SUBMISSION BY CREICH COMMUNITY COUNCIL

TO OPPOSE PLANNING CONSENT FOR

DALCHORK BESS, LAIRG, IV27 4ED

PLANNING REF: ECU00004963

03/02/2025

(approval sought in advance for late submission)

Contacts:

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Introduction

1) These comments are submitted by Creich Community Council in **opposition** to the planning application by Green Switch Capital (GSC) Dalchork Limited for a proposed Battery Energy Storage System (BESS).

2) The proposal is referenced as follows:

Dalchork BESS, Lairg, IV27 4ED

Planning Ref: ECU00004963

3) The proposed development comprises a 249.9MW Battery Energy Storage System (BESS) and associated infrastructure

4) Creich marches with Lairg and, at the nearest point on the boundary of the Community Council is ~5.1 km (~3.2 miles) from the centre of the proposed site. Winds from any airt from North round to West will bring released smokes or gasses – and potentially air carried cinders into our area.

5) Given the nature of the equipment at the site and the consequences of any incidents, the residents of Creich have grave concerns about the effects on their land, health, communications and businesses of a failure to design, construct, commission and operate the proposal safely. They have a very direct interest in the design and operation of such systems.

6) We base our opposition to the planning application on

- knowledge of the hazards presented by large scale battery storage systems and the real-world safety record of other such systems;
- the location and the working environment – for example the likelihood of very low temperatures and strong arctic winds for significant intervals;
- the complexity of proper control – with the construction and commissioning phase as much an initiator of BESS incidents as later operations;
- the impacts of incidents and accidents and the consequent risks to health, the environment and the general wellbeing of the community in the short and long term.
- and deficiencies, evidenced by the submission documents, in knowledge of the dangers, in particular, the failure to consider alternative, safer battery types, the limited attention to the relationship between safety/unit separation/site selection and the very limited attention to major hazards in an application that suggests 'it will be all right on the night – trust us'.

7) In our comments we have occasionally emboldened phrases as **[We suggest that . . .]**. These are matters that we consider must be considered in the planning review process.

8) These comments have been prepared by Professor Colin MacFarlane who is a member of Creich Community Council and resident in Creich and the comments have been reviewed and agreed by the Council as representing the views of the overwhelming majority of the Creich residents.[1]

Who We Are

CREICH

9) Creich Community Council represent the people in arguably one of the most scenic and scenically diverse areas of the highlands, encompassing the north shore of the inner Dornoch Firth, the Kyle of Sutherland and the north bank of the Oykel to the watershed at Assynt in the West. There are straths,

[1] A brief review of Professor MacFarlane's relevant experience is attached as an Appendix

rivers, mountains, and the tidal waters of the Kyle. Views can be intimate or panoramic with wide skies and colours and textures that change with the seasons.

COMMUNITY VIEW ON RENEWABLE ENERGY PROPOSALS

10) The people we represent are, almost without exception, opposed to the intrusion of the multiple wind farms, pylon lines and battery storage systems that litter and will further litter our parish.

11) The overarching basis of our objection is that this and other proposals are inequitable. We suffer all the loss, intrusion, commercial and cultural damage, but with no benefit.

12) Generators in our area pay the highest Transmission Network Use of System tariffs in the UK and are, therefore, reluctant to compensate the population adequately for the damage done so that, to add insult to injury ,the proposers of BESS also seek to escape from providing compensation to local residents by pretending they do not generate. They do generate – when it makes them most money.

13) We do, however, appreciate the need to provide alternative energy to mitigate the impacts of humanity on climate.

14) We consider many of the proposals for wind energy, battery storage and energy transmission are not, however, based on addressing those effects, but on making money for speculators and investors. This is true of almost all proposals for battery storage – very of few of which would pass a test of utility to the transmission system.

15) It is our view that no true test is being applied at either scoping or planning application level to find out whether a scheme is purely commercial or beneficial in any way to the issue of climate change which is the notional driver for approval.

[We request that the applicant be asked to set out in what way this scheme benefits the UK energy framework and the local HV grid operation and how it will interact with other BESS in the area]

THIS PLANNING PROPOSAL

16) Without prejudice to the following comments and criticisms, this proposal differs from almost all of the schemes we have seen in that, on the face of it, it could be directed at real issues in grid transmission.

17) This is not, however, stated anywhere in the proposal – it seems to be suggested that, for no obvious purpose, an industrial unit with complex hazards and commensurately high risks can be built without explanation in a sensitive location.

18) Cutting and pasting materials from 'standard' pamphlets and hand-waving mentions of regulations and standards without context does not deal with issues specific to a site (for example, spatial extent, temperature, wind) and a promise to 'do the design and safety work as we go along' is not reassuring to the people we represent.

19) The applicant is suggesting that integrity levels will be decided later and there is no suggestion that the Community will be able to review the integrity levels reached – although we should be.

20) This engineering is the wrong way round. The application is for a unit that has a reasonably foreseeable risk of causing serious immediate, short term and long-term harm. The applicant should set out targets of acceptable risk and work to achieve them.

[That is, we suggest this BESS should be treated as falling within the COMAH regime].

False or Misleading Statements Leading to No EIA

21) We refer to the document *GSC EIA Screening - Dalchork - R001v3* in which a request was made to absolve the applicant of the need to submit an Environmental Impact Assessment. In this a false or misleading statement was made at 4.6 (f)

Subject: f) The risk of major accidents and/or disasters relevant to the development concerned, including those caused by climate change, in accordance with scientific knowledge.	**Statement:** The construction works would not require the use of significant quantities of hazardous or toxic material. The installation of the BESS system involves only siting of the individual containers that are constructed off-site. The technology has a good safety record

22) There is no disagreement that civil engineering works will not require the use of significant quantities of hazardous materials nor that the individual containers for the BESS system are made off site.

23) The 'risk of major accidents' is not, however, addressed and that is a glaring omission.

24) Among subjects that are glossed over are the very critical interval between installation of the containers and final commissioning of the units. In this interval, the probability of an incident is increased because units are charging or charged and yet the management system may be faulty.

25) We refer to an incident in Victoria, Australia on 30 July 2021 when the Victorian Big Battery (VBB) experienced a fire that involved two pre-packaged (Megapack) units during commissioning.

26) The most likely immediate cause of the incident was assessed as a leak within the Megapack cooling system that caused a short circuit that led to a fire in an electronic component. This resulted in heating that led to a thermal runaway and fire in an adjacent battery compartment within one Megapack, which spread to an adjacent second Megapack.

27) The situation that led to the incident was an interlock failure in the supervisory control and data acquisition (SCADA) system that removed visibility of the developing event, caused the cooling system and the battery protection system to shut down, including the high voltage controller (HVC) that could have operated a pyrotechnic fuse to disconnect the faulty battery unit.

28) In a more general sense, there have been over 30 recorded serious thermal runaways in Battery Energy Storage Systems (BESS) worldwide. In 2020 a 20 MWh BESS in Liverpool took over 11 hours to contain and resulted in an explosion and release of toxic gasses.[2]

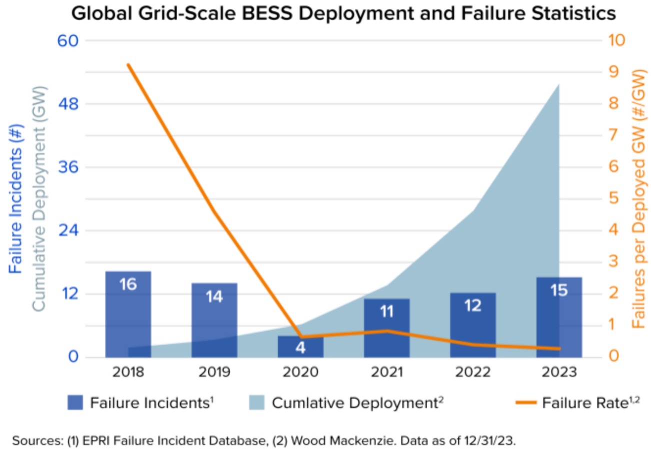
29) Incidents are gathered by the Electric Power Research Institute (EPRI)[3]. The collation of information was initiated in 2021 as part of a wider suite of BESS safety research after the concentration of lithium-ion BESS fires in South Korea and the Surprise, Arizona, incident in the US.

30) The database was created to inform energy storage industry stakeholders and the public on BESS failures and includes discussion of root causes (which are immediate) and underlying influencing factors.

[2] Lithium-ion energy storage battery explosion incidents, Zalosh, Gandhi, Barowy Accessed 30/02/205 https://doi.org/10.1016/j.jlp.2021.104560

[3] EPRI BESS Failure Incident Database. Accessed 30/01/2025. https://storagewiki.epri.com/index.php/BESS_Failure_Incident_Database

31) The figure to the right (from EPRI) shows that, although the installed capacity of BESS has grown, the rate of incidents per GW installed remains relatively steady.



32) Thus, it is not true that the technology has a 'good' safety record. It may or may not have an 'improving' safety record, but the number of incidents in time is steady and the technology has very substantial potential for large scale catastrophic incidents and a steady rate of possible initiators.

33) We discuss in more detail the hazards of battery storage systems later in this document.

[As the decision to require no EIA was given on false information it is essential that the applicant should be required to produce an EIA. Among other matters this assessment should consider the impact of battery fires, and the gases released and the consequences of a thermal runaway]

Major Industrial Hazards and Dalchork

Grid Scale BESS Should be Regulated under COMAH

34) The Control of Major Industrial Hazard Regulations (COMAH[4])require businesses to identify, prevent and mitigate the effects of major accidents involving dangerous substances. The aim is to avoid risks arising from accidents involving toxic, flammable, environmentally hazardous and explosive substances.

35) COMAH is applied to storage activities, explosives sites, nuclear sites and other industries where quantities at and above given thresholds of dangerous substances (identified in the regulations) are kept and used

36) The regulations referred to are the CLP ((Chemical Classification, Labelling and Packaging Regulations[5])

37) A major (or indeed any reasonably sized BESS and associated transformers) combines hazards of fire, deflagration, explosion, release of harmful toxic and flammable vapours, release of short and long term environmentally damaging materials, other releases both toxic and damaging to humans and the potential to start consequential fires in peatlands and moorland with hugely damaging and long-term effects on climate change.

38) Incidents in the BESS may also cause damage to the nearby electricity sub-station with effects on grid stability and operation. These effects may be electrical (which should be protected against), physical in terms of projectile damage, thermal in terms of radiation and operational in terms of restrictions on access to the sub-station.

39) Indeed, it is our view, that a burn of moorland started by a BESS incident would cause vastly more damage than any benefit in terms of displacement of hydrocarbon fuels.

[4] Control of Major Accident Hazards Regulations 2015. Simply put, the COMAH regulations are applicable to any establishment storing, or otherwise handling, large quantities of chemicals or substances of a hazardous nature, including production facilities, warehouses, and some distributors.
[5] Chemical Classification, Labelling and Packaging Regulations (CLP)

40) That BESS are not included in sites where COMAH applies is due entirely to a quirk of labelling and a lack of joined up thinking in Government. That is, it is an accident of Government stupidity that large scale battery storage systems are not classified as major industrial hazards.

41) Batteries, so far as CLP is concerned, are articles. As articles they are treated on their own as individuals. While, as items they may be like snowflakes - individually charming – in bulk they are very far from being innocuous.

42) 5 litre containers of petrol are, similarly, not a major hazard, but 3.0 million cubic metres of various hydrocarbons as at Stanlow Terminals on the banks of the Mersey Canal most certainly do constitute a major industrial hazard.

43) If the same weight or volume of fertiliser was stored at a site as in the batteries of a large-scale BESS, the site would fall under COMAH.

44) The hazard is caused by the gathering together in one place of individual items that require strict control at cell level, at module level and at system level.

45) Into that set of hazards is thrown the additional hazard from transformers with their probability of fire, explosion and consequent projectile production.

46) Enough is known right now about the hazards and partial mitigation for BESS (especially but not confined to Li-ion based systems) for a BESS to be treated, if not in law as a COMAH site, but at least in common sense, and practicality as such a site. Because the law is stupid, organisations and the engineers within them do not have to act stupidly.

47) It is possible that the law will catch up as a House of Lords private members bill attempts to impose a binding obligation on the local planning authority and require consultation of the Environment Agency and the Health & Safety Executive in addition[6]. The bill also gives the government the power to regulate the granting of environmental permits for BESS units containing Lithium-ion cells. We will not, however, hold our breaths.

48) In short, both the applicant and those who approve such grid-scale BESS should accept responsibility for any future incidents that can be avoided by competent engineering. **[We request that as part of any approval (if given) the applicant be required to act in all respects as if the site, equipment, maintenance and operations were subject to COMAH.]**

Implications of COMAH and the Common Planning Framework

49) In detail, we note that for a planning application of a site where COMAH applies, the minimum requirement is a major accident prevention policy that describes the operator's understanding of the risks involved and their approach to controlling them.

50) There should be set out broadly acceptable target risk levels and the philosophy (As Low as Reasonably Practicable or ALARP) that would be followed if acceptable levels were not achieved including setting out the upper tolerable level of risk.

51) As part of the planning application, therefore, there should be a detailed description of the possible major accident scenarios and their probability or conditions under which they might occur.

52) There should be a summary of the events that may trigger these scenarios either internally or external to the site.

[6] HL Bill 8 of 2024–25 Lithium-ion Battery Safety Bill [HL]. This also has a good review of some of the hazards associated with Li-ion cells https://researchbriefings.files.parliament.uk/documents/LLN-2024-0050/LLN-2024-0050.pdf

53) In a broad spectrum of other matters,

- Safety precautions built into the plan and equipment from design should be shown – for example, separation as a major mitigation for projectile risk
- Active measures to limit the consequences of a major upset or accident such as immediate fire suppression and times to hold escalation should be described – with estimates of the uncertainty associated with the time to hold.
- Realistic emergency plans should be set out that that are interfaced with local authority resources and plans. There is little value in 'holding' escalation for an hour if a 3-hour mobilisation of external resources is the best available.

54) Over and above that, COMAH does not cover the ground of the Hazardous Substances (Planning) Common Framework published in 2021.

55) Whereas, COMAH relates to on-site controls to minimise the risk of a major accident, the Planning Framework refers to residual off-site risk. That is, the risk of a major accident arising due to the proximity of hazardous substances to other development or sensitive environments.

56) This location sensitive issue was considered to be a spatial planning matter to be addressed through planning controls. It is these planning controls we are suggesting should, in equity, apply here.

[Planning consideration must look at the post incident effects of fire and noxious releases as well as immediate matters of fire detection, suppression and extinction]

57) The hazardous substances regime requires local planning authorities to comply with various consultation requirements and consider any major accident hazard issues before they can grant planning permission in relation to establishments, to certain types of development near such establishments, and hazardous substances consent.

58) Insofar as they apply, or should apply we refer to :

- The Planning (Hazardous Substances) (Scotland) Act 1997
- The Town and Country Planning (Hazardous Substances) (Scotland) Regulations 2015
- The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013

Hazards of BESS

59) No competent engineer would suggest that a large-scale BESS does not present complex potential initiators of major hazards that may have low probability but have large consequences to life, the environment and to population health.

60) The only engineering argument, we suggest, would be about whether the hazards are adequately controlled and whether thresholds of acceptable risk are exceeded.

61) An argument on the planning side would be whether the applicants have displayed in their application sufficient understanding of the risks involved in their project and shown the engineering competence to deal with them.

62) We have seen little evidence in this application of either of these planning aspects being addressed. It may be the applicants have such skills or can access them, but as applicants and, presumably, operators they should show them.

Transformers as Initiators

63) It is a fact that transformers explode and cause fire despite their protective systems.

64) The processes involved happen in around 200 to 400 milliseconds, for which standard protections are not designed to react.

65) Typically, for some reason there will be an internal short-circuit in the transformer. The short-circuit reaches 1,200 degrees Celsius and the oil, in contact with this temperature, vaporizes and creates explosive gases.

66) Within milliseconds, a pressure wave is traveling at the speeds above 1,000 m/sec.

67) The pressure wave propagates internally, and pressure may build inside the casing to greater than 10 atmospheres and the transformer ruptures.

68) The explosive gases generated during the short-circuit will be in contact with oxygen and the oil contained in the transformer, which leads to an explosion and associated fire. This is, in essence a Boiling Liquid Expanding Vapour explosion or BLEVE with greater energy flux than a jet or pool fire

69) In one study[7], peak overpressure caused severe damage within 20 m of the explosion centre with a 100% probability of the thermal radiation from a BLEVE causing fatalities to a distance of 140 m. A majority of the fragments would land within a range of ~100 metres.

70) At Dalchork we do not know the number, size and rating of the transformer units and, no doubt, claims will be made about the safety of the selected units.

71) What we do know, however, is what the costs of incidents in transformers rated 25 kVA and above has been in an interval from 1997 to 2001[8]. The tables show the results:

Table 1 – Number and Amounts of Losses by Year

Table 1	Total # of Losses	Total Loss	Total Property Damage	Total Business Interruption
1997	19	$ 40,779,507	$ 25,036,673	$ 15,742,834
1998	25	$ 24,932,235	$ 24,897,114	$ 35,121
1999	15	$ 37,391,591	$ 36,994,202	$ 397,389
2000	20	$ 150,181,779	$ 56,858,084	$ 93,323,695
2001	15	$ 33,343,700	$ 19,453,016	$ 13,890,684
Grand Total	94	$ 286,628,811	$ 163,239,089	$ 123,389,722

** Total losses in 2000 includes one claim with a business interruption portion of over $86 million US*

Table 1A – Number and Amounts of Losses by MVA and Year

Table 1 A	Total # of Losses	Losses w/data	Total MVA reported	Total PD (with size data)	Cost /MVA
1997	19	9	2567	$20,456,741	$7969
1998	25	25	5685	$24,897,114	$4379
1999	15	13	2433	$36,415,806	$14967
2000	20	19	4386	$56,354,689	$12849
2001	15	12	2128	$16,487,058	$7748
Total	94	78	17,199	$15,4611,408	

[7] Fire and Explosion Risks and Consequences in Electrical Substations - A Transformer Case Study
Mohanad El-Harbawi ASME Open Journal of Engineering 2022, Vol. 1 / 014501-1
[8] Analysis of Transformer Failures. William H. Bartley P.E. ; The Hartford Steam Boiler Inspection & Insurance Co. 2003

72) In another study, causes were split into internal (water content in the oil, insulation failure, short circuits between windings, short circuits between windings and their tanks, and failures of bushing connections)[9]. External causes were lightning strikes, switching errors and short circuits on transmission lines. Internal to external causes were 40/10.

73) The rate of transformer explosion as initiator rate for BESS incidents is not trivial. On average it is 3/1000 per year per unit. This does not account for common mode failure in linked groups of transformers.

74) The point here is that BESS are industrial sites and could reasonably be treated as major hazard sites on the basis of transformers alone.

Hazards from Batteries in BESS

75) Hazards for Li-ion batteries are not the same for one cell as they are for thousands of cells. There are good reviews of the range of hazards in papers by Vazzana et al and Jevarajan et al[10]. These and other publications should be referred to for detail and we only offer a summary here.

76) The impacts of failure vary with the size and volume of the battery, since the tolerance of a single cell to a set of off nominal conditions does not translate to a tolerance of the larger battery system to the same conditions.

77) Li-ion batteries are prone to overheating, swelling, electrolyte leakage, venting, fires, toxic and flammable smoke, and explosions. There is a very good summary of the process in Chen at al.[11]

78) The cells, if Li-ion, will degrade over time and repeated charge/discharge cycles.

79) In the worst case there would be a deflagration, a consequent explosion and an out-of-control thermal runaway.

80) The primary failures are likely to lead to a fast fire with associated pressure in the flame front – a deflagration.

81) However, the gases produced as a result of a fire, smoke, and/or thermal runaway can accumulate to a combustible level in the installation location and cause an explosion (detonation). They are also toxic. Chen et all [11] discuss their composition.

82) In general, the off-nominal conditions that can cause the occurrence of catastrophic events with Li-ion batteries can be categorized into electrical, mechanical, and environmental types.

83) The most common electrical hazards are over-charge/discharge, and external or internal short circuits.

84) Less common, although very relevant here, are the effects of sustained low temperature. If cells operate at low temperature their performance drops and while this may be commercially undesirable it is not all that happens.

85) As a cell is operated at low temperatures unobservable changes take place within the cell materials. These are not reversed when temperature rises again, and they are now defects in the cell and make the cell more likely to fail – usually with an internal short circuit

86) The performance of all Li-ion components at low temperatures is interdependent and interconnected a significant decrease of the capacity and faster degradation upon continuous cycling.

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[9] Analysis of Major Failures of Power Transformers. Tenbohlen, Hanif, Martin; on behalf of Cigre

[10] Risk Management in Energy Storage using Lithium-Ion Batteries: Emerging Risks Associated with Bess Systems Vazzanaa et al. Chemical Engineering Transactions vol. 111, 2024
Battery Hazards for Large Energy Storage Systems. Jevarajan et al, ACS Energy Letters, 7, 2022

[11] Lower explosion limit of the vented gases from Li-ion batteries thermal runaway in high temperature condition. Chen e al., accessed 30/1/2025; Journal of Loss Prevention in the Process Industries https://doi.org/10.1016/j.jlp.2019.103992

87) The influence of other environmental hazard causes, such as changes in altitudes, pressures, salt fog, floods, rain, etc., are not well understood.

88) Mechanical hazards such as those caused by vibration, shock, and impact are understood to a certain level, especially those encountered under transportation conditions.

Mitigation in Design – Separation

89) A primary protection that must be considered – and should have been considered by this stage - is separation between enclosures and within groups of enclosures and also separation from the transformers.

90) Insofar as we can judge from the drawings the units are in blocks of four with very inadequate separation. In the even of an upset, it is very likely that all four will, therefore, be involved.

91) We also estimate that the blocks of 4 are spaced 6 metres apart. This is quoted in many national guidance notes as the '***minimum'*** spacing between units.

92) Noting the possibility of a transformer incident throwing debris with high energy to at least 20 metres and possibly to 100 metres then Tx separation is also critical

93) The applicants have not shown any basis for their separation choices. They should show by calculation with their information sources how they calculate the spacing.

[The applicants <u>must</u> show by calculation (with sources) and using probabilities of individual unit failure, multiple unit failure and consequential unit failure, the separation required to mitigate fires, deflagration pressures and explosions]

Dealing With Incidents

94) Primary protection is through system data acquisition and control. These control systems operate at levels from the cell to the container of cells and then to the whole BESS – including intake of power and discharge with the necessary transformers.

95) The control will usually be active in terms of:

- charging/discharging cells - requiring knowledge of the cell state of charge and thermal condition and modifying the rate and depth of charge to suit
- heating/cooling enclosures to avoid overheating – and in the Dalchork case very low temperatures
- shutting down blocks of units either in a planned or emergency closure

96) If these protections fail, then fire and explosion will occur

97) A major issue with Li-ion batteries is their thermal energy feed-back whereby fire is fed by products of the fire and thermal runaway occurs.

98) A related issue is the chance of fire pressure fronts and explosions producing debris that can damage other units.

99) As noted above transformers may also cause mechanical damage to units – with consequent fires starting.

100) Intervention needs to be skilled and fast – it is generally accepted that substantial suppression is required within the first hour and should continue thereafter for many hours – even days.

101) Intervention and control of battery fires and, at the extreme, thermal runaway propagating through the BESS requires water – and lots of it.

102) The applicants do not explain who will intervene in a fire. Local volunteer fire services are not trained for such fires and also cannot bring to bear the resources needed.

[The applicants should set out who will intervene to fight any fire, what their response time is and what resources they will have. They should state what other agencies they will rely on and show evidence that these agencies have the capability to fulfil the needs <u>in the required timescales</u>]

103) The applicants discuss water resources and suggest 180,000 litres whereas, we understand that Yorkshire fire brigade have estimated 5.5 million litres would be required for a 50 MW BESS.

104) One Tesla car required ~115,000 litres as it kept re-igniting.

105) They do not explain how supply will be maintained in an interval where temperatures are at or below minus 10 degrees Celsius for a week or more.

106) They do not discuss the need to also spray and damp down the surrounding moorland.

[The applicants must provide detail of the fire suppression demands of any reasonably foreseeable fire and the associated supply capacity – and how it can be delivered in all weathers Any calculations for sufficient water supply for an appropriate suppression system will need to be completed by a competent person considering the appropriate risk and duration of any fire and the probability of multiple battery units being involved]

Summary

107) We believe this planning application for a hazardous industrial installation is defective. It does not demonstrate knowledge of the hazards inherent in the system proposed and does not set out how these might be mitigated.

108) The agreement that an EIA was not required was obtained using false or misleading information so that the consequences of fires and vapour releases that will affect our community are not covered An EIA is required.

109) On these grounds, this application should be rejected.

110) If the application is not rejected then it should only be accepted if it is re-submitted as if the site was subject to COMAH regulations and to demonstrate meeting acceptable risk levels in terms of damage to life, health and the environment.

Professor Colin MacFarlane

For Creich Community Council

31st January 2025

Colin MacFarlane   Background and Relevant Experience

Born in Inverkip, Renfrewshire 4 March 1950

2012-date	Technical Director, Tymor Marine Limited
2005-2012	Managing Director MOSIS International Systems; Technical Director MMK Ltd.; Marine Consultant, Clearwell Subsea Limited.
1986-2005	Lloyd's Register of Shipping Professor of Subsea Engineering, Glasgow & Strathclyde Universities
1981-1986	Naval Architect, Special Services and Structures, BP International, Central Engineering Department, London.
1973-1981	Naval Architect, Three Quays Marine Service (P & O Steam Navigation Company), London
1972-1973	Assistant Numerical Control Manager, Scott-Lithgow Shipbuilders, Port Glasgow.
1968-1971	Student Apprentice (Shipwright) Lithgows Shipbuilders, Port Glasgow.

Education

BSc (Naval Architecture) 1st Honours, University of Strathclyde, Glasgow, 1972.

Employment details

Colin MacFarlane is presently Technical Director of Tymor Marine Limited an independent marine and naval architectural consultancy with offices in Aberdeen, Glasgow and Lafayette, USA. The company performs a range of design and analysis functions, such as assessment of vessel and rig stability, structural design and modifications to vessels, seafastening of cargo and equipment, subsea deployment analysis, offshore and nearshore wave modelling, mooring analysis and offshore equipment design and modification. Typical work performed recently is given at the end of this document.

Colin MacFarlane held the Lloyd's Register Chair of Subsea Engineering at Strathclyde University from 1986 until he took early retirement in 2005. He graduated with a BSc in Naval Architecture from Strathclyde University in 1972, sponsored to university by Lithgows Shipbuilders with whom he was a Shipwright Apprentice. After graduation he was involved in the installation of a numerical control design and production system before moving to London as a Project Naval Architect with P & O Steam Navigation Company and later with their consultancy arm Three Quays Marine Services. In 1981 he joined BP's Central Engineering Department as a specialist Naval Architect and in 1986 was offered the Lloyd's Chair - the first in Subsea Engineering in Europe.

With P&O (& TQMS) his work included ship design, a considerable period of newbuilding inspection in Japan, Korea and other countries, repairs, conversions and general marine consultancy.

In BP he worked with a group of Oceanographers and Structural Specialists to provide central expertise on sea loading and the effects of the sea on all marine systems and structures and to provide assistance with oceanographic matters. The work involved design, measurement, inspection, maintenance and repair - particularly 'troubleshooting' on structural problems. With BP he was involved with a number of risk assessments and safety audits – generally of floating systems, but also of fixed platform and drilling systems.

He taught Maintenance and Maintainability to UK Ministry of Defence subject specialists within a specialist course on Reliability at Strathclyde University and aspects of pipeline engineering at Robert Gordons University. He was an external examiner for the MRes in Marine Studies at Newcastle University and for the MSc in Project Management at Aberdeen University. He was also the external examiner for the UK Health and Safety Executive's Diploma for their Inspectors when it was run at Heriot Watt University. Unusually for an engineer, he has been an examiner for MBA modules at Heriot Watt in Organisational Behaviour; HRM, Negotiation and Strategies for Change.

His research included work on the performance of materials in the ocean, convergence problems with slender rods/cables, development of novel thrusters for underwater vehicles, performance of radar over the ocean and aspects of breaking waves. The work on waves was with a Royal Society fellowship.

He was Quality Manager of the Centre for Advanced Maritime Studies at Strathclyde University – an organisation that specialised in providing education, training and technical services to the Maritime Industry – particularly concerned with hazardous operations – including cargo transfer and jetty operations, shipboard safety management, oil, chemical and gas tanker safety and ship technical operations. This work included jetty risk assessments, ship and berth safety audits and development of safety plans at gas terminals.

He was Managing Director of Mosis International Systems Ltd, a company that provided specialist stability instrumentation and stability services to the Offshore Industry and which is now part of Tymor Marine.

He has been involved in legal and arbitration work for a range of solicitors and industrial clients and has made a number of court and Inquiry appearances. He was technical advisor to the Trade Union Legal Group at the *Piper Alpha* Inquiry and acted for the family of the deceased at the *Ocean Odyssey* FAI. He was Technical Coordinator for the Isle of Man Government during part of the investigation of the loss of the *MFV Solway Harvester,* supported the partner of one of the deceased at the *Brent Bravo* Inquiry and was a member of the Joint Panel of Experts for the re-opened *MFV Trident* Inquiry. He assisted BP in their investigation of the damage to the *Thunderhorse* platform.

He was involved in investigation of the loss of the *Bourbon Dolphin*, an anchor handling vessel that sank off Shetland while placing an anchor, the salvage and investigation of the sinking of the tug *Flying Phantom* a 'hybrid' tug that was lost while manoeuvring a ship in the River Clyde and the loss of the tug *Jascon 5* off Nigeria while supporting a tanker FPSO.

He was accredited by the United Kingdom Transport and Security Directorate to provide anti-terrorist training and support and was involved with the police and others in aspects of anti-terrorist training and in port security planning. This included development of a number of Port Security plans in Italy and elsewhere.

In his present position he has been involved in a very wide range failure investigations and assessment of operational risk.

Professor MacFarlane combines a practical background with broad ranging industrial and academic experience. His interest in safe working has led him into accident and incident investigation, but he is still involved in design, construction and installation of marine and other systems.

Research

Principal research interests within Tymor Marine are around the measurement of stability in service and the effects of uncertainty. Tymor are developing the existing MOSIS system (Measurement of Stability In Service) which is in use worldwide to extend the understanding of stability and the capabilities of the system. This is presently in partnership with the American Bureau of Shipping (ABS).

Consultancy

The following are examples of relevant work:

- Removal of Schiehallion Floating Production System and installation of Glen Lyon Floating Production System at Schiehallion Field including risk assessment of operations
- Reviewing and measuring stability for drilling, accommodation and production units and investigating and resolving anomalous behaviour.
- Mooring analysis at quays for unloading project cargo, including development of environmental design information.
- Assessment of the safety of ships under the action of wind in dry docks in the UK.
- Assessing the makeup and quantities of wind driven sea spray and consequent salt coverage of cargo within a port in Korea
- Hydraulic design of modifications to ship firefighting systems.
- Design of anchor system and emplacement methods in a high-risk region of ‘quick clay’ to avoid soil collapse.
- Assessing the suitability of Irish Navy warships to carry large numbers of refugees on deck, including measurement of stability and assessment of deck area for social and medical use.
- Development of an Emergency Response Plan for a new Gas Terminal in the USA
- Developing a number of hydro-electric schemes for Southannan Estates Ltd., Fairlie
- Preliminary electrical design of 50 MW battery Storage Systems using inverter technology