Comments on Applicant Submissions at Deadline 4 : Dr Edmund Fordham

Dated: 13th January 2023

Annex EF45 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 on Applicant Submissions by Deadline 4

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 5 (13 January 2023). They are responses to the following documents:

(a) Written Summary of Applicant's Oral Submissions at the ISH3 8 December 2022 EN010106/APP/8.58 16 December 2022 REP4-032

(b) Applicant's response to BESS Safety Issues raised during ISH3 EN010106/APP/8.69 16 December 2022 REP4-044

(c) Applicant's Response to Dr Edmund Fordham Deadline 3A Submissions EN010106/APP/8.60 16 December 2022 REP4-034

2. These Comments crystallise the issues involved in the BESS safety matters, and the obligations for assessments by the COMAH Competent Authority at the consenting stage, in Planning decisions.

3. Accordingly this submission includes a formal request for an Issue-Specific Hearing on the regulatory law relating to major accident prevention and mitigation and its place in Planning decisions.

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

(per Guidance, being approx. 10% of the main submission)

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

1. Specifics from the Applicant's PHS on ISH3 are analysed:

(i) the irrelevance of the BESS location in the Beijing fire and explosion to the essential fact of a major BESS failure (in LFP cells) with cabin-to-cabin escalation, by what may have been an electrical rather than a thermal route;

(ii) the neglect of toxic emissions in my Annex EF16, other than HF, HCN and CO;

(iii) the lack of a "full consequence model" essential for assessment of the matters … in Article 13(2) of the Directive required by R.24(1)(b) P(HS)Regs 2015;

(iv) the lack of appreciation of the importance of the known generation of "Nickel Oxides in Inhalable powder form", a Named Hazardous/Dangerous Substance in the Schedule to both the COMAH Regs 2015 and P(HS)Regs 2015;

(v) confusion regarding input parameters for the Appendix 16D Air quality Assessment.

2. Conflict between Appendix 16D, and other appraisals by HSE(NI) and independent experts, exemplifies the need for the involvement of the HSE, with the subject matter expertise, and resources, to appraise such assessments.

3. The Applicant's EN010106/APP/8.69 on BESS safety issues provides an excellent overview of the complete "state of flux" regarding BESS technology, engineering standards, best-practice consensus, and prevention and mitigation measures. Consenting an Application seeking one of the largest BESS in the world would pre-judge the question of whether BESS at the size proposed can be operated safely at all, given the immature state of the Process Safety Engineering of this technology.

4. The Applicant's EN010106/APP/8.60 responds to my Deadline 3A Comments providing many technical specifics, only by blanket reference to other documents.

5. The Applicant's EN010106/APP/8.60 does however respond to design adequacy, and safety appraisals by the COMAH CA. Responses are abstracted in detail (Para. 12 below) as exposing the procedural issues at the heart of this case. Useful acknowledgments are made, but so are contradictory statements.

6. The Applicant acknowledges that a finalised design is necessary for a "full consequence model" providing a "robust risk assessment" of "worst case forseeable event scenarios".

7. The contention however that a finalised design is needed to determine the obligations for HSC and COMAH notification is wrong. Those obligations are controlled by simple presence of dangerous/hazardous substances, in aggregate

quantities over the establishment, subject to thresholds. Engineering controls, or other prevention and mitigation measures are largely irrelevant to this. It would be open to the Applicant to have provided literature analyses equivalent to my Annex EF16, or actual failure test data on the two cell types proposed, but neither has been done. Absent such input from the Applicant, my Annex EF16 and WR provide scoping estimates of the likely thresholds (in MWh) at which the Controlled Quantities are exceeded. The size of the BESS proposed makes it virtually certain that HSC and COMAH notification are required.

8. The Applicant acknowledges the "loss of control" provisions in both the COMAH Regs 2015 and P(HS)Regs 2015, but inconsistently relies on a Ministerial Statement that the COMAH Regs 2015 do not apply to BESS, which is itself inconsistent with the position taken by HSE(NI) administering materially identical Regulations. I am aware of no exemption for BESS in the regulatory law as enacted.

9. Accordingly the Policy requirements of Sect. 4.12.1 and footnote 94 of NPS EN-1, regarding HSC, do apply to the Sunnica BESS. Similarly the Policy requirements of Sect 4.11.4 of NPS EN-1, regarding a safety appraisal by the COMAH CA, also apply to the Sunnica BESS.

10. Recognising the known major accident potential of grid-scale Li-ion BESS, Notes 5/6[1] of the Regulations require (relating to the chemical content of the BESS) "provisional assign[ment] to the most analogous category or named hazardous substance falling within the scope of these Regulations".

11. A "full consequence model" is essential to appraise the issues of siting, safety distances, and "protection of areas of particular natural sensitivity or interest" as required by Article 13(2) of *Seveso* (remaining in force *via* R. 24 P(HS)Regs 2015), and a duty on the SoS by R.24(1)(b).

12. Dealing with these issues "post-consent" would violate the legislative intention of implementing Article 13(3) of *Seveso,* requiring "sufficient information on the risks … when decisions are taken". It is clear from my evidence, and from independent evidence from Professor Christensen[2], a leading expert on Li-ion batteries, that sufficient information on risks posed by the two technology types proposed, has not been provided.

13. The Application is non-compliant with Policy requirements in Sect. 4.12.1 and footnote 94 of NPS EN-1 regarding HSC. The claimed exemption (quoted Para. 7) is legally wrong (Para. 32) and HSE advice to consult with the relevant HSA on HSC has been ignored.

14. The Application is non-compliant with Policy requirements in Sect. 4.11.4 of NPS EN-1 regarding a safety appraisal by the COMAH CA. It is impossible for the ExA to "be satisfied" on the requirement unless the safety appraisal by the COMAH CA is received at the consenting stage.

[1] In Schedule 1, Part 3 COMAH Regs 2015 and in Schedule 1, Part 4 P(HS)Regs 2015, respectively
[2] Submitted by SNTSAG Ltd

15. Dealing with HSC “post-consent” is allowed by Policy, but subject to conditions which have not been satisfied. Dealing with a safety appraisal by the COMAH CA “post-consent” violates Policy in Sect. 4.11.4, and if allowed would violate the legal duty on the SoS in R.24(1)(a) P(HS)Regs 2015 to maintain that Policy.

16. Finalising design and conducting safety appraisals “post-consent” would by-pass the clear Policy requirements for major accident prevention and mitigation within the consenting process. Granting a DCO with “post-consent” safety appraisals could easily result in a safety appraisal by the COMAH CA being required after all, thereby revealing an improper process. Procedural propriety cannot be “secured by requirements in the DCO”.

17. An ISH should be scheduled on the regulatory law relating to major accident prevention and mitigation, and its application to the Sunnica BESS, at which both the HSE and EA are engaged.

18. The Application should be **refused**, as being

(i) deficient in the “full consequence model” needed to discharge the duty on the SoS under R.24(1)(b) P(HS)Regs 2015; and

(ii) non-compliant with Policy in Sect 4.12.1 and footnote 94 of NPS EN-1 regarding HSC; and

(iii) non-compliant with Policy in Sect. 4.11.4 NPS EN-1 regarding a safety appraisal by the COMAH CA.

(Summary 1007 words)

EJF, 13/01/23

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

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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
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:

(a) Written Summary of Applicant's Oral Submissions at the ISH3 8 December 2022 EN010106/APP/8.58 16 December 2022 REP4-032

(b) Applicant's response to BESS Safety Issues raised during ISH3 EN010106/APP/8.69 16 December 2022 REP4-044

(c) Applicant's Response to Dr Edmund Fordham Deadline 3A Submissions EN010106/APP/8.60 16 December 2022 REP4-034

2. The objective of these Comments is to draw together and crystallise the key issues to which the ExA will need to have regard in this case. Most of the of the legal and regulatory issues have already been rehearsed in my prior submissions to the Examination[3] but the key matters are brought together here, based on the Applicant's own case and assertions made on pages 16 – 20 of document (c) above.

3. Specifically, I contend that the Applicant relies *inter alia* on a mis-reading and misunderstanding of both Policy (in NPS EN-1) and the law relating to major accident prevention and mitigation. The issues in Para. 39 below can be readily refuted by providing the exact legal authority providing the claimed exemption of BESS from COMAH and HSC. I am aware of none.

4. Should the ExA hold any doubt as to what the law relating to major accident control requires they should consider including this topic (i.e. regulatory law relating to major accident prevention and mitigation, and the obligations in the context of Planning decisions) at the next Issue-Specific Hearing. This would assist a lawful decision being made in this case. Such a Hearing would require the presence of both the Health and Safety Executive (HSE) and the Environment Agency (EA), acting as the two Parties to the COMAH Competent Authority (CA). I have already formally requested (at OFH2) the engagement of HSE at this Planning stage, but the engagement of EA would also be required to comprise the COMAH CA.

[3] 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. 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

5. Several of my contributions at the ISH3 have been misunderstood. Most of my comments have been dealt with in my PHS on the ISH3[4], which should be consulted, which summarises the leading technical issues identified in my "Comments on the Applicant's response to the ExA's first Questions"[5]. The Applicant has in addition submitted responses to my REP3A-046, which is discussed below.

6. The following points however deserve specific mention:

(i) Page 21, Para. 5.1.18. The positioning of a BESS at the top of a shopping centre is irrelevant to the fact that the Beijing accident[6] occurred from BESS internal failures, not from its location. It also involved cabin-to-cabin escalation apparently not via a thermal propagation route. The VCE that killed two firefighters was a surprise event, the majority were tackling the fire in a different container. If the route to cabin-to-cabin escalation was not thermal, but electrical, then even thermal barriers or spacing are insufficient to guard against cabin-to-cabin escalation; the electrical topology and controls must be considered also. The rarity, or otherwise, of cabin-to-cabin escalation is beside the point that with a Li-ion BESS of 2400 MWh capacity, the maximum scale of accident is colossal, sufficiently large that extraordinary measures are required to ensure that cabin-to-cabin escalation is functionally impossible. The Beijing incident remains notable for its demonstration that cabin-to-cabin escalation can, and has, occurred, and probably by a non-thermal propagation mechanism. At 25 MWh, the maximum scale of accident is limited by that capacity. The capacity projected for Sunnica approaches 100 times the capacity at Beijing, with commensurate increase in the maximum major accident potential.

(ii) Page 22 5.1.20 item (a): toxic emissions are not limited to the three singled out. A full spectrum of potential toxic substances was identified in my WR[7], supported by the detailed technical paper with Professor Sir David Melville CBE CPhys FInstP included as Annex EF16[8]. The evolution of chemical analogues of outlawed chemical weapons is reported by a Swedish government agency[9]. No mention is made of any of these toxic substances.

(iii) Page 22 5.1.20 item (c): "Without a detailed design, a full consequence model cannot be undertaken". Precisely so. This is exactly why the Application is fundamentally defective: it is not possible to undertake a proper safety appraisal. (This is a different matter from identifying the legal obligations for HSC or COMAH notification, see Paras. 15-26 below). Lack of detailed design has been a defect even at the consultation stage: the Applicant has failed to consult on Hazardous Substances, and has refused to supply sufficient details to enable the local

[4] PHS on ISH3, REP4-089
[5] Comments on Applicant's responses to the first set of ExA Questions, REP3A-046
[6] Annex EF13, REP-129b
[7] WR, REP2-129
[8] Annex EF16, REP-129e
[9] Annex EF19, REP-129h

community or even other technical experts to come to their own view. This is a violation of the requirements of the Seveso III Directive (*Seveso*) Article 13(3):

> The procedures shall be designed to ensure that operators provide sufficient information on the risks arising from the establishment and that technical advice on those risks is available, either on a case-by-case or on a generic basis, when decisions are taken. Member States shall ensure that operators of lower-tier establishments provide, at the request of the competent authority sufficient information on the risks arising from the establishment necessary for land-use planning purposes.

A "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[10] (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;

The importance of the "full consequence model" for a Planning Application is discussed further below, under "Legal and Policy Requirements".

(iv) Page 22 5.1.20 item (d): The medical commentary is bizarre: it is not necessary for $PM_{2.5}$ to be "absorbed into the blood stream", at all, to do damage. Lung cancers may be, notoriously, induced by particulates that simply sit in the alveoli of the lungs, mesotheliomas induced by asbestos being the classic example. This should be a warning to all regulatory agencies: strict controls on asbestos were only introduced after it became clear that certain types of asbestos were carcinogenic to workers. The Applicant shows no awareness of the fact that transport of inhalable Nickel Oxides (in the particle size range of relevance to inhalation) has been demonstrated from EV fires, over long distances, in submissions already made[11]. Moreover, in the case of NMC cells, the generation of "Nickel compounds in inhalable powder form" are a Named Hazardous/Dangerous Substance in Part 2 of the Schedule to both the COMAH Regs 2015 and the P(HS)Regs 2015 with a stringent 1 tonne Controlled or Qualifying Quantity, potentially making a single BESS cabin an "upper tier" COMAH establishment on that ground alone.[12] In consideration of the legal obligation for HSC or COMAH, it mut be remembered that both those Regulations control by *presence* alone. Containment is irrelevant to the existence of the legal obligation.

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[10] Defined in R.2(1) to be a reference to the Seveso III Directive "as it had effect immediately before Exit Day"
[11] Annex EF26, REP2-129n
[12] Paras. 58-60 of my WR, REP2-129

(v) Page 22 5.1.20 item (f): The inspiration for the Applicant's "reference case" is informative, but "derived from Cleve Hill and consented" is little more relevant. "Going through the DCO process and been granted consent" does not make it technically correct. If the Cleve Hill appraisal was technically wrong, it remains wrong, and cannot be used in this case as a defence of the model. My evaluation of this issue is given in my PHS[13] and I stand by it. The neglect of the Larsson source[14] is inexplicable, and leads to HF loadings many times in excess of those assumed. By "loading" I mean the aggregate quantity of HF generated in the accident. The Larsson source is used by consulting engineers Atkins in their report and reference model for HSE(NI)[15] and leads to wholly different conclusions, unsurprisingly for a model using more representative HF emissions data, and for a reference case of complete destruction of a 5 MWh BESS. The Applicant cannot claim they have analysed a "worst credible accident"[16] without considering complete destruction of an entire cabin, simply because such accidents are well-known to have happened, notably quite close to home in Liverpool[17].

(vi) Page 23 5.1.20 item (h): The Applicant is confused. I did not suggest that "a rate dependent on the storage capacity" of the scheme was appropriate. I said that the Larsson report is the best available source of HF loading data based on laboratory fire tests, It is supported by independent data from elsewhere[18], and is endorsed by HSE(NI)[19]. Moreover I said that the HF loading should be estimated from the energy storage capacity represented by the destroyed cells using the upper Larsson figure as a worst case. What is not stated is the energy storage capacity being destroyed in the Applicant's "model case". The Applicant refuses to provide definite figures, but a simple estimate can be made on the basis of number of racks destroyed, and assuming a capacity of 5 MWh per cabin. This is totally realistic, and exposes the model input used in Appendix 16D as unrealistic[20]. There is also confusion between (i) total HF "loading" i.e. aggregate quantity of HF potentially generated, and (ii) emission *rate*. No justification is provided for the emission rate of 1 $\mu g\ m^{3}\ s^{1}$ either, but that is a different issue from the "loading" i.e. total generation feasible. The first business in any engineering estimation is: are the quantities "about right" ? If the loading assumed is many times smaller than the potential loading based on destruction of racks, that must cast major doubt on the model.

7. Appendix 16D remains inconsistent with other air quality assessments. The assumed HF loadings bear no relation to Larsson[21], it does not take a worst credible accident as its reference case, it diverges from the model now used as a reference case by HSE(NI), and is defective on other grounds identified by the UK's leading expert on BESS safety, Professor Paul Christensen[22].

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[13] PHS to ISH3, Para. 3 (g), REP4-089
[14] Annex EF15, REP2-129d
[15] Annex EF28, REP2-129p
[16] As claimed in Annex 6 EN010106/APP/8.69 as quoted
[17] Reports in Annex EF14 REP2-129c
[18] E.g. Sturk et al., footnote 51, para. 97, page 25 of Comments on Responses, REP3A-046
[19] Annex EF28, REP2-129p
[20] Comments on Responses, REP3A-046, Paras. 95 – 104
[21] Annex EF15, REP2-129d
[22] Para. 89, Comments on Responses, REP3A-046, quoting Annex to WR of SNTSAG

8. These divergences between an Applicant and objectors and independent experts cannot be resolved except by involvement of the statutory regulator, equipped with the necessary expertise, and resources in the form of testing laboratories and sites. It is a technical issue. Appendix 16D is a prime exemplar of the necessity of involving the HSE, like HSE(NI) a statutory regulator able to undertake independent modelling. Debating assumptions used in models has in any case limited scope; the only reliable engineering assessment would involve large-scale tests, including tests to destruction.

Applicant's response to BESS Safety Issues raised during ISH3 EN010106/APP/8.69 REP4-044

9. This submission is a good demonstration of the "state of flux" of the BESS industry in the matter of BESS safety. This was made apparent at ISH3. There is an unstable landscape of engineering standards, consensus on "best practice", strategies for containment, mitigation of thermal runaway events, and so on. Yet the Application seeks a DCO to construct what would be among the largest BESS in the world, when comparable BESS at this scale, e.g. the Moss Landing Energy Storage Facility, in Monterey County, California, has suffered several incidents in its short history. Until the engineering standards and prevention strategies have stabilised, it would be irresponsible to consent to a DCO for this scheme, because that would pre-judge the question as to whether safe operation is possible at all, in the present state of the technology.

10. The necessary work is called "Process Safety Engineering" by the Institution of Chemical Engineers (IChemE)[23]. I maintain that the essential Process Safety Engineering for "Giant BESS" has simply not yet been done. Until it has, and independent safety appraisals against a stable finalised design are available, then grid-scale BESS of the scale proposed at Sunnica cannot responsibly be proposed, nor consented.

[23] For example, [redacted] also [redacted]

Applicant's Response to Dr Edmund Fordham Deadline 3A Submissions EN010106/APP/8.60 REP4-034

Unwillingness to engage with technical specifics raised

11. The Applicant has produced a comprehensive listing of the issues raised in my Comments on Reponses to the ExA questions. Whilst the synopses of the issues identified are largely accurate, demonstrating that they have been noted, there is no technical engagement with them. The majority of responses simply revert to documents already submitted: EN010106/APP/8.58 and EN010106/APP/8.69. This demonstrates either unwillingness, or inability, to engage with the technical specifics, or both, confronted by an Interested Party who is also a subject matter expert. I have, in my Comments, provided detailed specifics. The Applicant has declined to make specific responses except by blanket citation to other documents.

Design adequacy and need for safety appraisals by the COMAH CA

12. The Applicant does respond on the question of inadequacy of the design, and the need for a safety appraisal by the COMAH CA, on pages 16 – 20 of this document. This usefully highlights the issues at the heart of the matter in this case. The Applicant's responses are therefore quoted in full (paragraph numbers added, called "Quoted Paragraph 3" etc hereinafter):

(i) In response to my contention of inadequate design detail:

1. The Applicant does not agree with Dr Fordham's analysis. There is more than sufficient information presented in the Application to enable an assessment to be undertaken. In particular the environmental statement has been prepared for the Application which has assessed a reasonable worst case based on parameters established in the Application.

2. It is correct that a detailed design has not yet been produced and this will not happen until any Development Consent Order is granted. Finalisation of the detailed design is secured by a requirement in the DCO, which requires approval by the relevant planning authority of the detailed design in accordance with documents submitted as part of the DCO Application.

(ii) In response to the need for a safety appraisal by the COMAH CA, citing Summary, Para. 7 and Paras. 4, 43, 44 and 80 – 86 of the main text of my Deadline 3A Comments[24]:

3. NPS EN-1 sections 4.11 and 4.12 set out the requirements for Safety and Hazardous Substances respectively.

4. Section 4.11.4 states: "*Applicants seeking to develop infrastructure subject to the COMAH regulations should make early contact with the Competent Authority. If a safety report is required it is important to discuss with the Competent Authority the type of information that should be provided at the design and development stage, and what form this should take. This will enable the Competent Authority to review as much information as possible before construction begins, in order to assess whether the inherent features of the design are sufficient to prevent, control and mitigate major accidents. The IPC should be*

[24] I agree broadly with the synopsis abstracted by the Applicant on page 17 of their EN010106/APP/8.60. The same points are made throughout my submissions, in particular my WR REP2-129, my PHS on ISH1 REP2-082, and in my PHS on ISH3 REP4-089

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

5. Section 4.11.4 does not define exactly when such contact with the Competent Authority should occur, but it is clear that the HSE should be consulted with when it is understood that the development will be subject to The Control of Major Accident Hazards Regulations 2015 (COMAH) Regulations.

6. Section 4.12.1 states "*All establishments wishing to hold stocks of certain hazardous substances above a threshold need Hazardous Substances consent. Applicants should consult the HSE at pre- application stage if the project is likely to need hazardous substances consent. Where hazardous substances consent is applied for, the IPC will consider whether to make an order directing that hazardous substances consent shall be deemed to be granted alongside making an order granting development consent. The IPC should consult HSE about this*."

7. Whilst Section 4.12.1 does state that "*Applicants should consult the HSE at pre-application stage*" this is only where it is known that the project will be likely to need Hazardous Substances Consent (HSC). 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 of the scope of the COMAH and Hazardous Substances Consent.

8. On 12th July 2021 the Secretary of State for Work And pensions published the following response to a question on whether the exclusion of lithium-ion batteries for grid storage from the Control of Major Accident Hazards Regulations 2015 should be reviewed:

"*The Control of Major Accident Hazards Regulations 2015 (COMAH) apply to dangerous substances as classified by the Classification, Labelling and Packaging Regulations 2008. Lithium- ion batteries are considered to be articles, rather than substances, and are therefore outside of the scope of the COMAH.*

The Health and Safety Executive considers that the current regulatory framework is sufficient and suitably robust in relation to lithium-ion batteries and battery energy storage systems.

Of particular relevance are the Dangerous Substances and Explosive Atmospheres Regulations which set minimum requirements for the protection of workers and others from fire and explosion risks; the Electricity at Work Regulations which require precautions to be taken against the risk of death or personal injury from electricity in work activities; and the Management of Health and Safety at Work Regulations which require risks to be assessed and appropriately managed. In addition, for large scale battery storage, there are statutory requirements to notify the Fire and Rescue Service to inform their emergency response planning."

This therefore confirms the current position in England and Wales that COMAH and HSC do not apply to batteries as they are not defined as hazardous substances under CLP.

9. COMAH and HSC both require that the foreseeable potential for dangerous substances to be generated by the site activities (including in the event of incidents) should be considered when assessing whether a facility should be regulated as a COMAH establishment or requires HSC.

10. However, the identification of foreseeable events and assessment of the nature of and quantity of hazardous substances generated can only be robustly undertaken once the following information is all available:

- Fully developed plant design and layout;
- Details on the size of each battery storage unit;
- Defined battery technology;

- Detailed understanding of the chemical composition of the battery units;
- Detailed understanding of the mechanisms by which hazardous substances could be generated;
- Detailed understanding of potential event scenarios that could lead to the potential generation of hazardous substances;
- Understanding of separation distances between battery storage units and the potential for event propagation between units;

This data can then be used as part of a robust risk assessment to provide an understanding of potential hazardous substances that could be generated under foreseeable conditions and the maximum quantities that could be produced under the worst case foreseeable event scenarios.

11. The Scheme is still progressing through the design process, and as yet full detailed design has not yet been completed. As part of this design process, the specific battery technology for the Scheme has not yet been selected, and hence the battery chemistry is not yet defined. Hence it is not yet possible to undertake a robust review of the potential for generation of hazardous substances which can then be used to assess whether COMAH or HSC apply, as stated within the Written Summary of Sunnica Limited's Oral Submissions at the Development Consent Order Issue Specific Hearing on 1 November 2022 **[REP2-036]**.

12. It is therefore proposed that the COMAH and HSC requirements will be reviewed in full at the appropriate point in the Scheme design process. The COMAH Competent Authority will be consulted regarding the adequacy of the risk assessments undertaken and asked to confirm the applicability of COMAH and HSC at the site.

Acknowledgements made by the Applicant

13. The Applicant has acknowledged the following:

(a) The Applicant (quoted Para 1.) has no intention of finalising a design except after grant of a DCO. This is confirmed in quoted Para. 11;

(b) The Applicant explicitly recognises (quoted Para. 9) that COMAH and HSC both require foreseeable generation of dangerous/hazardous substances to be considered in assessing whether a facility is regulated as a COMAH establishment or requires HSC[25]. Hence the "loss of control" provisions of both Regulations are fundamental, as insisted upon throughout my submissions;

(c) The explicit admission (quoted Para. 10) that a full design is required to undertake a robust safety appraisal; this is also confirmed by the admission in Para. 6 (iii) above from EN010106/APP/8.58: "Without a detailed design, a full consequence model cannot be undertaken";

(d) The Policy cited from Sections 4.11 and 4.12 of NPS EN-1 as setting out the overarching Policy requirements for major accident prevention and mitigation.[26] Further sections from NPS EN-1 relating to HSC (Section 4.12.2 and Footnote 94) and relating to Safety (Section 4.11.3), have already been cited by me[27].

Contradictions in the Applicant's position

14. The Applicant is self-contradictory in the following respects:

(a) Quoted Para. 1 contradicts quoted Para. 10. Either there is sufficient information to conduct a safety appraisal or there is not. The Applicant cannot have it both ways.

(b) Quoted Para. 9 contradicts quoted Para. 8. The Applicant recognises that "loss of control" provisions of the COMAH Regs 2015 and the P(HS)Regs 2015 are relevant to deciding the legal obligation for HSC and regulation as a COMAH establishment, but also cites (quoted Para. 8) a Ministerial statement asserting that those Regulations do not apply. Again it cannot be both ways. Either those Regulations apply, in particular via the "loss of control" provisions, or they do not.

(c) Quoted Paras. 4 and 5 contradict quoted Paras. 12 and 2. The relevant part of quoted Para. 4 is: "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." This makes absolutely clear that the "IPC"[28] (now abolished and for present purposes meaning the ExA advising the SoS) is required to be satisfied that a favourable safety appraisal has been done by the COMAH CA *as part of the consenting process.* This makes the Applicant's intentions in Paras. 12 and 2 (for "post-consent" safety appraisal) outside of the Policy requirements.

[25] The "loss of control" provisions in the COMAH Regs 2015 and the P(HS)Regs 2015 are both explicit, as discussed in my WR.
[26] As cited by me in my PHS on ISH1, REP-082a, Para. 15; also in my WR REP2-129 Para. 82
[27] In PHS on ISH1, REP2-082a, Para. 15; in my WR, REP2-129
[28] Infrastructure Planning Commission

Resolving the contradictions: safety appraisals and legal obligations

15. It is essential to appreciate that the legal obligations to seek HSC, and for regulation as a COMAH establishment, are a different matter from the engineering controls necessary to secure safety. The P(HS)A 1990 controls Hazardous Substances by mere *presence* alone, and in quantity, controls HS by the *aggregate total* in the establishment. The COMAH Regs 2015 similarly control "dangerous substances"[29] by *presence*, and by the aggregate total in the establishment. It is the *mere presence* (beyond CQs) that creates the obligation for HSC, and for "notification" as a COMAH establishment. That is the mechanism enacted by Parliament to ensure the active engagement of the COMAH CA whenever DS/HS are involved at industrial establishments.

16. The engineering controls (bunding, containment, venting, cooling, fire suppression, spacing, warning and control systems etc) are, of course, critical aspects in *deciding* whether or not to grant HSC (by the HSAs), or to approve the Major Accident Prevention Policy[30] (by the COMAH CA), but they are irrelevant to the (closely related) questions as to whether HSC, or "notification"[31] as a COMAH establishment, are legal obligations.

17. Therefore, I reject the contention in quoted Para. 1 that there is "sufficient information" to conduct a safety appraisal, and I endorse the statement that a full specification on the lines in quoted Para. 10 is indeed required, *for the purposes of full safety appraisal.* The COMAH CA could not appraise safety without a full design specification, enabling a detailed technical evaluation by those with the necessary subject matter expertise as to whether the proposed controls were adequate.

18. However, it is quite *wrong* to suggest that a full safety appraisal is needed to decide the question of whether HSC, and COMAH "notification", *are legal obligations.* The P(HS)Regs 2015 and the COMAH Regs 2015 control establishments by the *mere presence* of DS/HS beyond certain thresholds. The engineering controls and safety measures are largely irrelevant to this. For such large proposal (2400 MWh) the obligation for HSC and COMAH notification can be seen by scoping calculations of the kind already provided. Alternatively, it would be open to the Applicant to provide actual test data, of BESS cells of the two types proposed, to refine such calculations. Quoted paragraph 10 is therefore wrong in this regard.

19. In summary: quoted Para. 10 is thus entirely correct that full specification is required to conduct a "full consequence"[32] safety appraisal. It is however wrong to say that a full specification is needed to determine whether HSC, or COMAH notification, are legal obligations.

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[29] The language of the COMAH Regs 2015 is in terms of "dangerous substances"; that of the P(HS)A 1990 and P(HS)Regs 2015 is in terms of "hazardous substances"; however the Schedules to the Regulations make clear that the identical substances are involved.
[30] Required by Regulation 7 of the COMAH Regs 2015
[31] An obligation of the operator required by Regulation 6 of the COMAH Regs 2015
[32] As in the Applicant's Written Summary of Oral Submissions at ISH3, EN010106/APP/8.58, Page 22 5.1.20 item (c); see also Para. 6 item (iii) above

20. It is possible to perform “scoping calculations” for the energy storage capacity (in MWh) at which various thresholds (Controlled Quantities) of HS listed in the Schedule to the P(HS)Regs 2015 would be exceeded, even absent representative fire test data, and without a full design specification being provided, for a variety of Li-ion cell chemistries including the NMC and LFP types under consideration. I have published these calculations in a publicly available paper written with Professor Sir David Melville CBE CPhys FInstP (Annex EF16[33], REP2-129e, summarised in my WR[34]). We did calculations for various cell types, including the “LFP” and “NMC” cell chemistries under consideration. The sources used to carry out this work are all public domain documents, from the technical literature, frequently the peer-reviewed scientific literature. The conclusions, as in my WR, are clear: the thresholds (reckoned in energy storage capacity) at which the CQs[35] are exceeded are quantitatively so far below[36] the projected energy storage of 2400 MWh that it is inconceivable that HSC is not a legal obligation.

21. Engineering controls, and rates of progress in accidents, are largely irrelevant to the HSC assessment. The issue is the aggregate quantity of HS listed in Parts 1 and 2 to the Schedule of the P(HS)Regs 2015 that may be generated during loss of control of the processes, and those may be estimated from the existing technical literature. This relates to aggregate material quantities; if a given amount of energy storage (in MWh), corresponding to a given tonnage of functional BESS chemicals, is destroyed in a BESS accident, what is the *aggregate quantity* of HS generated in such loss of control.

22. In our paper Annex EF16 we make clear[37] that actual measurements are of course to be preferred. Absent such measurements or verifiable data being provided by the Applicant, existing public domain material has been used. In “borderline” cases, it could be arguable that the use of external data made it unclear whether HSC was a legal obligation or not. This might apply to more modest BESS up to around 50 MWh in storage capacity. However with a projected capacity at Sunnica of 2400 MWh, to argue that the scoping estimates already provided are so wrong that HSC is *not* an obligation would be unfounded. Recall that the P(HS)A 1990 regulates HS by *presence*, and it is the *aggregate quantity* of HS in the whole establishment that determines the legal obligation for HSC.

23. The P(HS)Regs 2015, Regulation 5(1)(d), oblige applicants for HSC to provide full details of (iii) each HS, including the maximum quantities, (v) how they are kept and used, (viii) the proposed measures for limiting consequences of a major accident. Under Schedule 1, Part 3, Column 1, “substances used in processes” are HS for the purpose of the P(HS)A 1990 and P(HS)Regs 2015. Hence all the active functional chemicals within the BESS cells are HS for the purposes of the Act, and their aggregate quantity determines whether HSC is required.

[33] REP2-129e in the Examination Library
[34] REP2-129 in the Examination Library
[35] As defined by the “loss of control” provisions in Part 3 of the Schedule to the P(HS)Regs 2015
[36] 2.75 MWh for NMC cells and 22.1 MWh for LFP cells; see WR REP2-129 Summary Para. 4
[37] Annex EF16, REP2-129e, Executive Summary, page 6, Items 9 – 11

24. The Regulations require maximum quantities of HS to be stated; this could be satisfied by a statement of tonnages of active functional chemicals in the BESS cells. However whether the CQs defined in Part 3 Column 2 are exceeded could not be determined by the HSA without the Applicant providing, in addition, their assessment of the CQs defined by Schedule 1 Part 3 Column 2. This surely implies that providing such an assessment is a duty of the Applicant.

25. In the Sunnica proposal, no statement of energy storage capacity was provided until ISH1. No choice of cell chemistry (between NMC and LFP) has been provided even now. Hence the need to make scoping estimates of the kind provided to the Examination in Annex EF16 and my WR.

26. In summary:

(i) Engineering controls to secure safety are a different matter from the legal obligations to seek HSC and notify as a COMAH establishment. The latter are determined by *presence* of DS/HS alone, above specified thresholds (CQs or QQs).

(ii) The Applicant has provided wholly insufficient information to enable a “full consequence” safety appraisal, but scoping calculations on the probable need for HSC and COMAH notification have nevertheless been provided in my Annex EF16 and my WR; for such a large proposal (2400 MWh) it is inconceivable that HSC would *not* be an obligation, implying *prima facie* that COMAH notification is also required;

(iii) Any Application for HSC to the HSAs would be required to state maximum quantities of each HS, and by implication to provide an assessment of the CQs in Schedule 1 Part 3 Column 2 for HS generated during loss of control (BESS accidents), which would require verifiable fire tests on representative BESS cells. No such details have been provided to the Examination and indeed the Applicant has refused to do so (quoted Paras. 2 and 11). Absent such definite details, the approach in my Annex EF16 and WR is justified.

Resolving the contradictions: "loss of control" provisions in the Regulations

27. I endorse completely the Applicant's quoted Para. 9 above: COMAH and HSC both require that the foreseeable potential for dangerous substances to be generated by the site activities (including in the event of incidents) should be considered when assessing whether a facility should be regulated as a COMAH establishment or requires HSC.

28. The loss of control provisions are found in the "Interpretation" section R. 2 of the COMAH Regs 2015[38]:

"presence of a dangerous substance" means
the actual or anticipated presence of a dangerous substance in an establishment,
or of a dangerous substance which it is reasonable to foresee may be generated during loss of control of the processes, including storage activities,
in any installation within the establishment, in a quantity equal to or in excess of the qualifying quantity listed in the entry for that substance in column 2 of Part 1 or in column 2 of Part 2 of Schedule 1, and "where a dangerous substance is present" is to be construed accordingly;

29. In the P(HS)Regs 2015 the loss of control provisions are in Schedule 1 Part 3 Column 1:

Where it is reasonable to foresee that a substance falling within Part 1 or Part 2 ("HS") may be generated during loss of control of the processes, including storage activities in any installation within an establishment, any substance which is used in that process ("S").

30. It should be noted that the COMAH Regs 2015 refer to the reasonably foreseeable generation of DS during loss of control, from "any installation within the establishment", and that no restriction whatsoever is placed on the nature of that "installation", howsoever categorised by the CLP Regulation, or otherwise.

31. I reject as fundamentally wrong the Applicant's quoted Para. 7 above: Whilst Section 4.12.1 [of NPS EN-1] does state that "*Applicants should consult the HSE at pre-application stage*" this is only where it is known that the project will be likely to need Hazardous Substances Consent (HSC). 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 of the scope of the COMAH and Hazardous Substances Consent.

32. No such condition is stated in the Policy. No such exclusions are made in either the COMAH Regs 2015 nor in the P(HS)Regs 2015. The definition of "presence of a dangerous substance" in the COMAH Regs 2015 refers to "any installation", without conditions. The cited Ministerial Statement makes no reference to the P(HS)Regs 2015. The Part 3 provisions in P(HS)Regs 2015 make "any substance which is used in that process" a HS, "Where it is reasonable to foresee that a substance falling within Part 1 or Part 2 ("HS") may be generated during loss of control of the processes". The generation of listed HS in BESS accidents is more than "reasonable to foresee", it is certain, making BESS cell chemicals HS under Part 3. The CQs are estimated for a variety of cell types in my Annex EF16 and could have been similarly estimated by the Applicant, but were not. The Scoping Opinion from HSE advised that the presence of hazardous substances would

[38] The COMAH Regulations 2015 are now annexed as Annex EF45

probably require HSC, and further advised consulting the relevant HSAs regarding HSC, but I have seen no evidence that the Applicant did so.

33. Moreoever the opposite is explicitly the case in both Regulations: in the COMAH Regs 2015, Schedule 1, Part 3, Note 5:

5. In the case of dangerous 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 dangerous substance falling within the scope of these Regulations.

34. In the P(HS)Res 2015, Schedule 1, Part 4, Note 6, the identical wording (except for the change of language from Dangerous to Hazardous substances) is found:

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.

35. It should be noted that "waste" is explicitly included, and waste streams frequently contain objects that would be considered "articles" under the CLP Regulation. The above Notes make clear that the intentions of these Regulations (originating in *Seveso*) did not envision any restriction to the CLP definition of a "substance"; what matters is the major accident potential of "any installation within the establishment".

36. There is therefore no basis in law for the contention that batteries are outside the scope of the COMAH Regs 2015 and P(HS)Regs 2015 and the Applicant provides none in its assertion (quoted Para. 7). Recognising the major accident potential of high-capacity Li-ionBESS, it appears that "provisional assign[ment] to the most analogous category or named hazardous substance falling within the scope of these Regulations" is required, under Notes 5/6 of the Regulations.

37. Similarly, for the same reasons, I reject as fundamentally wrong the assertion made in quoted Para. 8 above, notwithstanding its assertion by the SoS for DWP in a Parliamentary Answer[39]. If the Applicant agrees (quoted Para. 9) that the "loss of control" provisions must be considered in deciding if HSC and COMAH notification are required, it is contradictory to rely simultaneously on quoted Para. 8. I have also discussed the reasoning extensively in my PHS on ISH3[40], and the public domain paper submitted as Annex EF40[41].

[39] Also provided to the Examination as Annex EF38, REP4-090
[40] PHS on ISH3, REP4-089
[41] Annex EF40, REP4-092

38. Moreover, the quoted Para. 8 (from the DWP) makes no reference at all to the P(HS)Regs 2015, and makes no statement whatsoever regarding their application. It cannot be used to defend the quoted Para. 7 above, which is erroneous.

39. To be clear: I believe that the SoS for DWP has been wrongly advised in the Parliamentary Statement. I have invited the Applicant to provide the exact legal authority for the claimed exemption in my PHS on ISH3, Summary Para. 10. To my knowledge, and reasons as in Paras. 26 – 35 above, no such exemption exists in law, and HSE(NI) explicitly states the opposite[42].

40. In summary:

(i) I agree completely with the Applicant regarding the imperative to consider loss of control scenarios in determination of obligations for HSC and COMAH notification (though I reject the contention that a full design specification is needed to indicate such obligations, for an Application of such unprecedented size, Para. 25 (ii) above);

(ii) This is at odds with the DWP position in quoted Para. 8, as discussed in detail in my PHS on ISH3[43] and Annex EF40[44];

(iii) The regulatory law cited in Paras. 26 – 35 above makes clear that no exemption from the COMAH Regs 2015 or the P(HS)Regs 2015 is apparent in the law as written;

(iv) The opposite position to the exemption claimed by DWP is taken in Notices to LPAs by HSE(NI);

(v) The DWP statement makes no reference to the P(HS)Regs 2015 so this statement cannot be used to defend the Applicant's assertion (quoted Para. 7) that BESS are exempt from the requirements of Section 4.12.1 of NPS EN-1.

41. I conclude that BESS cannot be exempt from the COMAH Regs 2015 nor from the P(HS)Regs 2015, both (i) on the grounds of inescapable "loss of control" provisions (ii) on the grounds of Note 5 (COMAH Regs 2015) and Note 6 (P(HS)Regs 2015) requiring "provisional assign[ment] to the most analogous category or named hazardous substance falling within the scope of these Regulations".

42. Similarly the requirements of Sections 4.12.1, 4.12.2, and footnote 94 of NPS EN-1, regarding HSC, therefore do apply to the Sunnica BESS, as discussed in my PHS on ISH1[45].

43. Similarly the requirements of Sections 4.11.3 and 4.11.4 of NPS EN-1 on major accident prevention and mitigation, via the COMAH Regs 2015, do apply to the Sunnica BESS, as discussed in my WR[46].

[42] E.g. Annex EF29, REP2-129q
[43] PHS on ISH3, REP4-089
[44] Annex EF40, REP4-092
[45] PSH on ISH1, REP2-082a, Paras. 15 & 16
[46] WR, REP2-129, Paras. 82 & 83.

Legal requirements in P(HS)Regs 2015 and Policy requirements in NPS EN-1

44. The P(HS)Regs 2015 are the UK implementation of the "Land Use Planning" requirements in Article 13 of the Seveso III Directive (*Seveso*). It is clear that the legislative intention of the P(HS)Regs 2015 is to implement Article 13(3) of *Seveso*, as made explicit in the Explanatory Memorandum[47]. Article 13(3) has been quoted (Para. 6 (iii) above) and reads:

> The procedures shall be designed to ensure that operators provide sufficient information on the risks arising from the establishment and that technical advice on those risks is available, either on a case-by-case or on a generic basis, when decisions are taken. Member States shall ensure that operators of lower-tier establishments provide, at the request of the competent authority sufficient information on the risks arising from the establishment necessary for land-use planning purposes.

45. The P(HS)Regs 2015 indeed require Applicants to state both hazardous substances, and quantities, and proposed mitigation measures, in applications for HSC. For applications under the PA 2008 procedures, there are specific requirements in the P(HS)Regs 2015 for any national Policy designated under S.5(1) PA 2008 to consider:

> R.24(1)(a) the objectives of preventing major accidents and limiting the consequences of such accidents for human health and the environment;
>
> R.24(1)(b) the matters referred to in Article 13(2) of the Directive[48] (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;

46. Hence the law clearly requires major accident prevention and mitigation to be taken into account in Designated Policies, and specifically the need for sufficient information to assess, in land-use Planning decisions, matters such as safety distances from housing, other buildings, recreational areas, and areas of natural sensitivity, all of which are plainly involved in Sunnica.

47. The regime enacted by Parliament for major accident prevention and mitigation (R. 24(1)(a) P(HS)Regs 2015) comprises the COMAH Regs 2015 in the operational aspect, and the P(HS)A 1990 and the P(HS)Regs 2015 in the Planning aspect. The COMAH CA is involved in both aspects, as the enforcing authority for the COMAH Regs 2015, and as a consultee for the P(HS)Regs 2015; in PA 2008

[47] Annex EF6, REP2-082g
[48] Defined in R.2(1) to be a reference to the Seveso III Directive "as it had effect immediately before Exit Day"

procedures Policy in Sect 4.11 NPS EN-1 requires a safety appraisal by the COMAH CA, and in Sect 4.12 the involvement of HSE.

48. These points have already been made in my PSH to ISH1[49]. The Policy statements in NPS EN-1[50] regarding major accident prevention and mitigation should be read with these legislative requirements understood. The P(HS)Regs 2015 post-date the existing NPS EN-1 which was designated in 2011. Existing Policy provisions for Safety (Sections 4.11) and Hazardous Substances (Section 4.12) appear largely consistent with the 2015 Regulations R. 24(1)(a), but R. 24(1)(b) P(HS)Reg 2015 makes explicit the duty of the SoS to set Policy requirements for "the matters … in Article 13(2) of the Directive" (*Seveso*), i.e. consideration of siting, safety distances from habitation, recreation areas, and protection of areas of natural sensitivity, as listed in Para. 45 above.

Need for a "full consequence model" to appraise siting

49. The Applicant has acknowledged, see Para. 6(iii) above, their N010106/APP/8.58, Page 22 5.1.20 item (c): "*Without a detailed design, a full consequence model cannot be undertaken*". This is amplified by quoted Para. 10 above that a full design specification is required for "*a robust risk assessment*".

50. Yet without a "full consequence model", and a "robust risk assessment" of "worst case forseeable event scenarios", it is simply not possible to satisfy adequately the requirement to appraise the issues of siting, safety distances, and "protection of areas of particular natural sensitivity or interest" as required by Article 13(2) of *Seveso* (remaining in force *via* R. 24(1)(b) P(HS)Regs 2015).

51. Accordingly the Application should be rejected as lacking the "full consequence model" need to appraise these issues.

52. It is not appropriate to deal with such issues "post-consent", because R.24(1)(b) P(HS)Regs 2015 requires them to be part of designated Policies, and the legislative intention was clearly to implement Article 13(3) of *Seveso*, which requires that: operators provide sufficient information on the risks arising from the establishment and that technical advice on those risks is available, either on a case-by-case or on a generic basis, when decisions are taken.

Hazardous Substances Consent

52. Policy in Sect. 4.12.1 requires consultation with HSE at the pre-application stage. Moreover footnote 94 in NPS EN-1, whilst allowing HSC to be applied for post-consent, nevertheless requires (a) pre-application consultation and (b) details in the DCO.

[49] PHS after ISH1, REP2-082a, paras. 12 to 14.
[50] Annex EF8, REP2-082i

53. Although the Applicant claims (wrongly) that this is not necessary in quoted Para. 7, it has in fact made that pre-application consultation[51] but rejected the HSE advice to seek further information of HSC from the relevant HSA[52]. Had they done so, the HSA would have advised on the "loss of control" provisions of Part 3 of the P(HS)Regs 2015, indicating the need for HSC, or at least an appraisal on the lines of my Annex EF16. Instead, the Applicant has wrongly dismissed the HSE advice as "a generic comment" and "not … relevant to this project".

54. Policy in Sect. 4.12.1 offers the Applicant the option of seeking a Direction granting HSC (under S. 12(2B) of the P(HS)A 1990) within the DCO process. This option was declined at ISH1. Footnote 94 (Sect. 4.12.1 NPS EN-1) reminds us that whilst obtaining HSC "post-consent" remains an option, the requirements of Section 4.12.1 still apply, the Applicant must make pre-application consultation with HSE, and also "include details in their DCO".

55. Whilst the Applicant did obtain a "Scoping Opinion" from HSE at the pre-application stage, the advice received from the HSE (which was to seek further advice from the HSAs) has apparently not been followed. Moreover, no appraisal of the Application by HSE has been done (required by Sect. 4.12.2) and no "details in their DCO" (required by footnote 94) are provided. The Applicant is therefore not compliant with the requirements of NPS EN-1 in Sections 4.12.1 and 4.12.2 and footnote 94. The Application should be rejected on those grounds.

Safety and the COMAH Regulations

56. The related Major Accident requirements in NPS EN-1 are in the "Safety" Sections 4.11.3 and 4.11.4, the latter being cited by the Applicant in quoted Paras. 4 & 5 above. The requirement is for "early contact with the COMAH Competent Authority" (which Sect 4.11.3 reminds us comprises the HSE and the EA acting jointly). Quoted Para. 5 above claims that "HSE should be consulted with when it is understood that the development will be subject to The Control of Major Accident Hazards Regulations 2015 (COMAH) Regulations". This is wrong, the consultation required is with the COMAH Competent Authority which requires involvement of the EA in addition to HSE.

57. Quoted Para. 5 claims that "Section 4.11.4 does not define exactly when such contact with the Competent Authority should occur", however the Policy clearly requires 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 described above." This can only mean that (irrespective of when the first contact with the COMAH CA is made) a favourable safety review by the COMAH CA must be received by the ExA at the consenting stage. Unlike the HSC requirements, the Policy provides no provision for involvement of the COMAH CA "post-consent", and it would violate the duty of the SoS under R.24(1)(a) P(HS)Regs 2015 if it did.

[51] Sunnica Volume 6, Environmental Statement Chapter 16 "Other Environmental Topics", 18 November 2021, Document Reference EN010106/APP/6.1 Table 16-8 Page 16-24 last entry.
[52] Already discussed in my PHS on ISH1, REP2-082a, Paras. 34 & 35.

58. The ExA, advising the SoS, is the successor to the IPC and the ExA is required to be satisfied that an appraisal by the COMAH CA has been done, meeting the safety objectives. It is categorically impossible for the ExA to be satisfied that such an appraisal has been done, unless at the consenting stage.

59. Hence it would be a violation of Policy in Sect. 4.11.4 for a DCO to be granted, with "Finalisation of the detailed design … secured by a requirement in the DCO" as desired by the Applicant (quoted Para. 2 above). The ExA is required by policy to 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." This leaves no room for neglect of a safety appraisal by the COMAH CA, at the consenting stage.

60. The Application plainly does not include a safety appraisal from the COMAH CA and should be rejected on those grounds as non-compliant with Policy in Sect 4.11.4 of NPS EN-1.

The Applicant's stated desire for "post-consent" approvals

61. The Applicant's stated desire (quoted Para. 2) is for: Finalisation of the detailed design is secured by a requirement in the DCO, which requires approval by the relevant planning authority of the detailed design in accordance with documents submitted as part of the DCO Application. This amounts to an Application for a DCO, with detailed design (and safety appraisals) dealt with "post-consent".

62. This amounts to a disregard of the legal and Policy requirements above, based on an assumption that HSC and COMAH notification are not required, which I contend is fundamentally wrong; it appears very clear that they are.

63. Such disregard would by-pass the clear Policy requirements designed to ensure major accident prevention and mitigation within the consenting process. Granting a DCO with "post-consent" safety appraisals could easily result in a safety appraisal by the COMAH CA being required after all, resulting in grant of a DCO by what would then be revealed as an improper process, having neglected the requirement for the ExA to be "satisfied that an assessment has been done where required and that the Competent Authority has assessed that it meets the safety objectives".

Conclusions

64. The Applicant has provided wholly insufficient information for a "full consequence model", or a "robust risk assessment" of "worst case foreseeable event scenarios" (BESS accidents) to be undertaken. The Applicant acknowledges that a finalised design would be needed to do so, but declines to provide one.

65. A "full consequence model" is a different matter from determining whether HSC or COMAH notification are legal obligations. The Regulations control DS/HS by *presence* (irrespective of containment measures or engineering controls) above specified thresholds, for aggregate quantities in the establishment. The Applicant could have provided details of the proposed cell chemistries, with documented fire tests to determine thresholds in loss of control, but has not done so. Absent such data, the scoping estimates in my Annex EF16 and my WR show that it is virtually certain that HSC is a legal obligation.

66. The Applicant acknowledges the "loss of control" provisions in the COMAH Regs 2015 and in the P(HS)Regs 2015 in determining the obligations for HSC and COMAH notification. These are inconsistent with the Ministerial Statement[53], which makes no reference to the P(HS)Regs 2015 and also conflicts with advice from HSE(NI) to LPAs[54], administering materially identical Regulations.

64. Recognising the major accident potential of high-capacity Li-ion BESS, Notes 5/6[55] of the Regulations require "provisional assign[ment] to the most analogous category or named hazardous substance falling within the scope of these Regulations".

65. The duty on the SoS[56] to ensure that Policy takes account of "the matters … in Article 13(2) of the Directive[57]" (*Seveso*) cannot be discharged without a "full consequence model". For example quantitative safety distances, and protection of areas of natural sensitivity cannot be made. No adequate model is available.

66. Policy in Sect 4.12.1 and footnote 94 of NPS EN-1 regarding HSC requires pre-application consultation with HSE, and inclusion of "details in their DCO". The Application is wholly non-compliant with these Policy requirements. The claimed exemption (quoted Para. 7) is legally wrong (Para. 32 above) and HSE advice to consult with the relevant HSA on HSC has been ignored.

67. Policy in Sect 4.11.4 requires the ExA to "be satisfied that an assessment has been done where required and that the Competent Authority has assessed that it meets the safety objectives". It is categorically impossible for the ExA to "be satisfied" on this requirement unless the safety appraisal by the COMAH CA is received at the consenting stage. It is virtually certain that BESS on the scale

[53] Annex EF38, REP4-090
[54] For example Annex EF29, REP2-129q
[55] In Schedule 1, Part 3 COMAH Regs 2015 and in Schedule 1, Part 4 P(HS)Regs 2015, respectively
[56] R.24(1)(b) P(HS)Regs 2015
[57] Already in Examination Library as Annex EF4, REP2-082e

proposed will require COMAH notification, for the same reasons as it is virtually certain they will require HSC, as set out in my Annex EF16 and WR.

68. The Application should be **rejected**,

(i) as deficient in the "full consequence model" needed to discharge the duty on the SoS under R.24(1)(b) P(HS)Regs 2015;

(ii) as non-compliant with Policy in Sect 4.12.1 and footnote 94 of NPS EN-1 regarding HSC; and

iii) as non-compliant with Policy in Sect. 4.11.4 NPS EN-1 regarding a safety appraisal by the COMAH CA.

68. Whilst dealing with HSC "post-consent" is allowed by Policy, the conditions of
(i) pre-application consultation with HSE, and

(ii) "details in their DCO";

have not been satisfied. Dealing with a safety appraisal by the COMAH CA "post-consent" would violate Policy in Sect. 4.11.4 NPS EN-1, and would violate the duty on the SoS in R.24(1)(a) if allowed.

69. The Applicant's stated desire (quoted Para. 2) is for: Finalisation of the detailed design is secured by a requirement in the DCO, which requires approval by the relevant planning authority of the detailed design. This implies "post-consent" safety appraisals by "the relevant planning authority"; however the legal and Policy requirements demand a safety appraisal by the COMAH CA, not the LPAs, and at the consenting stage. The Applicant's wishes in regard to safety appraisals would be procedurally improper and possibly unlawful, for reasons given above.

(8,775 words) EJF 13/01/23

List of Annexes referred to follows; Annexes uploaded separately

List of Annexes referred to: –

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

EF1 – Personal details

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

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

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

EF5 – The Planning (Hazardous Substances) Regulations 2015

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

EF7 – The Planning (Hazardous Substances) Act 1990

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

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

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

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

EF12 – Underwriters Laboratories incident report into McMicken explosion

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

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

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

EF16 – Paper with Professor Sir David Melville CBE: “Hazardous Substances potentially generated in “loss of control” accidents in Li-ion Battery Energy Storage systems (BESS): storage capacities implying Hazardous Substances Consent obligations.

In public domain on *Research Gate* preprint server
DOI 10.13140/RG.2.2.35893.76005

EF17 – Golubkov *et al* (2014) *RSC Advances* DOI 10.1039/c3ra4578f

EF18 – Research Technical Report by *FM Global:* Flammability characterization of Li-ion batteries in bulk storage”

EF19 – Bergström *et al* (2015) Vented Gases and Aerosol of Automotive Li-ion LFP and NMC Batteries in Humidified Nitrogen under Thermal Load

EF20 – (2 items) Victorian Big Battery Fire, July 2021. Report of technical findings. Also compendium of news items with aerial photography.

EF21 – (2 items) Letter from Commissioner Sandra D. Kennedy, Arizona Public Service Company, August 2019, regarding McMicken explosion.

Also letter with Fire Department report into earlier 2012 BESS fire with eye-witness reports on flame length.

EF22 – Technical Memorandum from Golder Associates re composition of BESS at Kells, Northern Ireland

EF23 – Ouyang *et al.* (2018), *J. Thermal Analysis and Calorimetry,*
DOI: 10.1007/s10973-018-7891-6

EF24 – Essl *et al.* (2020), *Batteries*, **6**, 30 DOI: 10.3390/batteries6020030

EF25 – Chen *et al.* (2020), *J. Hazardous Materials*, **400,** 123169
DOI: 10.1016/j.jhazmat.2020.123169 (Citation only: article copyright)

EF26 – Held *et al.* (2022) *Renewable and Sustainable Energy Reviews,* **165***,* 112474
DOI: 10.1016/j.rser.2022.112474

EF27 – Wang *et al.* (2019) *Energy Science and Engineering*, **7**, 411-419
DOI: 10.1002/ese3.283

EF28 – Hazard Assessment of BESS, Technical Report by Atkins (Consulting Engineers) for Health and Safety Executive for Northern Ireland HSE(NI)

EF29 – Letter 13/05/2022 from HSE(NI) to Ards and North Down Borough Council

EF30 – Letter 22/09/2022 from HSE(NI) to Derry City and Strabane District Council

EF31 – Letter 10/09/2021 from HSE(NI) to Armagh City, Banbridge & Craigavon Local Planning Office

EF32 – Letter 18/07/2022 from HSE(NI) to Derry City and Strabane District Council

EF33 – Letter 20/05/2021 from HSE(NI) to to Armagh City, Banbridge & Craigavon Local Planning Office

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

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

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

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

EF38 – Parliamentary answer

EF39 – BAILII case

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

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

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

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

New Annex added this submission (13 January 2023)

EF45 – The Control Of Major Accident Hazards Regulations 2015