexcusable that the Applicant should rely on such out of date material, particularly when Annex EF15 is now used by assessments made for HSE(NI) by the consulting engineers Atkins (Annex EF28). Professor Christensen’s first and second reports made other criticisms regarding the inapplicability of scaling up temperature and heat release estimates in BESS fires.
- h. There is no recognition anywhere of the fundamental hazard presented by cabin-to-cabin escalation of a BESS fire. If a thermal runaway accident can escalate from Cabin 1 to Cabin 2, by the same token it can escalate from Cabin 2 to Cabin 3, and so on, without any obvious limit. This is the mechanism by which a fire or explosion in one cabin could be the initiating event for a major disaster, unless extraordinary efforts are made to ensure that such escalation is essentially impossible. This is why “Major Accident Prevention and Mitigation” remains fundamental to the policy in NPS EN-1.

The ExA should be under no illusion that the maximum possible scale of a major accident becomes larger in proportion to the total stored energy capacity of the scheme. The ExA should also note the cabin-to-cabin escalation in Beijing, which does not appear to have been thermal in nature, but the result of an electrical

propagation mechanism; hence physical layout would not have prevented the escalation at Beijing.

- j. There is also no recognition that as the total energy storage in the system increases, this will be achieved by increases in the number of cells. Perfect quality control being impossible, there will inevitably be a failure rate of individual cells which will lead at some point to cell failure somewhere being routine. Since in the current state of the technology a single cell failure can escalate via the thermal runaway mechanism to its neighbours, this means that the larger the systems becomes, the more likely thermal runaway events will be.

### **Consenting requirements for BESS**

4. Mr Rigby in his opening remarks had indicated that he would ask questions concerning the Consenting requirements for BESS. In the event he did not do so. On raising issue at ISH3 Mr Kean requested a written submission of the points. The remainder of this Post-Hearing Submission deals with this.

### **Applicant Responses to my WR and Parliamentary Answer**

5. The Applicant in their responses REP3A-035 responds to my Written Representation regarding the need for HSC by reference to a Parliamentary Written Answer given in July 2021<sup>2</sup>. The Applicant does not supply the actual parliamentary record but I have done so here as Annex EF38.

6. The line of argument in the Parliamentary Answer is familiar to me from correspondence with the HSE and our Members of Parliament (I have formally written via my own MP Mrs Lucy Frazer KC MP but shared the correspondence also with Mr Matt Hancock MP). I have not contributed this correspondence to the Examination because currently the HSE is not a Party at the Examination, and unless they become engaged, no dialogue is possible.

7. As well as offering expert technical input and independent judgment, an additional reason for requesting the involvement of HSE (made formally at OFH2) would be to enquire into these questions of regulatory law.

### **Position taken by HSE and Dept for Work and Pensions**

8. I believe the position taken by the HSE as reported in the Parliamentary Answer from the Dept for Work and Pensions (DWP), is fundamentally wrong as a matter of law, and violates the known legislative intent of the regulatory regime inherited from Seveso.

Ministers do not have the authority to interpret the law upon a political preference. Neither does the HSE; indeed the HSE is specifically prohibited from “[make\[ing\] regulations or other instruments of a legislative character](#)” [ S.13(5)(c) Health and Safety at Work Act 1974 ]

I have always understood that changes to the law are a matter for Parliament as a whole, and Interpretation is matter for the Courts

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<sup>2</sup> See REP3A-035 pages 43 – 46

9. Specifically, when the Applicant says<sup>3</sup> –

Under the European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP), and the associated enabling legislation in the UK, batteries are classified as articles, rather than substances and are therefore outside the scope of the COMAH and Hazardous Substances Consent

– no legal authority for the reasoning: “*therefore outside the scope*” – is provided. The gist of this argument is that BESS are excluded from the scope of the COMAH and P(HS)Regs 2015 by reason of being “articles” in the scope of the CLP Regulation.

10. Let us therefore examine this argument systematically. In doing so, I am guided by a recent Judgment in the High Court of Northern Ireland, annexed as Annex EF39<sup>4</sup>. The judgment at Para [73] holds:

The starting point for any statutory interpretation exercise is the natural and ordinary meaning of words. A court should consider an enactment as a whole and per Bennion on Statutory Interpretation at 21.2:

*“Given the presumption that the legislature does nothing in vain, the court must endeavour to give significance to every word of an enactment. It is presumed that if a word or phrase appears, it was put there for a purpose and must not be disregarded”.*

Any educated person, whether legally trained or not, may read the law taking “*the natural and ordinary meaning of words*” as their starting point, and ensure that “*every word of an enactment*” is considered, not disregarding any relevant “*word or phrase*”.

### **BESS cells in the scope of the CLP Regulation**

11. It is not the case that BESS cells are “articles” in the scope of the CLP Regulation.

(i) The CLP definition of an “article” (Article 2, Definition 9) reads:

‘article’ means an object which during production is given a special shape, surface or design which determines its function to a greater degree than does its chemical composition;

Whilst a layered structure is inherent in the design of most batteries, BESS cells in particular can be, and indeed are, manufactured in a variety of “form factors” (cylindrical, prismatic, pouch etc) even when based on essentially *identical* chemistries. It cannot therefore be the case that their “*special shape surface or design*” determines their function “*to a greater degree than does* [ their ] *chemical composition*”. On the contrary, it is the chemical composition of Li-ion BESS cells

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<sup>3</sup> REP3A-035 page 41, immediately prior to the citation of the Parliamentary Answer

<sup>4</sup> ABO Wind NI Ltd & Energia Renewables Company 1 Ltd vs. Dept for Infrastructure [2021] NIQB 96 (Humphreys J)

that is not only crucial to their function, but whose fine details are the subject of intense commercial competition between manufacturers. Moreover the definitions of a substance (Definition 7) and a mixture (Definition 8) *do not exclude* chemicals that are integral to the function of a structure such as a battery. The CLP Regulation does not define or discriminate between “articles” and “substances” any further than these Definitions, though CLP *does* require consistency with other Regulations and Definitions elsewhere, see below. On these considerations, the CLP Definitions do *not* categorise a BESS cell as an “article”, and do *not exclude* their chemical components from the definitions of a “substance” or “mixture”.

(ii) BESS cells are “*articles with integral substance(s)*” under the REACH Regulation<sup>5</sup>, which recognises that “objects” may be both “articles” *and* “substances or mixtures”, simultaneously, and with which Regulation the CLP Regulation requires consistency. This conforms to the widely appreciated common-sense understanding of the nature of a battery: that batteries contain chemicals essential to their function, even if packaged into a cell not releasing those chemicals in normal operation. The requirement of consistency with REACH is set out in Recital (12) of the Preamble<sup>6</sup> to the CLP Regulation:

The terms and definitions used in this Regulation should be consistent with those set out in Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), with those set out in the rules governing transport and with the definitions specified at UN level in the GHS, in order to ensure maximum consistency in the application of chemicals legislation within the Community in the context of global trade. The hazard classes specified in the GHS should be set out in this Regulation for the same reason.

REACH survives in the UK after EU Exit as “UK REACH”<sup>7</sup> so the basic provisions remain relevant.

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<sup>5</sup> See section 7.5, pages 23 to 26 of Annex EF40 in particular the Table abstracted from Appendix 6 of the ECHA Guidance Note “Guidance on requirements for substances in articles”, Version 4.0, [https://echa.europa.eu/documents/10162/23036412/articles\\_en.pdf/cc2e3f93-8391-4944-88e4-efed5fb5112c](https://echa.europa.eu/documents/10162/23036412/articles_en.pdf/cc2e3f93-8391-4944-88e4-efed5fb5112c)

<sup>6</sup> <https://www.legislation.gov.uk/eur/2008/1272/introduction>

<sup>7</sup> <https://www.hse.gov.uk/reach/about.htm>

(iii) In the same Recital, the CLP Regulation also commits to international consistency<sup>8</sup>, and to definitions at UN Level. The UN Globally Harmonised System (GHS) (on which the CLP Regulation is founded<sup>9</sup>) discriminates “substances” and “articles” according to the Hazard Communication Standard (HCS) of the Occupational Safety and Health Administration (OSHA) of the USA<sup>10</sup>. Under explicit rulings from OSHA<sup>11</sup>, Li-ion batteries, other than consumer items, “**cannot be considered articles**”. BESS cells of course are never sold as “consumer items”. As a consequence of the OSHA ruling, Li-ion BESS cells in the US market are required to be offered with Materials Safety Data Sheets (MSDS) and to be labelled with appropriate hazard class warnings, as with any other chemical or material supplies. It is therefore not possible to categorise BESS cells as “articles” under the CLP Regulation when UN definitions, and practice in the USA, explicitly reject this categorisation. To do so would immediately violate the requirements (contained within Recital (12) of the CLP Regulation itself) of consistency with UN definitions, and practice internationally, in at least one major foreign country.

12. Hence Li-ion BESS cells in the scope of the CLP Regulation are either:
- i. “substances or mixtures” by the CLP Definitions, or:
  - ii. “articles with integral substance(s)” by the REACH definitions, with which the CLP Regulation itself requires consistency, and:
  - iii. “cannot be considered articles” under the UN GHS definitions and the OSHA ruling, with which the CLP Regulation again requires consistency.

Under no reading is it possible to categorise BESS cells simply as “articles”. The Applicant’s claim that “**batteries are classified as articles**” is therefore simply wrong, even if the DWP makes the same error.

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<sup>8</sup> See also Recitals (4), (5) and (6) in particular.

<sup>9</sup> Made explicit in Recitals (5) and (6)

<sup>10</sup> See Article 1.3.2.1.1 of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS). 8<sup>th</sup> revised edition, 2019. ST/SG/AC.10/30/Rev.8 Sales No. E.19.II.E.21 ISBN 978-92-1-117199-0 [https://unece.org/fileadmin/DAM/trans/danger/publi/ghs/ghs\\_rev08/ST-SG-AC10-30-Rev8e.pdf](https://unece.org/fileadmin/DAM/trans/danger/publi/ghs/ghs_rev08/ST-SG-AC10-30-Rev8e.pdf)

<sup>11</sup> Annexed as Annex EF41

## Scope of the COMAH and P(HS)Regs 2015

13. The scope of the CLP Regulation is in any case irrelevant to the defined scope of the COMAH and P(HS)Regs 2015. On the contrary, both Regulations explicitly *include*: “dangerous/hazardous substances which are not covered by the CLP Regulation, including waste,” (which frequently contains or even consists wholly of “articles”). See: Schedule 1, Part 2, Note 5, COMAH Regs 2015; and the parallel provisions in Schedule 1, Part 4, Note 6, P(HS)Regs 2015

14. The key “loss of control” provisions in the COMAH Regs 2015 contain no restriction whatsoever regarding the nature of the “installations” *before* the loss of control has occurred. It is sufficient that “dangerous substances” listed in Parts 1 or 2 of the Schedule be “generated during loss of control of the processes” – as it is certain that they are, in the case of Li-ion BESS cells in thermal runaway.

15. The “loss of control” provisions in the P(HS)Regs 2015 in Schedule 1 Part 3 do refer to “substances”, but the definition of “substance” is extremely broad (“raw materials, products, by-products, residues or intermediates”) and not referenced to the CLP Regulation, whose Definitions anyway do *not* exclude “substances” which may be “integral” to an “article” (as in the REACH categorisation). It would also be inconsistent with the known legislative intent of Seveso to read the “loss of control” provisions in Part 3 of the Schedule to the P(HS)Regs any *less* widely than the unambiguous scope of the “loss of control” provisions in the COMAH Regs. On the contrary, it is clear that the P(HS)A 1990 and P(HS)Regs 2015 in several respects intended to go *beyond* the requirements of Seveso.

## Lack of any legal authority excluding BESS cells from COMAH or P(HS)Regs

15. After months of diligent study of both the COMAH Regs 2015 and the P(HS) Regs 2015, I have been unable to find any legal authority that excludes BESS from the scope of COMAH and the P(HS)Regs. There is no ground at all for the phrase: “therefore outside the scope of COMAH etc” asserted by the Applicant. I would invite the Applicant to cite the exact clause or authority, be it in:

- (i) statute,
- (ii) regulation, or
- (iii) a decided case in the Courts,

– which *excludes* BESS from the scope of COMAH and the P(HS)Regs 2015. Unless there is an authority of which I am unaware, the claimed “exemption” for BESS is mere assertion, and thus unsustainable at law.



## **Implications for the Examination**

16. Therefore, I stand by the argument made in my WR and PHS to ISH1, that the BESS components of Sunnica almost certainly require HSC, as a legal obligation enforceable ultimately by criminal sanctions.

17. Similarly, the BESS components of Sunnica should be regulated as a COMAH site by the COMAH Competent Authority.

18. At the Planning stage, under the NSIP process, the policy requirements in NPS EN-1 require a safety appraisal from the COMAH CA which has not been provided, and constitutes an irreparable defect of the Application.

## **Detailed paper submitted in evidence for Judicial Review application**

19. A detailed analysis of the wording of the Regulations has already been made in a paper co-authored with Mr Pat Swords FIChemE PPSE and annexed as Annex EF40. This paper contains much further detail on the above considerations and should be consulted for the detailed reasoning behind the summaries presented above.

20. As with my Annex EF16, I acknowledge the contributions of Mr Swords as a matter of personal and professional courtesy. However as Mr Swords is not a Party at this Examination, I take full responsibility for the content.

21. I am more than usually indebted to Mr Swords for the benefit of his very extensive experience as a chemical engineer working across multiple EU jurisdictions installing large scale chemical plant with full attention to regulatory compliance. As a Professional Process Safety Engineer (PPSE), a specialist credential of the Institution of Chemical Engineers (IChemE), he is a significant expert on the workings of the regulatory regime derived from the Seveso Directive.

22. As an example of Mr Swords' deep expertise in regulatory law regarding major accident control, his published paper is annexed as Annex EF42 outlining his experience in implementations of the regulatory law deriving from the earlier "Seveso II Directive" of the EU.

23. The paper annexed as EF40 (Fordham and Swords) has been in the public domain since May 2022 on the preprint server *Research Gate* and has over 400 "reads", a very high number for such a detailed and specific analysis. The paper was written, and submitted in evidence, for an application for Judicial Review in the High Court of Northern Ireland, on a case involving the HSE(NI), where a BESS Planning Application was not treated as a COMAH site. For this reason, the paper refers largely to the Northern Irish COMAH and Hazardous Substances Regulations; however although made under different Statutory Instruments these Regulations are

identical in substantive content to the Regulations applicable in England<sup>12</sup>. Both being derived from Seveso, it is inevitable that this should be so.

24. The outcome of the Judicial Review application was that the application was withdrawn on Counsel's advice after it became clear that the case was "out of time" from the date at which the judge was prepared to agree was the decision date. Therefore, the substantive issues raised in the case have never been adjudicated (to my knowledge) by any Court in any United Kingdom jurisdiction.

25. However, being submitted in the bundle of evidence in the Application, it is inevitable that the paper Annex EF40 will have been scrutinised in detail by the HSE(NI).

### **Divergence between the position of HSE in Great Britain and HSE(NI)**

26. It is clear from the multiple letters from HSE(NI) cited in my WR and annexed as Annexes EF29 to EF33, that the HSE(NI) does now in principle accept that:

"Large scale battery facilities, also known as BESS (Battery Energy Storage Systems) have the potential to require a Hazardous Substance Consent and be subject to the COMAH Regulations"<sup>13</sup>

27. This contradicts irreconcilably the position reported by the DWP as derived from HSE (Great Britain) in the Parliamentary Answer<sup>14</sup>. The COMAH and Hazardous Substances Regulations in Northern Ireland are substantively identical to those applicable in England. Hence the HSE(NI) and the DWP have taken diametrically opposite positions on materially identical enactments. It is impossible to reconcile these divergent positions. Not more than one can be legally correct.

28. The above considerations (Paras. 9 to 27), detail the reasons for my conviction that the position taken by the DWP, and relied upon by the Applicant, would not be sustainable at law.

(3563 words)

EJF 16/12/22

Updated list of Annexes referred to follows; Annexes uploaded separately

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<sup>12</sup> The Common Framework document Annex EF3 acknowledges that regional divergence is technically possible following EU Exit however no such regional changes have been made to date.

<sup>13</sup> Annex EF29

<sup>14</sup> Annex EF38

**List of Annexes referred to: –**

Post-Hearing submission: ISH2  
of 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

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

EF38 – Parliamentary answer, Mims Davies MP for the Dept for Work and Pensions

EF39 – ABO Wind NI Ltd & Energia Renewables Company 1 Ltd vs. Dept for Infrastructure [2021] NIQB 96 (Humphreys J)

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.