Comments on Applicant Submissions at Deadline 6 : Dr Edmund Fordham

Dated: 3rd March 2023

Annexes EF49 through EF53 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)

COMMENTS (at Deadline 7) on Applicant Deadline 6 Submissions

EurIng 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 7 (3 March 2023). They are responses to the following document:

8.86 Applicant's Response to other parties Deadline 5 submissions
EN010106/APP/8.86 30 January 2023 REP6-036

Conventions for colour highlighting:

Quotations from legislation are shown in blue

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

Quotations from Applicant are shown in ochre

Quotations from Government Statements are shown in green

SUMMARY

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

1. My position on major accident prevention has been misrepresented. What I do contend is that catastrophic events must be prevented by rigorous safety engineering proportionate to the scale of the worst credible accident hazard otherwise presented. It is for the Applicant to demonstrate such rigorous measures but has not done so. I also contend that the larger the total system, the greater the level of hazard presented by uncontrolled accidents, and the more likely it is that a failure will be initiated somewhere. This is an inevitable consequence of the thermal runaway phenomenon.

2. The Air Quality Assessment Appendix 16D remains not credible. Out of date sources have been used and the results are wholly at variance with the sources and reference case now offered routinely by HSE(NI) in BESS appraisals deriving from a highly-regarded firm of consulting engineers.

3. The Beijing incident remains critically important to note as an example of fire and unsuspected explosion in a BESS using cells of the LFP type, widely regarded as “safer”, and which resulted in two fatalities. Moreover the cabin-to-cabin escalation of the incident appears to have been the result of an electrical surge mechanism, rather than by direct thermal propagation. “Safety separations” between cabins will not help prevent accident escalation involving electrical propagation routes, which require additional safety engineering to safeguard.

4. As noted elsewhere, the fire suppression systems and water supplies proposed for the Sunnica BESS are simply inadequate.

5. Toxic emissions are required to be considered collectively in making determinations of liability for COMAH notification (or HSC) using the Aggregation Rule. The toxicology of Inhalable Nickel Oxides is not open to debate having its own Hazard Phrase (H350) and being a Named Dangerous Substance under Part 2 of the COMAH Regs 2015 with a stringent Qualifying Quantity. Generation of Inhalable Nickel Oxides is now a recognised hazard of Li-ion battery failures, as publications from the HSE’s own Research Division show.

6. It is readily conceivable that a BESS accident in a single cabin of the size proposed for Sunnica could result in QQs of Inhalable Nickel Oxides being generated in loss of control. This would make such BESS “upper tier” COMAH sites on those grounds alone if NMC cells are deployed;

7. It is open to the Applicant to show by engineered control measures that that exceeding the QQs is not “reasonable to foresee” in loss of control accidents, but they have not done so;

8. The SoS appears currently non-compliant with his duties under R.24(1)(b) P(HS)Regs 2015 but can discharge his duty by considering the "Article 13(2) matters" (siting, safety distances, and protection of areas of natural sensitivity) within the Examination. This however would require the "full consequence model" that the Applicant insists will only be forthcoming post-consent. There is no doubt that Hazardous Substances controls are a proper spatial Planning matter, as evidenced in recent Policy papers presented to Parliament by the DHCLG, and failing to consider these issues would be procedurally improper.

9. The Applicant helpfully rehearses the background to the COMAH Regs 2015, the P(HS)Regs 2015 and the P(HS)A 1990, although I have already done so elsewhere in the Library. In particular the loss of control provisions in both the COMAH Regs 2015 and in Part 3 of the P(HS)Regs 2015 are acknowledged.

10. The Applicant however confuses the obligations arising from such Regulations (which are continuing ones) with clear Policy provisions within NPS EN-1 for consideration of both aspects. With regard to HSC, Policy is clear that seeking HSC post-consent is allowed but that "details in their DCO" must be provided. Similarly Policy is clear that the SoS must receive an "assessment" *from* the COMAH CA that the "inherent features of the design are sufficient to prevent, control and mitigate major accidents". The Application remains non-compliant with both Policy requirements.

11. I believe the Applicant also confuses the required "assessment" (which is analogous to that required *from* the COMAH CA in applications for HSC determined by LPAs) with the Major Accident Prevention Policy and the Safety Report required *from the operator* under Rs. 7 and 8 COMAH Regs 2015.

12. The COMAH CA comprise the HSE plus the EA "acting jointly". Either agency acting separately does not constitute the COMAH CA.

13. After the ample evidence submitted regarding Hazardous Substances generated in loss of control accidents, the Applicant's contention that neither HSC obligations nor COMAH obligations can be determined at the present time is unsustainable. The burden of proof regarding COMAH notification lies firmly with the operator, which at the Planning stage can only mean the Applicant seeking Development Consent to build the system, and operate it. Having established from the technical literature that *prima facie* both HSC and COMAH notification are legal obligations, it lies with the Applicant to refute those technical considerations.

14. The loss of control provisions in COMAH Regs 2015 and in Part 3 of the P(HS)Regs 2015 differ. A separate Controlled Quantity definition in Part 3 P(HS)Regs 2015 makes no reference to control measures, but in the COMAH Regs 2015 policy and practice in other UK and EU jurisdictions allows measures to control the spread of accidents to be considered in what is "reasonable to foresee"

concerning “loss of control” accidents. It has always been open to the Applicant to demonstrate sufficient Process Safety Engineering that renders accidents at certain scales not “reasonable to foresee” but the Applicant has simply not done the necessary Process Safety Engineering. Absent which, the *prima facie* case that COMAH notification is an obligation remains.

15. The ExA cannot proceed on the basis that COMAH notification is *not* required, because that risks exposing an improper process of subsequently it is determined that COMAH notification *is* an obligation, which appears highly likely. My prior submissions have demonstrated the necessary technical appraisal extensively.

16. The main conclusions must be that the Application is (i) non-compliant with requirements in NPS EN-1 for obtaining HSC “post-consent”, because the “details in the DCO” are not provided, and (ii) non-compliant with the requirement for a safety “assessment” from the COMAH CA to be received, prior to the SoS making his decision, or the ExA advising the SoS appropriately.

17. In addition to the lack of a “full consequence model” (item 8 above) the non-compliance with clear Policy requirements in NPS EN-1 means that the Application is defective and should be rejected.

(Summary 1052 words)

EJF, 03/03/23

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
DS	– Dangerous Substance (as defined in the Schedule to COMAH Regs 2015). Usually synonymous to HS
GHS	– Globally Harmonised System (see UN GHS)
HS	– Hazardous Substance (as defined in the Schedule to P(HS)Regs 2015). Usually synonymous to DS
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

(continued)

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
IPC	– Infrastructure Planning Commission (now abolished)
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
EV	– Electric Vehicle
GCMS	– Gas Chromatography Mass Spectrometry
IChemE	– 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
PM	– Particulate Matter
$PM_{2.5}$	– Particulate Matter of diameter less than 2.5 μm
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

(continued)

GLOSSARY (cont.)

Chemical substances:

CH_4 – Methane
C_2H_4 – Ethylene
C_2H_6 – Ethane
CO – Carbon Monoxide
CO_2 – 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_2O – Cuprous (or Copper (I)) Oxide
H_2 – 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_2O_3 – diNickel triOxide
POF_3 – 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

(continued)

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 *power*, i.e. *rate* of transfer of *energy*

MWh – megawatt-*hour*, or one million watt-hours, a unit of *energy* e.g. the *energy* transferred by a *power* of 1 MW acting for 1 *hour*

m^2 – square metre (area)

ha – 1 hectare = 10,000 m^2

MWh ha^{-1} – energy storage density (on the land) in the BESS compounds, as MWh energy storage capacity, per hectare of land allocated

MWh / tonne or MWh $tonne^{-1}$ – energy density of the BESS cells themselves, as MWh energy storage capacity, per tonne of cells

Wh / kg or Wh kg^{-1} – 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 $(Wh)^{-1}$ – 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

$\mu g\ m^{-3}$ – trace concentrations of highly toxic gases, in micrograms of toxic contaminant per cubic metre of air

μm – 1 micrometre or 10^{-6} metre

Scope and Purpose of these Comments

1. These Comments respond to the following submissions by the Applicant:

8.86 Applicant's Response to other parties Deadline 5 submissions EN010106/APP/8.86 30 January 2023 REP6-036

The sections dealing with my submissions are in pages 63 – 73 and refer to my submission ("Comments on Applicant Submissions by Deadline 4") now indexed as REP5-093. Previous submissions by me are indexed in the footnote[1], and have since been supplemented by my submissions at Deadline 6 (Comments on applicant submissions at Deadline 5) and two further Annexes EF47 (REP6-083) and EF48 (REP6-085) whose receipt post-dated Deadline 6 and could not therefore be submitted at that Deadline.

2. Much of the debate on these issues consists in a disagreement as to what the law requires. In my prior submission REP5-093, I made a formal request for an Issue-Specific Hearing (ISH) on the regulatory law should there be any doubt in the ExA as to what the law requires, in the interests of advising the SoS on a lawful decision. This has not so far happened.

3. In my oral submissions at OFH2 I also made a clear request for the involvement of the HSE (or the COMAH Competent Authority) within the Examination on matters concerning BESS safety. This has not so far happened.

4. Much of the confusion could potentially be resolved by items 2 and 3. Absent which, these Comments attempt to deal with the Applicant's latest submissions in REP6-036.

[1] a. Post-Hearing Submission (PHS) on ISH1 on the draft Development Consent Order (dDCO), requesting a declaratory clause on Hazardous Substances Consent (HSC) (REP2-082a);
b. Written Representation (WR) on Hazardous Substances Consent (HSC) for the BESS components (REP2-129);
c. Comments on the Applicant's Responses to Questions from the ExA, on BESS safety issues; (REP3A-046);
d. PHS on ISH2 on Ecology and Biodiversity, on local microclimate changes (REP4-086);
e. PHS on ISH3 on BESS Safety, Consenting and regulation under the COMAH Regulations 2015 (REP4-089);
f. PHS on my contributions at Open Floor Hearing 2 (OFH2) on need for HSE involvement (REP4-083);
g. Comments at Deadline 5 (REP5-093);
h. Comments at Deadline 6 ;
i. Technical Annexes in support of the above Annex EF1 through to EF44. Examination Library references:
EF1 to EF11 : REP2-082b to REP2-082l EF12 to EF33 : REP2-129a to REP2-129u
EF34 & EF35 : REP3A-047 & REP3A-048 EF36 & EF37 : REP4-087 & REP4-088
EF38 to EF42 : REP4-090 to REP4-094 EF43 & EF44 : REP4-084 & REP4-085

8.86 Applicant's Response to other parties Deadline 5 submissions EN010106/APP/8.86 30 January 2023 REP6-036 – pages 63 to 73

5. "A fundamental issue is that Dr Fordham is considering a catastrophic event to be inevitable, which it is not." (Page 63 para. 1).

I enter formal objection to be being misrepresented in this way.

6. I made no such claim. What I do claim is that catastrophic events must be prevented by rigorous safety engineering proportionate to the scale of the worst credible accident. In particular cabin-to-cabin escalation of BESS accidents must be prevented by engineered control measures that are either "inherently safe" or sufficient in depth to render such escalation reasonable to exclude as a possibility. So long as cabin-to-cabin escalation cannot reasonably be excluded, there is no clear mechanism to stop accidents progressing from one cabin to another, without obvious limit. Such uncontrollable escalation would indeed lead to catastrophe, which is why the issue of rigorously tested engineering control measures are central.

7. It is for the Applicant to show sufficient engineered control measures rendering cabin-to-cabin escalation "reasonably excludable". No such control measures have been shown and a fixed design would be required to do so. So long as the Applicant refuses to provide a design, there is no possibility of demonstrating the adequacy of such engineering controls. Until they do, the possibility of very large scale accidents cannot reasonably be excluded. Cabin-to-cabin escalation is a demonstrated fact in prior experience. Fires in isolated BESS of small energy storage capacity report from eye-witnesses "flames up to 75 feet in length" (two cases in Annex EF21[2]) suggesting *a priori* that very wide separation distances would be required to guarantee safety by thermal escalation mechanisms.

8. What I do contend is that single-cell failures are inevitable somewhere, sometime. The probability of such a single-cell failure increases in direct proportion to the number of cells in the total system, and in a system of the size presented by the Sunnica BESS such single-cell failures are likely to be common, depending on Quality Controls achieved in manufacture, and documented times to failure. Again since the Applicant refuses to provided quantitative details, no quantitative estimates can be made. What is clear however is that the probability of a failure somewhere, sometime, increases proportionately to the number of cells.

9. A major accident can be initiated even by failure in a single cell, as shown in forensic detail in the report on the 2019 Arizona explosion (Annex EF11). Hence the measures taken to prevent (or restrict to an inconsequential level) thermal runaway events must become the more stringent, the larger the total system becomes. This is for two reasons (i) the probability of an initiating event somewhere increases in proportion to the number of cells (ii) the consequences of an uncontrolled major accident increases in proportion to the stored energy capacity.

10. The above considerations would be obvious in any responsible Process Safety Engineering and should have been properly considered. They have not been.

[2] Reports to the Arizona Public Service Commission, REP2-129j

11. Given the unprecedented scale of the BESS proposal (2400 MWh, corresponding to some 15,000 tonnes of high-technology functional chemicals over the establishment), the failure to demonstrate rigorous safety controls *before* bringing this proposal to Examination represents irresponsibility of a very high order.

Air Quality Assessment 16D and prior consents

12. I stand by my rejection of the Air Quality Assessment 16D. Contrary to the Applicant's assertions, there is very good reason to suppose that the Cleve Hill Examination failed to take into account all the evidence, not least being the use of a completely out of date lab report to inform the estimate of total HF emissions when a much more comprehensive peer-reviewed paper by the same authors was in the literature (Annex EF15). As previously remarked, the first business in evaluating any engineering estimation must be: "Are the quantities about right ?". As shown in REP3A-046 and REP4-089, the values taken for the total HF emissions are wrong by as much as a factor of 500. Again this depends on what cases are considered, which with the Applicant is a continual shifting sand. But if approximate figures produce results so widely at variance with figures elsewhere, it is quite impossible to take the model seriously, whatever the secondary assumptions made concerning dilution rates.

13. It is also hard to believe that any ExA can realistically possess the necessary subject-matter expertise to evaluate all aspects of a highly specialised field (air pollution modelling and plume dispersal) in addition to their considerable responsibilities for the other Planning matters. It would indeed be unreasonable to expect any panel to possess such a wide range of technical expertise, which is why engineering safety matters are rightly assigned to statutory regulators.

14. What has been subsequently provided (by me) is the modelling by Atkins, a top-flight engineering consultancy, for HSE(NI), with completely different conclusions for its reference case. This is already in the Examination Library as Annex EF28 and has been cited multiple times. Further repetition would be tedious.

15. "There is no scope at this stage of the process to undertake a new assessment in the way that Dr Fordham would like, and indeed the data required is not currently available." (Page 64)

I agree with this comment. A new and more comprehensive accident analysis is indeed required, but without a fixed design supported by actual test data it cannot be done. Indeed it would not possible or realistic in the timescale of the Examination.

The consequence of this must be that the Applicant has simply failed to provide a credible Air Quality Assessment, even on an illustrative basis.

The Beijing fire and explosion with two fatalities

16. This incident (Annex EF13) is noteworthy for two reasons. (i) It occurred in a LFP BESS system, sometimes declared as "safer" from the thermal runaway risk; however the likelihood of Vapour Cloud Explosion (delayed ignition and explosion) as opposed to instantaneous ignition (immediate fire) is higher with LFP cells than with NMC, simply because the cathode collapse in thermal runaway occurs later and at higher temperatures. This is explained by Professor Christensen in his Annexes to the submissions of the SNTSAG. (ii) In the Beijing incident, the fatalities occurred in a surprise explosion in a cabin spatially remote from the original fire, and the report suggested an electrical propagation mechanism, not a thermal one.

17. In spite of the Applicant's protests, the detailed design of the Beijing BESS is not relevant. What is relevant is that (i) LFP BESS do indeed suffer thermal runaway, fires, and Vapour Cloud Explosions, and (ii) an electrical mechanism for cabin-to-cabin escalation appears to have been responsible for the explosion and fatalities in the second cabin.

18. The Applicant's contrast with:

"… a state of the art BESS compound with safety designed in from the start – including the largest separation distances between cabinets seen in the UK to date, plus a full suite of fire suppression systems, and access for emergency services considered from the outset" (page 64, para 2)

… is a noble-sounding objective, but all of these features still have to be designed, and proven by test. They have not been.

19. The separation distances proposed may or may not be adequate. No dimensions are given. Flame lengths up to 75 feet have already been cited from two independent cases in Annex EF21[3]. Elsewhere (Answer to Qu 1.1.28 discussed in my REP3A-046, page 20), the Applicant proposed the *reverse* operation of bunching BESS cabins immediately adjacent separated only by fire walls of 1 – 2 hours fire resistance when BESS can last for much longer, an extraordinarily irresponsible proposal. These comments cannot be taken seriously, when such extreme shifts in the proposal occur continually in the Examination.

20. Separation distances are irrelevant if the cabin-to-cabin escalation takes place by an electrical surge mechanism as appears from published reports to have occurred in Beijing. The Applicant may like to say that this "would not happen here" but this is an empty protest, absent demonstrated engineered control measures to exclude the possibility. Electrical surge mechanisms remain an accident escalation mechanism of proven possibility (it happened) and nothing to prevent it happening again (once more, the Applicant provides no details).

21. The "full suite of fire suppression systems" has not been specified and adequate quantities of water have not been planned for. Professor Christensen

[3] REP2-129k, see also para. 7 herein and footnote 4

(Annexes to SNTSAG submissions) has pointed out that whilst water sprinkler systems have been shown to be helpful in thermal runaway accidents or fires in LFP cells, they have also been shown to be ineffective at control of fires in BESS using metal-oxide cathode chemistries (of which the alternate proposal of NMC is one). I am aware of no proposal within this Examination for any adequate fire suppression for thermal runaway events in cells using metal-oxide cathode chemistries, and no proposal for adequate water supplies based on supplies actually used in previous BESS accidents. The Applicant has demonstrated no capacity to learn from prior experience in the industry, and indeed has disregarded it.

22. These points were made already in my PHS after ISH3 (REP4-089) including the complete inadequacy of the proposed water tanks. The Applicant has chosen not to engage with these technical matters but they remain critical to site safety.

Toxic Emissions and Inhalable Nickel Oxides (pages 64 – 65)

23. The Applicant evades the central point, which is that all toxic gases and smokes should be addressed, but have not been. Hydrogen Cyanide is a known plastics fire hazard and caused significant operational concern and difficulty in the Arizona incident (Annex EF11 and Annex EF12). Inhalable Nickel Oxides are an increasing item of concern in Electric Vehicle fires and have been shown to be transported long distances (Annex EF26). Annexed as new Annex EF49 is a recent paper published by the HSE's own research division[4] on the generation of metal-oxide dusts as "near-field residues" from burning Li-ion batteries. To claim that metal-oxide dusts are not a recognised hazard from Li-ion cell failure is unsustainable.

24. A second reason for evaluating all reasonably foreseeable toxic emissions is that in evaluating obligations for HSC, or COMAH notification, it is essential to consider in loss of control accidents all Health Hazards together, and all Physical Hazards together, and all Environmental Hazards together, applying the Aggregation Rule of Schedule 1 Part 3 Note 4 of the COMAH Regs 2015 and the parallel provisions in the P(HS)Regs 2015. This practice is now clearly endorsed by HSE(NI) as exemplified in my post-deadline submission (received one day post Deadline 6) in Annex EF48 (REP6-085).

25. This was the procedure followed scrupulously in my Annex EF16 with Professor Sir David Melville CBE which has been in the Library[5] for some time. If an Interested Party can pursue this exercise, an Applicant with much greater resources – and a clear idea of what is proposed – should be able to do so. Yet nothing comparable has been produced by the Applicant.

26. The detailed toxicology of Inhalable Nickel Oxides is not open to debate. This has been considered elsewhere and the such Inhalable Nickel Oxides are a Named Dangerous Substance in Part 2 of the Schedule to the COMAH Regs 2015 (and similarly in Part 2 of the Schedule to the P(HS)Regs 2015). They have a Hazard Phrase "H350" meaning carcinogen by inhalation. Details were given long ago in Table 12 of my paper with Sir David Melville Annex EF16[6].

27. Moreover Inhalable Nickel Oxides have an extremely stringent Qualifying Quantity for COMAH notification, reflecting their known toxicological hazard. This is a very low 1 tonne, which if exceeded in a reasonably foreseeable BESS accident would make the site an "upper tier" COMAH site on those grounds alone (but should be aggregated with all other Health Hazards using the Aggregation Rule for a formal appraisal of COMAH notifiability even if falling below the 1 tonne threshold). This is a

[4] Buston, J.E.H. et al (2023) "Experimental determination of metals generated during the thermal failure of Li-ion batteries" *Energy Advances* **2**, 170 (Royal Society of Chemistry)
[5] REP2-129e
[6] See page 40 of Annex EF16 (REP2-129e)

particular concern for NMC cells (one of the two types stated by the Applicant to be under consideration).

28. BESS cells of the NMC type may have variable cathode chemistry depending on supplier. Typical compositions have been cited for one BESS within Annex EF16[7] and also Annex EF22[8] but could easily amount to several tonnes per cabin (again depending on cabin size, exact cell type, and similar details that the Applicant continually refuses to provide). The figure of 0.726 tonnes per MWh is given for the Nickel Oxides incorporated as nanoporous material in the cathodes. In a 5 MWh BESS this corresponds to 3.63 tonnes of Nickel Oxide, well in excess of the Qualifying Quantity for "upper tier" COMAH even if less than one third of the cathode material were converted to "black smokes" in a thermal runaway accident.

29. The published work in Annexes EF16[9], EF24[10] and EF26[11] (especially in the paper of Essl *et al.,* Annex EF24[12]) shows that large conversion of collapsing cathodes into "black smokes" is typical. Hence the conversion of cathode material into a Qualifying Quantity of Inhalable Nickel Oxides is readily foreseeable in a loss of control accident.

30. It must also be recognised that the cell type "NMC" itself covers a variety of detailed stoichiometries – the proportions of Nickel, Manganese and Cobalt (oxides) are not precisely defined and may vary between manufacturers seeking competitive advantages. In particular, increasing the proportion of Nickel Oxide relative to the other oxides is entirely possible though the cell type would still be described as "NMC". An example is shown in new Annexes EF50, EF51 and EF52 where the precise composition of the "NMC" cells in a BESS in Northern Ireland changed between the original application and the BESS as constructed. On the basis of a critique by HSE(NI) (Annex EF52) the Local Planning Authority rejected the change as a Non-Material Change and is currently undertaking enforcement actions.

31. The revised composition figures in Annex EF50 report ratios of Nickel Manganese and Cobalt Oxides in a 8:1:1 proportion, changed from the previously declared 1:1:1 proportions[13]. This is obviously a considerable increase in the weighting of Nickel Oxides. The letter from HSE(NI) (Annex EF52) quotes 3.131 tonnes of Nickel Oxide per container. The note by Jensen Hughes Annex EF51 implies from the details supplied a container of 3.165 MWh. These correspond to 0.989 tonnes per MWh. At 5 MWh there would be 4.95 tonnes Nickel Oxide, an increase on the estimate in para. 28 above. Only a fifth of this inventory would be

[7] See Table 7 page 35 of Annex EF16 (REP2-129e)
[8] Technical Memorandum by Golder Associates for a BESS Applicant in Northern Ireland, Annex EF22 (REP2-129k)
[9] REP2-129e
[10] REP2-129m
[11] REP2-129o
[12] REP2-129m
[13] See Table 7 in Annex EF16 (REP2-129e) and also Annex EF22 (REP2-129k)

needed to be converted into “black smoke” Inhalable Nickel Oxides in a reasonably foreseeable loss of control accident for this to be an “upper tier” COMAH site.

32. Recall this would an accident in a single 5 MWh BESS cabin. Multi-cabin accidents would of course have the potential to generate more Inhalable Nickel Oxides.

33. It bears repetition that *containment* measures are irrelevant to both HSC obligations and to COMAH notification. The Regulations requires Consents, or Notification, based on *presence* of hazardous/dangerous substances alone, or their *generation* in reasonably foreseeable loss of control accidents. The likelihood of *release* is not a consideration in determining the obligation to seek HSC, or make COMAH notification. Even if it were possible show that all generated Inhalable Nickel Oxides were certain to remain within the cabin structure (unlikely in a fire or explosion accident), that would make no difference to the legal obligations to seek HSC or make COMAH notification.

34. *Prima facie*, it is clear that if using NMC cells (and the Applicant declares they are under consideration), Inhalable Nickel Oxide generation would be the leading concern creating a HSC/COMAH obligation on the operator, is readily foreseeable at the present (i.e. Planning) stage.

35. Absent sufficient layers of engineered control measures rendering such accidents “not reasonable to foresee”, it is impossible for the Applicant to declare that COMAH notification is undetermined at present. The concern raised on the basis of publicly available technical data and estimates requiring no more than simple arithmetic are that BESS cabins of the size proposed could easily generate Qualifying Quantities of Inhalable Nickel Oxides. That makes a single cabin an upper tier COMAH site if NMC cells are used.

36. An illustration of the principles adopted by HSE(NI) has been submitted in my Annex EF48 (REP6-085) where is clearly stated that:

The Applicant can demonstrate that it is unreasonable to foresee such a loss of control scenario could occur as a fire involving enough BESS containers would be prevented by the layers of protection from:

- Battery control systems
- Fire detection and suppression systems
- Enclosure design
- Separation distances between BESS system

37. The fact that the Applicant consistently refuses to provide detailed designs with the engineered control measures proposed, and validated by tests, makes it impossible for the Applicant to demonstrate that such loss of control accidents are “*not* reasonable to foresee”. In principle the Applicant could demonstrate that control measures would make it “reasonable to exclude” the possibility of exceeding the

Qualifying Quantities but has failed to demonstrate any such measures. Once more, a detailed design is needed, supported by proper engineering tests.

Lack of a full consequence model (page 65)

38. As in my REP5-093, the "full consequence model" is exactly what is demanded by the specific requirement in P(HS)Regs 2015 for any National Policy designated under S.5(1) PA 2008 to consider:

> R.24(1)(b) the matters referred to in Article 13(2) of the Directive[14] (with the reference in sub-paragraph (c) of that paragraph of that Article to Article 5 being read as a reference to regulation 5 of the Control of Major Accident Hazards Regulations 2015).

– the "matters" in Article 13(2) being

> 2. Member States shall ensure that their land-use or other relevant policies and the procedures for implementing those policies take account of the need, in the long term:
>
> (a) to maintain appropriate safety distances between establishments covered by this Directive and residential areas, buildings and areas of public use, recreational areas, and, as far as possible, major transport routes;
>
> (b) to protect areas of particular natural sensitivity or interest in the vicinity of establishments, where appropriate through appropriate safety distances or other relevant measures;

39. The Secretary of State is under a duty to ensure that designated National Policy Statements take the "Article 13(2) matters" (spatial siting of establishments) into account. NPS EN-1 dates from 2011 and does not appear to list the "Article 13(2) matters" explicitly. Indeed since the Directive itself dates from 2012 it would be impossible for the 2011 NPS to have considered the "Article 13(2) matters" in exactly those terms. NPS EN-1 has not been revised since the 2015 Regulations created that obligation. Hence the Secretary of State would appear to be currently in default of his obligations under R.24(1)(b) P(HS)Regs 2015.

40. The Secretary of State can discharge his duty only if the "Article 13(2) matters" are properly considered before the decision on a DCO is taken. Yet neither the ExA nor the SoS are in a proper position to consider them in the absence of what the Applicant calls a "full consequence model". I reject the Applicant's contention (page 69) that the issues are outside the scope of the Examination. The SoS is being advised by the ExA on the proposed DCO. The SoS would appear to be currently in default of his obligations regarding a spatial planning matter which is a central issue in the proposal. To dismiss the legal duties on the SoS as "outside the scope" of the Examination, when his duty can obviously be discharged by proper consideration within it, would be very incomplete advice.

41. The Article 13(2) matters are indeed classic spatial Planning matters concerning siting. If foreseeable accident consequences threaten other land use, or areas of particular natural sensitivity (of which there are several in the immediate neighbourhood) then a DCO should only be approved if it can be clearly shown that foreseeable BESS accidents would not have dangers to life, health, property or the natural environment. No such demonstration has been provided and without the "full consequence model" it cannot be.

[14] Defined in R.2(1) to be a reference to the Seveso III Directive "as it had effect immediately before Exit Day"

42. In the recent Policy document Annex EF3 (REP2-082d) from the then DHCLG presented to Parliament in August 2021 the broad policy guidelines relating to hazardous substances (in implementation of the Seveso III Directive) were set out very clearly and distinguish between on-site controls (governed by the COMAH Regs 2015) and the "residual off-site risk":

The latter is primarily the risk of a major accident arising due to the proximity of hazardous substances to other development or sensitive environments (i.e. if there were an accident due to on-site failures, what the risks would be where certain developments or habitats are or would be close by). This latter issue was considered to be a spatial planning matter to be addressed through planning controls.

43. Hence there is no doubt that Hazardous Substances controls are a "spatial planning matter" to considered in Planning decisions, as are the "Article 13(2) matters" which the SoS is required by R.24(1)(b) to take into account.

44. It is simply impossible for the ExA or the SoS to take such matters adequately into account, especially with such a new technology, lacking mature Process Safety Engineering, on such a scale, without the "full consequence model" that the Applicant consistently refuses to provide. Safety distances, or protection of sites of natural sensitivity, are fundamental to the central Planning question as to whether the proposal is an appropriate use of land.

45. The excuse that this is to allow for "the latest technology and safety measures" is empty. *Any* technology will always see incremental improvements. The distinguishing feature of the Sunnica proposal is the unprecedented scale, yet lacking any *proven* safety controls. Adequate controls demonstrated now could reasonable result in a responsible approval of the scheme DCO; superior controls emerging later could of course be allowed for. What the Application lacks entirely is any adequate scheme of engineering control, precisely because the Applicant has stated no stable design.

46. The Applicant appears to regard this by analogy for "outline planning consent" for say a site of 100 houses. The analogy is wholly false, because the appropriateness of a housing estate in the context of other land use can be responsibly determined without detailed designs. We already know how to build houses, and routinely do so, reliably. In the case of grid-scale BESS, we do *not* know how to build or operate safely systems on the scale proposed. Precisely because the technology is rapidly evolving, proposals on this scale should not be consented without first ensuring that safe operation – in the context of the proposed siting – can be guaranteed to the public.

47. Similarly, the analogies made with other much smaller proposals are false ones. Even the Cleve Hill scheme is "only" 700 MWh of BESS storage, less than 1/3 of the Sunnica proposal. Other more local BESS schemes are smaller yet; though presenting widely under-appreciated hazards, they do not present anything like the hazard level involved in the Sunnica proposal. Mature safety engineering is needed now, but has not been shown.

Application of the COMAH Regs 2015, the P(HS)Regs 2015 and P(HS)A 1990 (Pages 66-68)

48. The Applicant rehearses the origins and effects of the COMAH Regs 2015, the P(HS)Regs 2015 and the P(HS)A 1990, as already pointed out in my submissions throughout the Examination Library.

49. I am gratified that the Applicant acknowledges the effect of Part 3 of the Schedule to the P(HS)Regs 2015 and quotes it, as I have already done in my WR and elsewhere. This makes "any substance S used the process" a Hazardous substance, providing only that it be "reasonable to foresee" hazardous substances listed in Parts 1 or 2 being "generated in loss of control of the processes".

50. Since it is not merely "reasonable to foresee" such generation, but certain technical knowledge, this means that the entire inventory of functional chemicals must be considered hazardous substances for the purposes of the P(HS)A 1990. That inventory is around 15,000 tonnes of functional chemicals in the Sunnica BESS. The idea that the Controlled Quantities defined in Column 2 of Part 3 would *not* be exceeded is unsustainable.

51. A recent letter from the DLUHC emphasise the importance of the Part 3 provisions in the P(HS)Regs 2015 and is submitted as Annex EF47 (REP6-083). The endorsement of the DLUHC is clear.

52. I am similarly gratified that the Applicant acknowledges Part 4 Note 6:

6. In the case of hazardous substances which are not covered by the CLP Regulation, including waste, but which nevertheless are present, or are likely to be present, in an establishment and which possess or are likely to possess, under the conditions found at the establishment, equivalent properties in terms of major accident potential, these must be provisionally assigned to the most analogous category or named hazardous substance falling within the scope of these Regulations.

The effect of this is discussed in my Deadline 6 submission.

52. Likewise the Applicant acknowledges the scope and effect of the COMAH Regs 2015 and in particular the "loss of control" provisions in the definitions of "presence of a dangerous substance". These are of course central to the operation of grid-scale BESS, where a leading concern is of course the "loss of control" accidents which have been amply documented from world-wide experience.

53. The Applicant correctly notes the COMAH notification requirements in advance of construction, but the point at issue in the Examination is the requirement for a safety review as part of the process, considered below.

Objection to my contentions in my REP5-093 (page 69) - HSC

55. The Applicant states they are not required to seek HSC at the present time. I agree with this; as it matters stand in NPS EN-1, Footnote 94 states that obtaining HSC "post-consent" is permitted. What however is required are (i) the pre-application consultation with HSE, and (ii) "details in their DCO" .

56. There are no "details in their DCO", so the Applicant is wholly non-compliant with the post-consent provisions given in NPS EN-1, footnote 94.

57. The Applicant protests that "it would be unnecessary, and therefore unlawful, to impose a requirement in the Applicant's proposed DCO to require it to comply with the P(HS)A". This is beside the point, which is not compliance with the Act, but with the Policy, which is certainly a matter to which the ExA is obliged to have regard. Compliance with footnote 94 is required by clear Policy in NPS EN-1.

58. The Applicant is further confused about my contentions regarding the application of the regulatory regime which "do not require what Dr Fordham says they do" (although exactly what is objected to is not specified). I agree the law is quite clear and I have relied only upon current versions of legislation in force on www.legislation.gov and I have not attempted to assert anything beyond what UK law in force requires.

59. The Applicant cannot dismiss the Directive entirely for multiple reasons:

(i) it survives explicitly in the P(HS)Reg 2015, defined in R.2(1) to be a reference to the Seveso III Directive "as it had effect immediately before Exit Day";

(ii) Article 13(2) (which the Applicant asserts "do not help") is absolutely explicit in R. 24(1)(b) P(HS)Regs 2015, cited as such;

(iii) it is referred to as "the retained Seveso III Directive" in the 2021 DHCLG Policy paper Annex EF3 (REP2-082d);

(iv) it is a clear guide to the intentions of the transpositions made in the cited Explanatory Memorandum (Annex EF6 REP2-082g).

60. The Applicant states repeatedly they are not seeking HSC through this process but will apply for it later. This is possible but requires the "details in the DCO" specified in footnote 94 of NPS EN-1. None are provided. The Applicant claims on page 72 that "The suggestion that the Applicant is not compliant with NPS EN-1 is not tenable" but appears not to have noticed footnote 94. The Applicant is indeed non-compliant with NPS EN-1, and obviously so.

61. Elsewhere I have remarked on the legal and administrative chaos that would result with all four Local Authorities being involved in considering related matters, the County Councils discharging fire safety requirements and the District Councils acting as HSAs considering HSC. This would be an unconscionable burden on Councils and the local community which as OFH2 should have made clear is uniformly hostile to the proposal.

62. Finally the Applicant cannot reasonably claim that it is uncertain if HSC is required. Having themselves cited Part 3 of the Schedule to the P(HS)Regs 2015, it should by this stage be very clear that HSC *is* required, and indeed almost inconceivable that it would not be. Hazardous substances listed in Parts 1 and 2 are well-known to be generated in loss of control BESS accidents. This makes the entire inventory of functional chemicals in the BESS hazardous substances under Part 3. I have submitted abundant evidence regarding likely generation of quantities of Part 1 or Part 2 listed substances using the Column 2 definition in Part 3, in my WR (REP2-129) and my paper with Professor Sir David Melville CBE (Annex EF16 REP3-129e). With some 15,000 tonnes of functional chemicals being proposed, the idea that an HSC obligation can be avoided is not seriously sustainable.

63. On pages 72 -73, the Applicant says that they have consulted with the District Councils. They clearly have, but not in their capacity as Hazardous Substances Authorities, nor on the matters of HSC, which is what the HSE advice referred to. Instead, the Applicant dismissed this with the response that "this is a generic comment" and "not relevant to this project". Having themselves now cited the loss of control provisions in Part 3 of the Schedule to the P(HS)Regs 2015, the Applicant should be prepared to revise this.

64. On page 73, the Applicant claims I confuse HSC with development consent. Not so: I remain very clear. From the start (ISH1 on the dDCO) it was necessary to extract from the Applicant whether they were intending to apply for deemed HSC within the DCO (which requires the SoS to consult with the HSE under the P(HS)A 1990) or not. If not, it is clear from abundant evidence submitted that HSC is almost certainly required, and that obtaining post-consent HSC from the HSAs is subject to the Policy conditions in footnote 94 of NPS EN-1. Moreover the DCO then fails to "wrap up all necessary consents" and leaves others to be obtained, but in the present draft does not advertise that essential requirement.

65. It is the compliance with the designated Policy requirement that has not been observed. The line of argument that "we don't know yet if it is required" is unsustainable in the light of the evidence and the well-known properties of Li-ion cells in failure that are amply documented in the technical literature. I have provided such evidence to the Examination ever if the Applicant has not, and indeed dismissed the question of Hazardous Substances as "not relevant to this project" which should by now be recognised as fundamentally wrong.

66. The ExA cannot proceed on the basis that HSC is likely not required because that would be procedurally improper if subsequently determined that it is required after all (which is virtually certain). The DLUHC letter Annex EF47 emphasises the Part 3 "loss of control" provisions and the quantities of chemical sare so large that it is inconceivable that the CQs would not be exceeded.

66. In summary regarding HSC:

(i) it is unsustainable by this stage to contend that HSC is not required or is not determined;

(ii) the Applicant remains wholly non-compliant with footnote 94 in NPS EN-1 because there are no “details in their DCO”;

(iii) nothing in the dDCO alerts anyone to the fact that a necessary consent is *not* “wrapped up” in the DCO;

(iii) the Applicant has of course consulted the District Councils but not as the HSAs and not on the question of HSC nor on the Part 3 loss of control provisions;

(iv) the DLUHC emphasises the importance of the loss of control provisions in decisions on HSC;

(v) the fundamental point is not that HSC is the same as Development Consent (clearly it is not) but that the Development Consent process must take account of Policy provisions in the NPS. The Applicant has not observed them hence the Application is defective.

Objection to my contentions in my REP5-093 (pages 70 - 72) – COMAH Regs

67. The Applicant protests that Section 4.11 of NPS EN-1 does not require a safety report as part of the Application and that COMAH notification requires a safety report only prior to commencement of construction.

68. Once again this confuse the requirements of particular Regulations with the requirements of Policy in NPS EN-1.

69. Section 4.11.4 of NPS EN-1 is crystal clear and concludes:

The IPC should be satisfied that an assessment has been done where required and that the Competent Authority has assessed that it meets the safety objectives described above.

70. Elsewhere in NPS EN-1 (section 1.3 Future Planning Reform) Sect. 1.3.2 explains that:

"Any statement about the IPC in its capacity as an examining body should be taken to refer to the MIPU. Any statement about IPC in its capacity as a decision-maker should be taken to refer to the Secretary of State for Energy and Climate Change in his capacity as a decision-maker. MIPU would have regard to such statements in framing its reports and recommendations to the Secretary of State."

71. If Sect 4.11.4 requires that the IPC must be satisfied that safety report has been done, it is impossible to read this Policy requirement in any other way than that the SoS in his capacity as decision-maker must be satisfied. Moreover the ExA must have regard to this Policy requirement in framing its report to the SoS. This requires that the ExA has sight of the safety report within the Examination, or the Policy cannot be satisfied.

72. The Applicant claims this is not "properly construed" but fails to explain why. Whilst it may serve the Applicant's purpose to read the Policy in some other way, it can only do so by bending the ordinary meaning of words beyond recognition.

73. The appeal to the Rochdale Envelope (inappropriate for industrial safety decisions) does not diminish these clear requirements in any way.

74. The later assertion (page 71) that "sect 4.11 of EN-1 does not require a COMAH safety report to [be] produced at the DCO application stage" is in defiance of the natural and ordinary meaning of words. That is surely exactly what the words abstracted in Para 69 do say. The past tense appears. The SoS must have sight of a safety report by the COMAH CA assessing that the proposed design meets the safety objectives of the Policy, and the ExA must correctly advise the SoS.

75. In protesting that if a full COMAH safety report was required, the EN-1 "would have stated so" (page 72, top) the Applicant may be confusing two different things. The Policy requirement refers to "an assessment" and that the COMAH CA "has assessed" that it meets the safety objectives in Para. 4.11.3 of NPS EN-1. This means a report *from* the COMAH CA. It does not specify what form the assessment

should take, nor how extensive it should be. It does not say it has to correspond to the Major Accident Prevention Policy required at the construction and operation stages by R.7 COMAH Regs 2015 or the Safety Reports required in R.8. Those reports are in any case the responsibility of the *operator* to provide, not the COMAH CA. What the Policy *does* say, inescapably, is that "The IPC should be satisfied that an assessment has been done where required and that the Competent Authority has assessed that it meets the safety objectives".

76. It should be noted that an application for HSC made to HSAs (i.e. determined by LPAs) similarly results in a formal Notice to the COMAH CA who reports back to the LPA with their assessment of the details provided by the Applicant. The details must include: "the measures taken or proposed to be taken to limit the consequences of a major accident" under R.5(1)(d)(viii) P(HS)Regs 2015. Such HSC applications would of course proceed alongside the Planning Consent application. Any application for Planning consent for an industrial facility would oblige the Applicant to state clearly whether HSC was required in addition to Planning consent. Thus, as an integral part of the Planning process where HSC is required, the COMAH CA performs an assessment of the details and reports accordingly to the HSA/LPA.

77. It cannot be right that an NSIP project should be treated any less rigorously than a significantly smaller project determined by LPAs. Hence the requirement in NPS EN-1 for the COMAH CA to assess the proposal is both a reasonable and a responsible Policy.

78. There is no way to satisfy this Policy requirement except by providing such an "assessment" from the COMAH CA. No such assessment has been provided, so the Applicant is non-compliant with clear Policy requirements in NPS EN-1.

79. The only exception to this if the facility is genuinely not subject to the COMAH Regs 2015. There are only two ways this can happen:

(i) Dangerous Substances, even those "reasonably foreseeably generated in loss of control", are not present;

(ii) they are present (or reasonably foreseeably generated in loss of control) only below the Qualifying Quantities.

80. The first possibility above is simply unsustainable. It is certain technical knowledge that Dangerous Substances are indeed generated in loss of control accidents from Li-ion BESS. These have been documented in my WR REP2-129 and in my Annex EF16 REP2-129e. Further evidence regarding Inhalable Nickel Oxides is provided above because these would be of particular concern for the requirement for COMAH notification in the case of NMC cell types. Currently the Application propose either LFP or NMC cells, and so encompasses a possibility where COMAH notification is almost certainly required from the loss of control provisions.

81. The second possibility requires (in relation to the loss of control provisions) some degree of Process Safety Engineering to be conducted. Unlike the P(HS)Regs 2015, where the Part 3 “loss of control” provisions specify a Controlled Quantity that is defined (Part 3 Column 2) without reference to engineering controls, there is no separate Qualifying Quantity for COMAH in the loss of control provisions which are at the level of a definition.

82. Policy and practice elsewhere are that sufficient engineering controls limiting quantities generated in loss of control accidents are relevant for determining COMAH notification under the loss of control provisions.

83. Within the UK, HSE(NI) clearly now adopts such a policy, as outlined in para. 36 above and Annex EF48 (REP6-085).

84. In Germany, which as an EU Member State has of course also adopted the Seveso III Directive, a major accident advisory committee of the Federal government (*Kommission für Anlagensicherheit* (KAS), or “Commission for Plant Safety”) has issued guidance on “reasonable foreseeability”. The guidance document KAS-43 is Annexed as Annex EF53**.** The title *Empfehlungen zur Ermittlung der Mengen gefährlicher Stoffe bei außer Kontrolle geratenen Prozessen* may be translated as “Recommendations for evaluating the quantity of hazardous materials from processes which have run out of control”. Section 3 is entitled *Konkretisierung “… bei denen vernünftigerweise vorhersehbar ist, …”* or: Concretisation "...where it is reasonably foreseeable that..." and an English translation is provided of that section.

85. Section 3 of KAS-43 acknowledges that the phrase “reasonably foreseeable” has no statutory definition. The KAS Commission provides “concretisation” by specific expert recommendations, albeit non-statutory. These include:

(1) interpretation of the phrase “reasonable to foresee” as equivalent to “cannot reasonably be excluded”;

(2) that what is “reasonable to foresee” therefore depends on measures to prevent or limit accidents;

(3) recommendations that either:

(i) “one inherently safe engineered protective measure”, or

(ii) “at least two independent engineered protective measures”,

are required for an accident to be “*not* reasonably foreseeable”;

(4) technical or structural measures limiting the quantities of dangerous substances generated in accidents are relevant to a quantity determination;

(5) non-technical measures should not be taken into account in determining “reasonable foreseeability”.

86. The rest of KAS-43 contains specific guidelines on acceptable measures for quantity estimations in loss of control situations.

87. Hence, as noted above in para. 37, even under the loss of control provisions it would be open to the Applicant to have demonstrated sufficient layers of “engineered protective measures” that even though Dangerous Substances are reasonable to

foresee being generated in loss of control, then control measures designed to limit quantities would prevent the Qualifying Quantities being exceeded. In that case the establishment could reasonably declare itself *not* to be a COMAH site.

88. Precisely because the Applicant has refused to perform any such Process Safety Engineering, the possibility of a BESS accident generating Qualifying Quantities of Dangerous substances "cannot reasonably be excluded" in the words of the KAS-43 guidelines, or equivalently, it remains "reasonable to foresee".

89. The ExA cannot proceed on the assumption that COMAH notification is *not* required, because to do so would risk exposing the Examination as procedurally improper. Should it be subsequently determined that COMAH notification *is* required, the Policy requirement (for a safety report to the SoS, advised by the ExA) would have been violated, by the ExA's neglect of both procedure and Policy.

90. The Applicant presents their position that it is "too early to tell" (page 70 para 6) if COMAH notification is required, in spite of all the evidence supplied that it is, and in spite of the Applicant acknowledging the key "loss of control" provisions in the definition of "presence of a dangerous substance" (R.2(1) COMAH Regs 2015) which is fundamental to the safety concerns in BESS. If truly "too early to tell", then the Application is simply premature. COMAH liabilities should have been determined in advance of the Application. At the present stage, the evidence I have submitted cannot simply be ignored. If contested, it would be open to the Applicant to seek a determination from the COMAH CA. This has not been done either.

91. The Applicant also ignores the question of burden of proof. The legal obligation for COMAH notification is an obligation upon the *operator* (R.6 COMAH Regs 2015). The whole purpose, intention and effect of the regulatory regime inherited from *Seveso* is to throw the burden of responsibility for COMAH entirely upon the operator. In the Planning context (required by NPS EN-1, or the P(HS)Regs 2015) this can only mean the Applicant, who seeks consent to construct the facility. The duty therefore lies wholly with the Applicant to determine whether or not COMAH notification is required, by an appropriate level of engineering analysis.

92. It is not up to LPAs, the ExA, Interested Parties, or even the COMAH CA to object to any proposal on the ground that COMAH notification *is* required, although I have presented ample evidence in my submissions. The burden of proof that COMAH notification is *not* required lies with Applicant.

93. Finally, the Applicant states (page 72) that "No statutory party has come forward to confirm that COMAH applies to BESS and both constituent bodies of the COMAH CA have had every opportunity to do so". That is likely to be because they have not been asked, either to provide the safety "assessment" required in Sect. 4.11.4 NPS EN-1 or for other advice, as advised earlier in the same Section, in the recommendation to "make early contact".

94. It should be noted that the COMAH CA is defined as the HSE plus the EA, "acting jointly" (R. 4(b) COMAH Regs 2015 and elsewhere). The COMAH CA is

required to provide its assessments “acting jointly” and the agencies acting separately do not constitute the COMAH CA. The Applicant has at no stage sought to involve the COMAH CA either pre-application or within the Examination.

95. In summary regarding COMAH:

(i) determining liability for COMAH is an obligation placed firmly on the operator, which in the context of a Planning decision can only mean the Applicant;

(ii) it is unsustainable by this stage to contend that the BESS would not be subject to the COMAH Regs 2015 or that the question is not determined;

(iii) ample evidence has been presented that COMAH notification is a more than probable obligation, in particular for NMC cells where the generation of Inhalable Nickel Oxides in loss of control accidents could readily make even a single BESS cabin an “upper tier” COMAH site, arising from the stringency of the Qualifying Quantity for that Named Dangerous Substance in Part 2, and requiring no consideration of cabin-to-cabin escalation;

(iv) the burden of proof in these circumstances lies with the Applicant to demonstrate that the QQs *cannot* be exceeded;

(v) both UK (Northern Ireland) and EU (Germany) jurisdictions recognise that sufficient layers of engineering controls can exclude a facility from COMAH even under the “loss of control” provisions, provided limiting measures demonstrate, by quantitative analysis, that exceeding the QQs is no longer “reasonable to foresee”;

(vi) it has always been open to the Applicant to perform the Process Safety Engineering and demonstrate such control measures but they have not done so;

(vii) the Application remains non-compliant with the policy requirement in Sect. 4.11.4 NPS EN-1 for an “assessment” by the COMAH CA that the “inherent features of the design are sufficient to prevent, control and mitigate major accidents”. The Policy wording is crystal clear but no such assessment has been provided;

(viii) the Applicant appears to confuse the “assessment” required, *from* the COMAH CA, with the Major Accident Prevention Policy or Safety Report required *from* the operator, under Rs. 7 and 8 COMAH Regs 2015;

(ix) much smaller proposals determined by LPAs would require HSC at the Planning stage, triggering formal notice to the COMAH CA who would assess the proposal at that stage, reporting to the LPA. It cannot be right that much larger proposals under PA 2008 be treated any less rigorously;

(x) the COMAH CA comprises the HSE and EA “acting jointly” and cannot be replaced by either agency acting separately;

(xi) as with the HSC obligations, the fundamental point is not that COMAH notification is required at the Planning stage, but that Policy in NPS EN-1 requires the specified “assessment” from the COMAH CA to be received by the SoS prior to any decision, and that the ExA must advise the SoS accordingly, and cannot properly do so unless received within the Examination.

(7994 words) EJF, 3/3/2023

List of Annexes referred to: – Comments at Deadline 7: Dr Edmund Fordham (dated 3rd March 2023)

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.

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

EF45 – The Control Of Major Accident Hazards Regulations 2015

EF46 – United Nations Manual of Tests and Criteria, 7th edition

EF47 – Letter from DLUHC regarding operation of Part 3 of the P(HS)Regs 2015

EF48 – Letter from HSE(NI) to Armagh City, Banbridge and Craigavon Borough Council regarding application of COMAH and HSC to BESS

New Annexes added this submission (3 March 2023)

EF49 – Buston, J E H *et al.*, (2023) Energy Advances **2**, 170

EF50 – Revised Golder Memorandum,19 Dec 2022

EF51 – Jensen Hughes memorandum, 3 March 2023

EF52 – Advice letter from HSE(NI), 12 January 2023

EF53 – KAS-43 Guidance Notes from German “Commission of Plant Safety” with English translation of Section 3.