



Isleham Parish Council Written Representation

Sunnica Energy Farm

Isleham Parish Council Registration ID Number: 20030170.

As chair of Isleham Parish Council (IPC), I would like to submit this Written Representation on behalf of the Parish Council and its parishioners to outline our objections to the Sunnica solar and battery farm proposal.

Executive Summary

Page 2 Introduction

This sets out Isleham Parish Council's strong objections to this scheme reflecting the concerns of our community relating to this project.

Page 2 Impacts and Objections

Explains the strong community identity of our village. The historic and ongoing links with Agriculture, our history, our use of the area, how we perceive our environment and our connections with our neighbouring communities. The Characteristics of the Landscape and the Cumulative Impact of this extensive development and what it means to Live in Isleham is explained.

Sunnica East A its Impact on Isleham from the Main Routes in and out of the Village, Isleham Marina and the River Lark, Impact on the Lee Brook chalk stream, Footpath and Leisure Impacts

Page 28 What we have been told by Isleham Residents, summarises the outcomes of the surveys undertaken within our village to ascertain the views of our residents. The level of opposition has remained overwhelming opposed to the development throughout this process.

It is clear that the development cannot be mitigated by the by the proposed screening. That screening will itself destroy what our community values most highly.

Page 28 Battery Energy Storage (BESS) and Substations

IPC considers that substantial additional information is required in order for battery safety to truly be assessed and do not feel that *preventive* safety measures are being 'designed in' to this scheme as they should be.

Page 29 Conclusion

Appendix 1 – Has a selection of statements from Isleham residents

Appendix 2 – Is a copy of IPCs response to the first ExA questions regarding the Isleham plane crash site

Appendix 3 – Has comments from a local business, the Rising Sun pub

Appendix 4 - SNTS AG Ltd Autumn 2021 survey of Isleham and Isleham Marina residents provides detail and results about the impact on Isleham residents

Appendix 5 – Commonly used routes by the Isleham Joggers group

Appendix 6 – Safety of Grid Scale Lithium-ion Battery Energy Storage Systems paper by Fordham et al.

1. Introduction

Isleham is a growing village having an estimated population of 2440 and with strong ties to agriculture over many centuries. This is evident in our village sign (see above) showing our 11th Century Priory surrounded by wheat, a tractor and horse-drawn plough. In addition, there is the importance of our historic waterways for trading and moving between neighbouring towns and villages, with whom we have forged strong connections over the centuries

Isleham's Neighbourhood Plan from 19 May 2022 seeks to ensure that the important attributes of Isleham that the community holds dear are not lost and that Isleham's individuality and distinctiveness as a Fen Edge village is retained and strengthened. If those attributes, those places of importance to our heritage and cultural heritage are harmed, our identity as a village will erode and we just become a bland and emotionless place to live. This must not be allowed to happen through the insensitive Sunnica development.

Isleham and our neighbouring villages have been blighted for the past 3 years with this ill-conceived Sunnica proposal. This application has raised significant concerns over the size and vast scale of this project impacting on our village and its setting within the wider area. The Sunnica East A site alone is more extensive than the entire village of Isleham. Our environment, views, landscape and physical and visual connection to our neighbouring villages, which we hold so dear, will be lost for over two generations, and in some parts forever

A considerable amount of resources in time, money and effort have been expended by our village already in objecting to this proposal. If Sunnica had engaged with residents (noting that around one-third of Isleham residents are senior citizens and a number of these could not access the online statutory consultation), if they had really listened and taken time to understand this area we feel sure they would not have proceeded with the application as it stands.

The concerns of the village have only been heightened because of the limited detail provided in the application documentation and the ongoing changes to their proposals. Their engagement with Isleham residents has been woeful. Sunnica have not entered into any effective dialogue with our community and their approach has been one of insouciance, arrogance, referring to Isleham as a "host site" and to us as "receptors". A number of their "expert" reports, are contrary to our local knowledge, understanding and perceptions.

This project will destroy our local environment and there is a complete lack of local benefit. The few long-term employment opportunities with the project increase the risk of further unemployment in the local Agricultural industries, a key part of the local economy in this area due to the vast area of land no longer being used for food production. This destruction is over a wide scale because of the spread out nature of the project so the cumulative impact worsens the overall situation.

Isleham Parish Council strongly objects to the Sunnica proposal. These objections are based on what people have told us in the village through surveys, meetings and discussions that have been held.

2. Impacts and Objections

Section 2.1 - Agriculture

One of our primary objections is the loss of large areas of high quality, high yielding, irrigated agricultural land, which we have farmed for generations. This has been heightened with the issues the country is having to address over food

security and food sustainability. We have a strong agricultural connection and to put it simply what Sunnica claim as being 'poor quality soil' is not true. We see the rotation of crops and the land's productivity year on year. We know from first-hand experience that this is good growing land, with winter-filled reservoirs that can be used for irrigation whenever needed. The high yields and the diverse range of crops (potatoes, sugar beet, onions, cereals etc) are evidence of the high quality of the soil. The conclusions put forward by Sunnica do not make any sense compared to what we know we can grow here. We believe that an independent soil analysis should be undertaken, using accredited methods.

As an example, this year farmers here were cropping more than 65t/ha potatoes and over 10t/ha wheat, even despite the extended dry conditions (see Figure 1). This land is capable of delivering high yields of food and grain even in extreme circumstances. The winter filled reservoirs are used to irrigate the crops. These are already in place, ready to use, so it is a perfect growing area that will deliver food even as our climate changes. To lose this would be a waste and would be foolhardy in light of the current food shortages across the globe

We consider that concerns over food security need to be addressed as part of the examination.



Figure 1. Fields of potatoes this year along Beck Road (on North and South sides). Potatoes do not grow on 'poor quality' soil. Crop yields this year have been excellent, despite dry summer

Section 2.2 - Characteristic Landscape and Cumulative Impact

Isleham is a Fen Edge village. We value our open landscapes and the far-reaching views available to us when travelling between our close-knit communities in this area. The landscape changes, the crops rotate over the course of the year. So you get a different outlook from one season to the next, and from one year to another. This makes it interesting and interactive. The fields are nearly always full of activity – be it ploughing, harvesting, sewing seeds etc. It is alive and this is highly valued. IPC objects to this dynamic landscape being substituted with lifeless, monochromatic fields.

Our views are long distance and wide ranging. The placing of Solar Panels, Battery Storage systems, visually intimidating fencing, substations and other industrial equipment changes this completely. To even consider that the planting of hedges and trees will mitigate the impact of this industrialisation of our landscape and views is unrealistic and unsympathetic to what we have here. Hedging is not original to this landscape. Nor are the suggested belts of woodland. Our classic Fen Edge landscape, the open views we value, will be lost forever and with the so-called mitigation, so will one of the main characteristics of Isleham and its setting. The centuries old open landscape that visually connects us to our neighbours will be gone.

Our neighbouring villages will be similarly impacted and we will have disruption to the whole area during any construction locally and even on a wider scale to connect all these dispersed sites to the Grid. This is an inefficient use of land and resources. The scheme design comprises around 9 or 10 large parcels of land that will be fenced off and filled with large scale industrial equipment. Road closures, footpath closures will all minimize our ability to move from village to village (see also later section on footpaths) and these impacts will happen in multiple locations, at the same time, which has the ability to sever our connection to our neighbouring villages and towns. The large number of HGV movements, staff vehicles all travelling along our narrow roads will further limit our ability to move around the area, not to mention the inevitable 'fly parking' by staff in and around the villages. Travelling by car and in particular by bicycle or on horseback will be more hazardous.

In this area we are a group of close-knit communities that that are separate but closely connected through family ties, the children going to our school coming from neighbouring villages, our churches (5 parishes including Isleham sharing vicars), the shared facilities in the surrounding villages and the various voluntary organisations and clubs e.g. ramblers, cycling groups and older/younger persons groups with participants from our surrounding villages. It is this interaction which binds our communities together and our connection to care for our local environment and the broader area.

The long-term impacts of the Sunnica scheme would be substantial. Travelling to Worlington or West Row from Isleham – the scheme will be there, highly visible for all to see. Travelling to Freckenham from Isleham along Station Road and the B1102 – it will still be there. Travelling to Chippenham and onto Snailwell and Newmarket – it would follow you. There is no escape. This sense of imprisonment from travelling through an extended and highly visible industrial compound is in complete contrast to the current sense of freedom we enjoy by virtue of the wide-open landscapes.

The impact on wildlife from this vast scheme would be significant. The extent of disturbance to wildlife habitats and the removal of the wildlife corridors will displace species. Deer and muntjac, which are common to see will be excluded from large numbers of fields by the proposed anti-deer fencing. Their displacement is likely to lead to more animals in the village and on the roads, which makes them more hazardous. IPC is particularly concerned about the inadequate conservation measures proposed for the rare stone curlew in this area. We are aware that a number of statutory bodies, including the Wildlife Trusts and Natural England, have made representations about this so we will not go into detail here, other than to state that we share their concerns.

There is nothing that can be done to overcome the harm caused by this scheme and our current and future generations will feel the negative impact. After construction our roads would be alongside barren industrial sites, stripped of their natural beauty. There would be no enjoyment of the landscape when travelling from one village to the next.

Section 2.3 - What it means to Live in Isleham

Isleham is rather special village in the sense of its strength of community spirit. It is a wonderful place to live, bring up a family, etc. There is a genuine sense of people looking out for one another and a strong feeling of cooperation and support amongst residents, possibly stemming from its agricultural heritage. Farmers continue to support each other during harvest periods. Farmers from outside the village travel here to help work the land, which is well-known as being high quality farmland that grows a wide variety of food crops and grains. This help is reciprocated. We are surrounded on all sides by fields of wheat, potatoes, barley, sugar beet, onions to name a few.

Local residents also support one another by growing vegetables, flowers and other local produce in allotments or in their gardens and making these available for others to have for free or for a small charge. As you walk around the village you will see many tables or stands outside peoples' homes offering local asparagus, eggs, potatoes, carrots, sweetcorn and many other foods all of which have been grown in and around the village. This ability to provide food for others gives residents a sense of pride and they feel lucky to live in an area that is so rich and fertile. There is a sense of pride to live in a region that provides food for the rest of the UK too.

There is a well-supported farmers market held at the Beeches community centre in Isleham each month, with many local producers from the surrounding area selling locally grown/reared foods and meats. Residents here also go along to other farmers markets in neighbouring villages (e.g. Freckenham). Thompson's farm near Isleham Marina

sells its award-winning locally reared meat directly from its farm shop, as well as at the farmers markets. They have a successful business which attracts people from neighbouring villages and beyond.

Isleham's agricultural and horticultural heritage and setting provides residents with a true sense of place, which is so important and grounding for both current and future generations. Primary school children are taught about the importance of farming and the Fens and about the wildlife and history here. They have a role to play in preserving this. There is a keen desire to keep local history alive, through the school and through village clubs and groups such as the Isleham Society, Friends of Isleham Nature reserve, etc.

Isleham residents will routinely sense, see and hear the Sunnica scheme because of its close proximity to the village boundary (less than ca. 500m) and the fact that the scheme is highly visible from two of the four main roadways into and out of the village, and the waterways too. The coming together of these views from multiple points will almost give the idea of being surrounded on many sides by the scheme. This partly explains the strong objection to the scheme in Isleham village and in this area as a whole.

2.3.1 Sunnica East A its Impact on Isleham from the Main Routes in and out of the Village

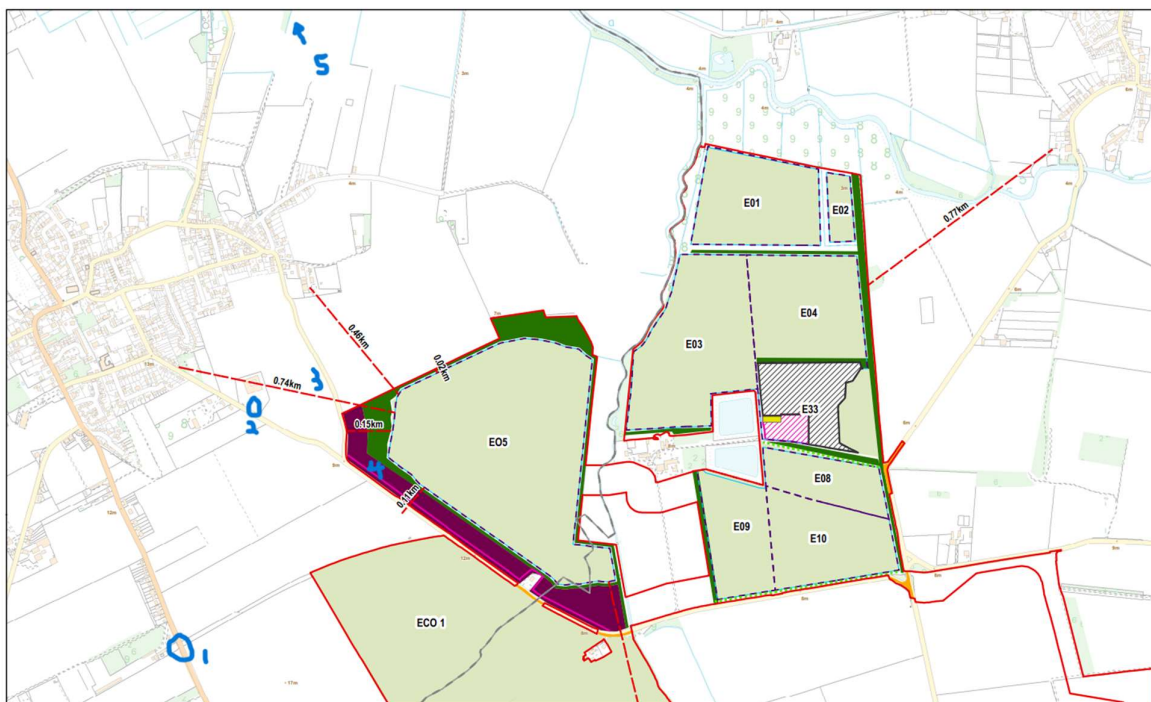


Figure 2. Screenshot of SEF_ES_6.3_Figure 10-14b Landscape Masterplan Sunnica East Site A

Figure 2 (Sunnica's SEF_ES_6.3_Figure 10-14b Landscape Masterplan Sunnica East Site A map) will be used in this report to help reference the viewpoints being discussed. The elevation is not shown on this map, so it cannot be used to show the impact that this scheme has over distance. As examples:

Area marked "1" (on Figure 2)

- The main road close to the area marked "1" on Figure 2 is Station Road (B1104). This is one of the main routes leading into / out of Isleham from the south, used by motorists and cyclists, but also walkers and joggers. Our neighbouring residents of Freckenham, Chippenham and beyond will typically approach Isleham from this direction. The route along Station Road (and even the along the B1102 from Freckenham) has a wide, open vista to the northeast, looking out towards Mildenhall and Lakenheath. It is easy to see the water

towers at the Mildenhall airbase in the distance; these are located some 2 miles or more away. It's a beautiful, open, agricultural view with fields of wheat etc as far as the eye can see (Figure 3).



Figure 3. Station road, taken from the upper edge of area marked “1” on Fig 2, looking out towards West Row and Mildenhall. The prominent building centre-left is the Ark church. Purple spot marks water towers at Mildenhall airbase, clearly visible as you drive along here. It is a far-reaching, open Fen Edge vista

- The circle next to the area marked “1” on Figure 2 shows the bridge that goes over the old railway track. Once again, from this elevated position of entry into Isleham, there is the characteristic far-reaching, Fen Edge landscape stretching away over towards Mildenhall. The Ark church, the UK’s largest green oak building, stands out. A beautiful, self-built hand-crafted building with strong connection to agriculture clearly visible in the way it has been built and the materials chosen. IPC understands that the Ark community has put its own representation together detailing the harm that would be caused to their setting by the Sunnica development, which would be in close proximity to this highly valued church and community hub. The industrialisation of its setting would damage its character and would have a detrimental impact on this unique place of worship and the close-knit community who use it.
- This main route into Isleham cannot be mitigated. It is not possible to plant trees etc in attempts to ‘hide’ the solar panels, security fencing, multiple BESS containers and huge substation on the East A site without dramatically altering the landscape in doing so. This sense of openness is so liberating when travelling in and out of Isleham that we must retain this for our future generations to enjoy. The characteristic landscape is integral to their sense of identity.
- Station road has houses on each side, many of which enjoy this beautiful open outlook from their homes and gardens. These properties would be around 600-700 m from the area proposed to be covered by solar panels, and approx.. 400-500m from ECO1 (on Figure 2). The panels, the BESS and the substations would be visible from these properties and would spoil their enjoyment of their homes. One Station Road resident commented,

“forty years ago exactly, November 1982, I purchased my first house here in Station Road, Isleham, a three bedroom semi detached property. Apart from the price of the property I very much liked being able to look

out both front and back over rural landscapes, watching wildlife where both animals and birds were free to roam or fly and was very content to raise my two children in this quiet rural setting. Some fifteen years later I purchased my second house also in Station Road and was able to continue to enjoy the peace and quiet of a rural setting. I have remained in this second house for the past twenty five years. Being a country boy, living in the countryside is about as good as it gets for me. I have enjoyed raising my children in this setting and showing them where our food comes from and knowing that this Road is where I have lived. Over the past two or more years this wretched company, Sunnica, is proposing to shatter these views that I have enjoyed over the last forty years by building an enormous solar farm/park, stretching over the many acres that will be in front of my house.” (Full statement in Appendix 1)

Area marked “2” (on Figure 2)

The main road marked “2” on Figure 2 is Beck Road, the main easterly route into/ out of Isleham connecting to Freckenham, Worlington, West Row and beyond to Mildenhall etc. It is a well-used route by motorists and cyclists, as well as by joggers, riders and walkers to access the Lee Brook, Mortimer Lane (public footpath W-257/002/X that connects Isleham to Freckenham village – see later section on footpaths) and beyond. Exiting Isleham village via this road to use the facilities in the nearby towns and villages follows an elevated position which descends slightly towards the intersection with Sheldrick’s road (road marked “3” on Figure 2). The view leaving the village along this road is remarkable and really does come into its own, especially in the spring and summer months. Beautiful open skies overlooking wide open arable fields full of vegetable and cereal crops. The view changes each season and each year depending on the crops grown. Onions, potatoes, sugar beet crops adjacent to large expanses of wheat and barley, which turn from their wonderful bright, lime-green colour to a rich golden colour over the course of the spring and summer. It is a very uplifting view and the openness gives anyone travelling along this route a great sense of freedom. Because of the elevation here, the view is particularly far-reaching with key landscape features clearly visible that remind us of our links to our neighbouring communities: the water and radio towers at the airbases of Mildenhall and Lakenheath (northeast), St. Mary’s Church in Mildenhall to the east, Freckenham church to the southeast, to name a few. This connectivity through this landscape would be lost if Sunnica were to go ahead (Figures 4 and 5).



Figure 4. Beck Rd. village exit. Ark Church on left. Residential dwellings on opposite side of the road (not visible on this image). A wide open, agricultural vista looking out to West Row and Mildenhall would be replaced by an industrial view for more than a generation. And then a blocked “view” of alien woodland if the proposed mitigation succeeded.



Figure 5: The churches of Mildenhall (St Mary’s, grade 1 listed, left blue circle) and Freckenham (grade 2 listed, right blue circle) are visible in this far-reaching view from the elevated Beck Rd. The visual connection between the churches of Isleham reminds us of our attachment to our neighbouring communities, which is valued must be preserved.

- The unique Ark church (Figure 6) is the dominant feature on the northern side of Beck road as you exit Isleham. It is beautifully crafted from green Oak (as discussed above). The elevated position of the Ark means that it faces a significant and harmful impact from the Sunnica proposal. Instead of looking over open fields of wheat and vegetables, it would look out onto fields of panels and expansive fencing, monotonous panels, security features and with battery and substation compounds visible in the distance (just beyond the Lee Farm buildings, which can be clearly seen from this location). This would be completely alien to this area and would be the wrong setting for this kind of building. The Ark community values the unrestricted and unspoiled views right across to West Row and Mildenhall and Freckenham from both the outside and inside of the building, from the upstairs and ground floor levels. The congregation of the Ark (in excess of 300 people) travel from all over the area to worship in this unique setting every week – it provides a place for families to gather, some of which no longer live in Isleham but enjoy coming here to socialise and worship together. It is also used as a community hub for the village (home of the Community Pantry) and a range of other community-based activities (e.g. toddler playgroups etc). This could lose its appeal if the setting changes, and people may choose to worship elsewhere and go to playgroups etc in other villages.

- Sunnica have suggested planting a woodland at the corner of Sheldrick’s rd. and Beck rd., which would stretch along the field border (E05) and connect with a further block of woodland. This mitigation in itself would transform the characteristic Fen Edge open landscape, blocking the views. The sense of freedom as you exit the village would be removed. The visual connection to our neighbouring villages and towns would be lost. There is no appropriate mitigation for this area without redefining the landscape that we value so much.

- There are residential properties around the area marked “2” on Figure 2 which also currently enjoy the colourful, unrestricted views out towards West Row and Mildenhall. These are only around 300 m from the huge area set to be fenced off for grey solar panels and other industrial equipment.



Figure 6. Fields of wheat in front on the Ark. View taken from corner of Sheldrick’s road, close to junction with Beck rd., looking west towards Isleham village. St Andrews church in Isleham centre can also be seen on the right

Area marked “3” (on Figure 2)

The area marked 3 on Figure 2 is Sheldrick’s rd., which provides access to the eastern side of Isleham from Beck Rd. It has a slightly elevated position and borders the Sunnica East A site. The visual impact from Sheldrick’s rd. would be significant – the view down towards the Lee Farm/ West Row and Mildenhall (including St Mary’s church) in the distance is entirely open. There is nothing that can be done to hide the intimidating, fenced-off fields of solar panels from this road without substantially altering the current characteristic Fen Edge landscape.

The view from Sheldrick’s rd. is highly valued, with fields of wheat and food crops (rotated regularly) as far as the eye can see. The road is a popular cycling, walking and jogging route into and out of the village, and is quieter than the main Beck Rd (Figures 7-9). One Isleham resident, Mr Minshall, who uses this route every day with his family to walk the dog commented, “I see more dog walkers along Sheldrick’s Road than I see cars.”



Figure 7. Sheldrick’s Rd looking south towards Beck Road. The Ark church and potato crops on the right hand side (west). The wheat fields where Sunnica East A is being proposed are on the left side (east).



Figure 8. Sheldrick's rd. looking towards Beck Rd. Red circle shows residential property at the end of Houghton's lane. Black circle shows Lee Farm in the centre of Sunnica East A.



Figure 9. Sheldrick's road is popular with cyclists, joggers, walkers, dog walkers who use the route to connect to Beck rd and on to Mortimer lane to access Freckenham

- Houghton's lane (Figure 10) branches off Sheldrick's road as you enter Isleham village from this route. There are a number of properties along Houghton's lane that currently look out onto active, open agricultural fields, but would look directly onto static zones of metal and glass, with BESS containers and a large substation in the distance. This will affect the quality of life for those living there. Mitigation of the view to the south of Houghtons lane towards Beck Rd is in the form of expansive woodland planting which in itself is uncharacteristic of this area and would also serve to transform the far reaching open outlook from these properties to a short distance outlook onto nothing. And in the first 15 years of the scheme, residents here would see and feel the full force of the industrial equipment from their windows and gardens, once again blocking the colourful far reaching views they currently enjoy. One family that lives along this route said,

"If the Sunnica project was to go ahead then this would have a huge impact on our daily family life, as the countryside that we enjoy very close to our doorstep would no longer exist. This would be detrimental to both our physical and mental wellbeing as we would no longer be able to enjoy this large aspect of our lives, which our children also

hold very dear. This change would bring a large question as to whether we could stay in our current home, in turn having a devastating effect on our family as a whole.” (see Appendix 1 for full statement)



Figure 10. View of Houghton’s lane, taken from the verge on Beck Rd. This would no longer be visible if Sunnica East A were to go ahead, as it would block this area completely. The residents of properties along Houghton’s lane would see a dramatic change to their outlook

One resident who lives on Festival Rd, which is elevated and lined with homes that look out to Sheldricks Rd and beyond also enjoys the open far-reaching views towards Mildenhall from her home. She said:

“Our back garden overlooks the fields behind Kennedy Road, Sheldrick’s Road and Appleyard close. On a clear day we can see Elveden war memorial and the chimneys of the sugarbeet factory in Bury Saint Edmunds. We can also see Saint Mary’s church at Mildenhall standing proud for all to see. I regular sit and watch the planes take off and land at both RAF Lakenheath and Mildenhall. We get to see the changing in colour of the fields around us from the brown in winter, green in spring, golden in summer and being harvest in the late summer early autumn.”

And that, *“To build any sort of building on these fields, and especially a solar farm and battery plant is so wrong. To take away the far reaching open views from me, my children and grandchildren would take away the enjoyment of living in our home that we love so much.”* (see Appendix 1 for full statement)

Area marked “4” – plane crash site (on Figure 2)

This site close to the barn just off Beck Rd/ Sheldricks Rd is where a loaded B50 bomber tragically crashed in Isleham just after WW2 (in 1949). This tragic event is an important part of Isleham’s village history and the crash site is considered a memorial site by Isleham residents out of respect for the brave crew who stayed aboard the failing aircraft to divert it away from the village centre, avoiding destruction of Isleham village. All 12 crew gave up their lives through this heroic action (see Appendix 2, a copy of IPCs response to the ExA questions for further details on this event). The explosion was felt 12 miles away and caused damage to a number of properties in the village. Many older residents remember it well and are keen to pass their recollections on to future generations. Memories of hiding under tables at the village school to protect themselves from debris, ceilings in their homes collapsing, scattered remains and debris at the site, etc. The crash site today is more or less as it was back then – open agricultural fields

with Lakenheath airbase (and Mildenhall airbase) as a backdrop (Figure 11). It has been preserved this way and protected for the last 73 years. Buried artefacts still remain and IPC considers this site should be preserved as a war grave.

IPC is both surprised and disappointed that Sunnica have paid little regard to this site, despite it showing up in their geophysical surveys (e.g. Figure 12) and despite being informed about the plane crash and the importance of it during the consultation process:

Section 6.3.134 of their Consultation report (SEF_5.1) states that *“Heritage assets such as Chippenham Hall, Fordham Abbey, and the Isleham plane crash site were included as assets that were felt could be harmed due to the Scheme.”*

In addition, in the Table on pg 1779 of their Consultation Appendices SEF_5.2 J1 to J5, it is stated that:

“The area of the Isleham plane crash site has been included within the study area of the heritage assessments (notably Appendix 7C of the Environmental Statement [EN010106/APP/6.2]) and has also been subject to geophysical survey and trial trenching, the results of which have been incorporated into the Environmental Statement. However, it is not possible to identify the precise location of the crash through the historical environment record or other documentary sources. The full results of the Applicant’s assessments carried out in relation to heritage can be found in Chapter 7 of the Environmental Statement [EN010106/APP/6.1] submitted as part of the DCO application.”

This is to be disputed – the geophysical surveys showed an anomaly in the field around Isleham, and Sunnica had been alerted to the plane crash event. IPC is interested to know what “other documentary sources” were used by Sunnica to investigate the incident and to establish the location of the crash site. A simple google search of “Isleham plane crash” would immediately bring up details of the tragedy. The applicant could also have approached IPC or village history experts for more information. This does not appear to have happened. We remain unconvinced that sufficient effort was made to investigate the site and remove it from the development area, which is something we feel must be done out of respect for the brave crew and because of the strong sentiment attached to this in the village.



Figure 11 – View of Plane Crash Site from Sheldrick’s Road/Beck Road. There is an open visual connection between the crash site, the village and the airbase at Lakenheath, which we feel must be maintained

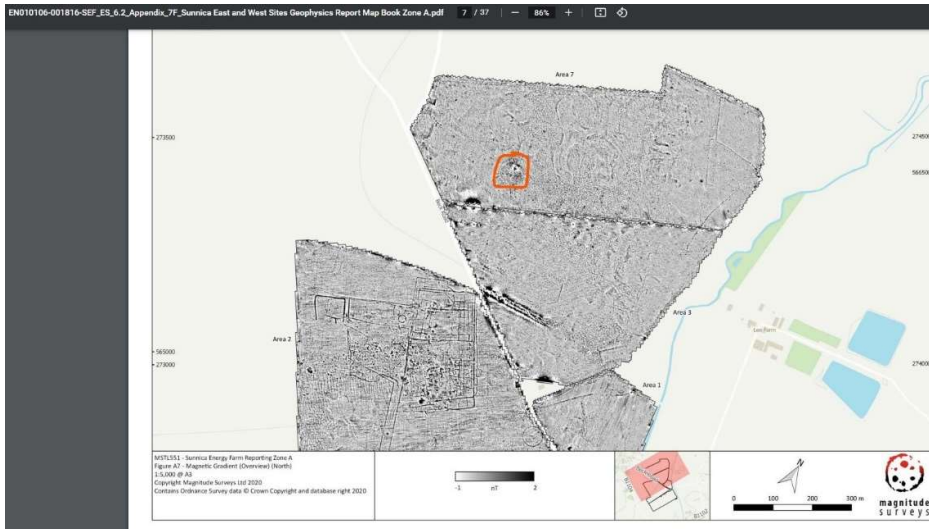


Figure 12 – Example Sunnica Geophysical survey ES 6.2 Appendix 7F. Red ring marks the anomaly identifying the main crash site

Relatives of the crew who lost their lives occasionally visit the site to pay their respects. From the field they get a true sense of how the tragedy unfolded. It is clear to see where the plane would have taken off from (Lakenheath airbase), the short route that it took over the village and where it eventually came to land. It also serves as a reminder of the close ties our community has with our neighbouring US airbases.

Commemorative events / talks / articles mark the anniversary of the tragedy (e.g. Figures 13-15). Isleham residents requested a plaque as a memorial to the crew who lost their lives, which was supported by IPC. The plaque is located at the community centre in Isleham (the Beeches) since the land is under private ownership,

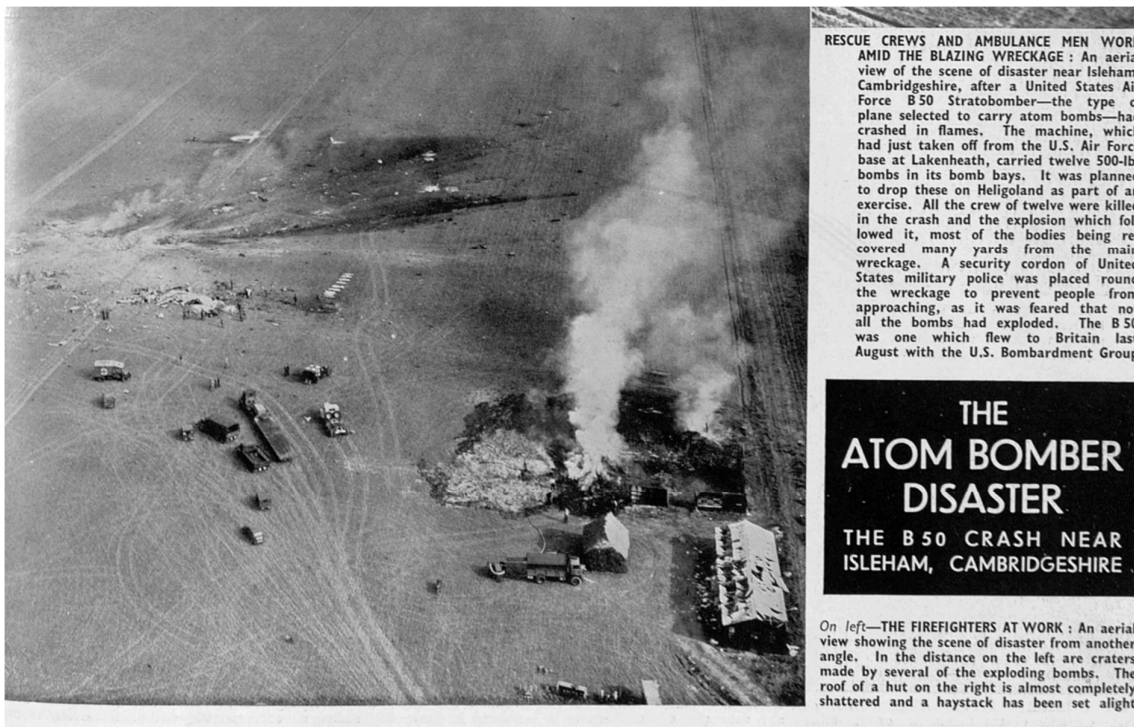


Figure 13 - Extract of newspaper reporting the crash at the time. The barn in bottom right corner of this picture is the one that stands in the field today



Miscellaneous Isleham History

The day Isleham escaped mass destruction

Published in the Newmarket Journal 10:44 Thursday 22 October 2009

Sixty years ago this month, when the flaming fuselage of the world's heaviest bomber streaked across a foggy October sky, residents of Isleham had no idea just how close they had come to destruction or how much they owed to the "noble actions" of its American pilot. Every member of the 12-man crew of the B-50 Strato bomber which was out on a practice bombing mission and crashed in Beck Road, was killed, but the consequences could have been considerably worse for hundreds of others as the 16 500lb bombs it was carrying had been designed for mass destruction. The B-50 had taken off from RAF Lakenheath at 9.25am on October 13. It had been checked the day before and immediately before take off. It was carrying enough fuel for 10 hours in the air but had got into difficulties shortly after leaving the airfield. Knowing that he and all those aboard were doomed, the pilot, Major George Ingham managed to steer the burning plane away from the village below, knowing the explosive power of the weaponry would have spelt certain disaster for hundreds of residents below. At an inquest into the death of Signaller David Garrett, the only British crew member on board the doomed bomber, held two days after the crash, witnesses to the tragedy told their stories. One of the first at the scene was a reporter from the Newmarket Journal who had followed fire crews to the crash site, described the chaos which followed the crash. "It seemed unbelievable," he wrote, "that the biggest bomber in the world could be reduced to small pieces of debris in such a short space of time. "When I arrived a search was being made for bodies which still lay where they had been thrown. "Wherever you walked there was evidence of a terrific explosion, either the pieces of the bomber itself or the gruesome reminders of the mutilation of some of the crew." Farm worker Joseph Leonard, of Beck Road, Isleham, told the inquest he could not see the plane because of the thick low fog, but he had heard a "spluttering sort of noise". Turning round he saw the bomber emerge from the clouds with its fuselage on fire. James Goodchild, a farmer of the White Lion, East End, Isleham said he had seen a plane coming from the Mildenhall direction at a very low height. Flames were streaking from its fuselage, its tail was crumpled up and the plane nose-dived towards the ground. Mr Leonard fell off his tractor and lay flat on his face after hearing a large crack and

Figure 14. Extract from Isleham Village News 2009 – marking 60 year anniversary of the tragedy

SuffolkNews



Villagers honour American air crew heroes seventy years on

By Alison Hayes - alison.hayes@liffepublishing.co.uk

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The 12-man crew of a US bomber which crashed into a field near Isleham 70 years ago has been honoured with a memorial in the village's community centre.

A plaque bearing the names of the 11 American and one British airmen who died when their B-50A Superfortress hit the ground and exploded in a ball of fire on October 13, 1949, was unveiled on Thursday at the Beeches Centre by USAF chaplain Lt Col Kyle Hundley.

The aircraft, which was designed for long-distance bombing raids and was said to have been specially

Figure 15. Extract from Newmarket Journal Jan 2020 – plaque unveiled to mark 70th anniversary of the crash (which was in Oct 2019)

Travelling from Isleham to West Row along Beck Rd

- Leaving Isleham along Beck rd. leads to a staggered crossroads at the 4-ways bridge (former railway bridge). This is located at the bottom right hand corner of the area labelled "E10" on Sunnica's map (Figure 2). Turning left (north-bound) takes you to West Row (along the Unnamed Rd leading to Ferry Lane in West Row). Straight over (east

bound) leads to Worlington and turning right (south bound) leads to Freckenham and beyond. The elevation and openness here once again means that the Sunnica East A site is highly exposed (Figure 16). Mitigation here is unlikely to be successful due to the elevation. These fields would be filled with solar panels, solar stations, an extensive BESS compound and a large substation compound with supporting infrastructure 10m high. The view north towards the River Lark and West Row would be blocked by the imposing industrial equipment.



Figure 16. View looking back towards Isleham from 4-ways bridge crossroads. Red circle = Beck rd., looking towards Isleham. Black circle = Lea Farm main building. Blue circle = land used for pigs, earmarked for BESS compound and substation, marked as “E33” on Figure 2. The trees in the distance close to the blue circle is where the River Lark runs.

- The area marked on Sunnica map (Figure 2) as “E33” is the area proposed for the extensive battery energy storage system (BESS) complex (66,000 m²) and substation (55 m x 85 m x 10 m high, per Sunnica’s Outline Battery Fire Safety Management Plan). The number of 17m x 5m x 6m high BESS containers has not yet been disclosed by Sunnica Ltd, although it is estimated that this could be over 50 containers (crude estimate based on the images of the smaller 29 and 30 MW facilities provided in Table 2 of the Outline Battery Fire Safety Management Plan). The arrangement of these is as yet unknown. This industrial complex will be surrounded by high security fencing, lighting, and cameras.

This will create a large and highly visible industrial complex that is totally out of keeping with the current peaceful agricultural environment. Site “E33” is adjacent to the road (Un-named rd./Ferry lane) that leads into West Row village. This is a well-used route (by motorists, cyclists and joggers) to connect Isleham to West Row and beyond. Not just for leisure trips and recreational activities, but also routinely used for commuting to/ from the nearby towns of Mildenhall and beyond for work, etc.

The sheer size and scale of this BESS and substation compound, the location close to the road, the openness of the view from the roads all around it and the elevated views over this entire site from the area around the 4-ways bridge, all mean that it would be impossible to mitigate or hide. It will be a significant change to the local landscape and will transform the area from a rural environment to an industrial zone.

- The Un-named Rd/ Ferry Lane is the only road to West Row from Isleham. It is also used to access Mildenhall and beyond, as well as Beck Row, etc. It is a popular route – not just for motorists but also cyclists. Travelling south from West Row towards the 4-ways bridge offers delightful views of the Grade 1 listed Worlington Church to the east and a far-reaching view over to St Andrews church at Isleham looking west. These visual connections between communities are important to retain (Figure 17).

The BESS and substation compound would be highly visible from this route, and at 10m height would be difficult to mitigate.

The Judes Ferry pub along this route is a popular stopping off point too (see later section on footpaths and recreation).



Figure 17 Ferry Lane/ Un-named road. Route heading south to Isleham after departing West Row. Blue line shows approx. BESS and substation location. This, and the panels would be highly visible from this well-used stretch of road

Area Marked “5” (on Figure 2) - Isleham Marina and the River Lark.

Isleham Marina (Figure 18) is a residential area on the River Lark, a rare chalk river. There are ca. 116 lodges (approx. 70% permanent homes) and over 150 boats moored (approx. 50-60% are lived in, others are leisure boats that are used regularly). Residents choose to live here to be closer to nature. It is a unique and wonderfully tranquil area to live and also to visit. Some of the lodges are also used as holiday lets.

The marina is approx. 1 Km from Sunnica East A and the open, unrestricted landscape from the river and the elevated riverbanks in this area means that East A would be visible every time the residents and visitors enter/leave the marina via the waterways or via the footpaths leading to West Row (Figure 19).



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Figure 18 Aerial view of Isleham marina lodges. River Lark runs along the north of the picture. Narrow boats (“live aboards”) can be seen along the riverbanks in the NW corner.

There will also be noise impacts for residents here (bearing in mind these lodges and boats are not well sound-proofed), not only during construction but also during operation with substations and BESS air handling systems etc.

The noise is likely to travel easily to this site, as there is little background noise to mask it and the landscape is open with little in the way of trees, tall vegetation etc. The marina residents did not feel that Sunnica had adequately consulted them about the scheme and the impact it might have as a number of residents here were unable to access online information. IPC is unclear whether Sunnica realised that this was a residential area and we are not convinced that noise impacts on this area have been adequately assessed.

Sunnica East A would harm the quality of life for the marina residents, many of whom have sold their homes in busy towns and cities to seek a tranquil lifestyle with access to the waterways (comments from some marina residents are included in Appendix 3. It is likely to also affect boating visitors (boat hire fleets include operators Hoseasons, Foxes Narrowboats etc) who come from other marinas such as Ely, Littleport, Brandon etc. The holiday letting businesses could also be impacted as people choose to come here to experience living closer to nature and to wildlife spot etc. Not to live in or boat through an industrial site. There is a risk that visitors would choose to go elsewhere and that current residents may take up moorings at other marinas.

As well as boating, marina residents and residents of Isleham village and other visitors to the area regularly use the waterways in this area for canoeing, kayaking, paddle boarding, fishing. A number of marina residents are also keen bird watchers and general wildlife enthusiasts. They use the footpaths (Figure 19) in this area routinely for dog walking, exercise, nature spotting etc. (see later section on footpaths and leisure).



Figure 19. River Lark footpath (northbank) looking East towards West Row and Worlington. Blue line shows roughly where Site East A would be and the high visibility from the river/ riverbanks.

2.3.2 Impact on the Lee Brook chalk stream

The Lee Brook (Figure 20) runs through the middle of the area proposed for Sunnica East A. It is a rare chalk stream (and tributary of the River Lark chalk stream). According to local expert naturalist, Tony Weston, there are a number of rare and protected aquatic species that inhabit this Brook, as well as water vole, which could be severely impacted through run-off from the solar panels (which face downhill towards the brook) which would causing silting and soil erosion. IPC does not feel that this has been adequately assessed. In the not unlikely event of the PV cells being damaged here, there is the further risk of run off of hazardous/toxic materials into the Lee Brook. IPC understands that the local nature group, Friends of Isleham Nature Reserve, is putting a representation together about this and other impacts. IPC is of the view that further assessments must be made of this important ecological site.



Figure 20. The Lee Brook rare chalk stream that leads into the Lark. Photo taken from the Lee Bridge on Beck Rd. This runs through East A site and is at risk of damage. The fields either side of the brook would be covered in panels and fencing. Black circle = Lee Farm main building

2.3.3 Footpath and Leisure Impacts

There has always been a strong association between local residents and the footpaths and recreational routes in this area. The Covid pandemic reinforced the value people place on being able to step out of their front door, straight into the countryside. It is essential part of the health and wellbeing of the communities here. Our footpaths were (and still are) used as outdoor meeting places for families and friends to gather, particularly from neighbouring villages.

There are also a number of initiatives to tie this recreational footpath usage to local history and heritage. Groups such as the Isleham Society and Friends of Isleham Nature Reserve organise well-attended activities that add even more value to the enjoyment of the landscape by highlighting key areas of historic or natural interest. Examples include tree planting activities (a recent tree planting exercise along Coates Drove attracted around 100 volunteers), identifying trails that follow historic routes, etc. The monthly Isleham Society heritage events are typically attended by over 40 people and increasing. IPC is supportive of the representations made by the Isleham Society and the Friends of Isleham Nature Reserve. The school also plays its role in teaching the children about their local environment, which ties in with local history and their topic work such as the Romans (we have a Roman settlement), the Bronze age (we are home to the “Isleham Hoard”, the UKs biggest bronze age find) and teachers take them out along the local footpaths in and around the village to identify with their natural surroundings and local heritage.

There are other regional initiatives such as the Fen Edge Trail (Figures 21-22), which includes Isleham as a Fen Edge village, and which promotes use of the ancient pathways along the fens that connected communities and allowed them to meet and trade. There is a keen desire in Isleham and in this area as a whole to keep this interest in the local environment alive.

Home The Trail ▾ The Fen Edge ▾ Links Contact Us 🔍

Walks update

We are gradually completing the walks to link up the whole of the Fen Edge from **Peakirk**, near the Lincolnshire border in the northwest, to **Isleham**, near the Suffolk border in the southeast, and around the islands – the 'Isle of Ely', **March**, **Chatteris**, **Whittlesey**, **Thorney** and **Wisbech**.

The map shows the routes of the walks that are already published and others that are currently being planned. **See below to download the published Walk Guides and for the list of walks.** (NB The map does not yet show the Cambridge Castle Hill to Sedgwick map as published.)

Walks published so far:	11
Due 2022:	9
Being developed:	22
Planning underway:	6

Fen Edge Trail Walks
 Published: Purple line
 To be published 2022: Yellow line
 Being developed: Orange line
 Being planned/contact us to help: Green line

Contours: 0m blue, 5m yellow, 10m and above red

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Figure 21. Fen Edge trail walks. Isleham is no. 31 on their route (see www.FenEdgeTrail.org for more details)

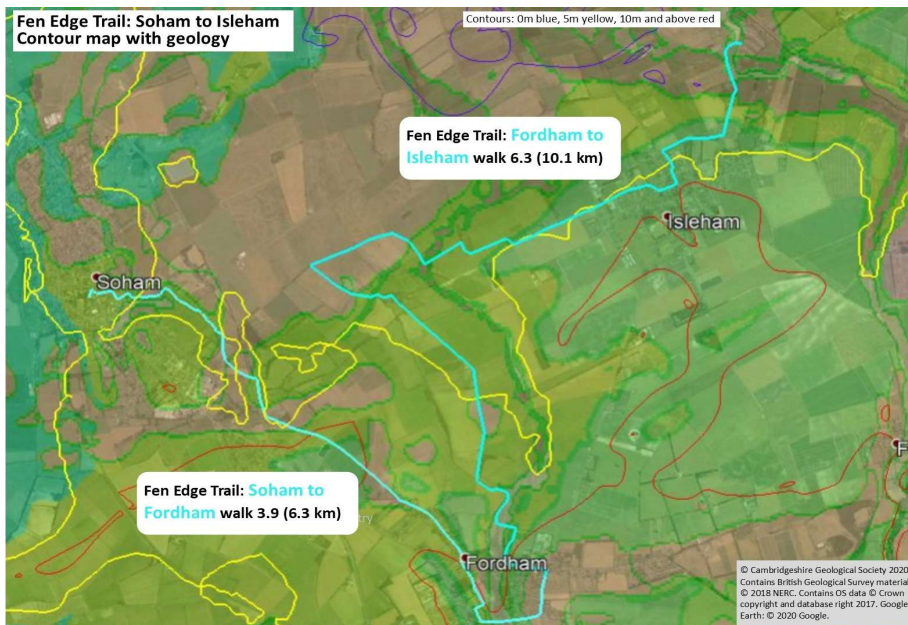


Figure 22. Shows the Soham-Fordham-Isleham trail

The Sunnica scheme would severely damage the enjoyment of the footpaths and waterways in this area. These initiatives that ensure future generations have a true sense of place, that their local landscape is valued, will suffer. Attracting tourists and hobbyists to the area to enjoy the characteristic wide-open landscapes, leading in to the Brecklands, the waterways, etc will be difficult. People do not choose to visit an area to walk around an imposing high security BESS compound, with expansive substation and 'dead' fields full of solar panels and solar stations. Local businesses will likely suffer as a result. A local pub landlord recently commented that the development would be harmful to his business (Appendix 3)

Examples of some of the footpaths that will suffer are outlined below. We have also reviewed some statistics from the Outdoor Recreation Valuation tool (ORVal), developed by the Land, Environment, Economics and Policy (LEEP)

Institute at the University of Exeter, as well as feedback from a number of local surveys and observations (some of which have been carried out with the help of the Say No to Sunnica Action Group Ltd, SNTS). The footpath references are taken from Sunnica’s SEF_ES_6.3_Figure 12-6 Public Rights of Way Post Construction (Figure 23).

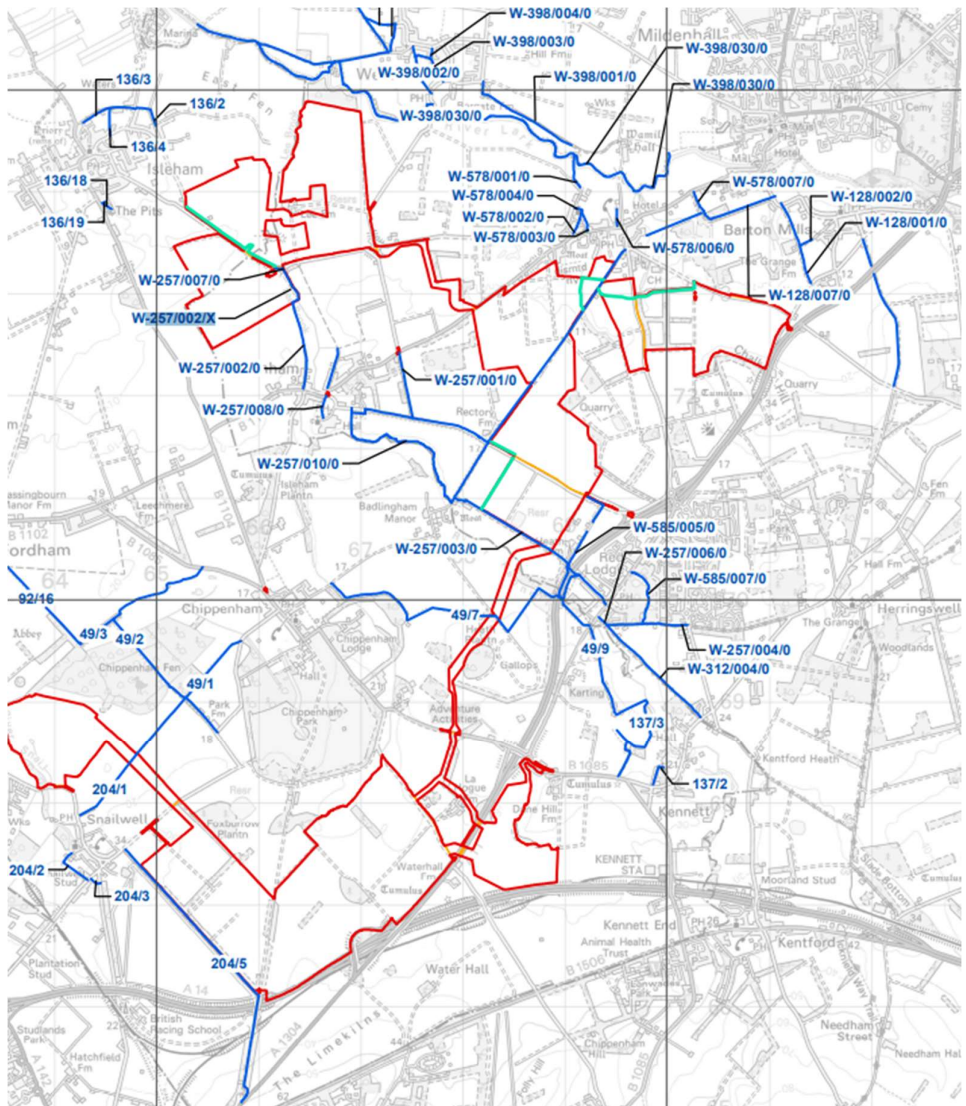


Figure 23. SEF_ES_6.3_Figure 12-6 Public Rights of Way Post Construction

1) River Lark (Sunnica ref W-398/003/0)

In the northern edge of Figure 23 the footpaths along the banks of the River Lark can be seen. These stretch from Prickwillow direction to West Row and are indicated on the ORVal tool as having 44,845 visits a year, with a recreational value of £176,063 per year (Figure 24). It is a beautiful, unspoiled stretch of tranquil countryside, with an abundance of wildlife.

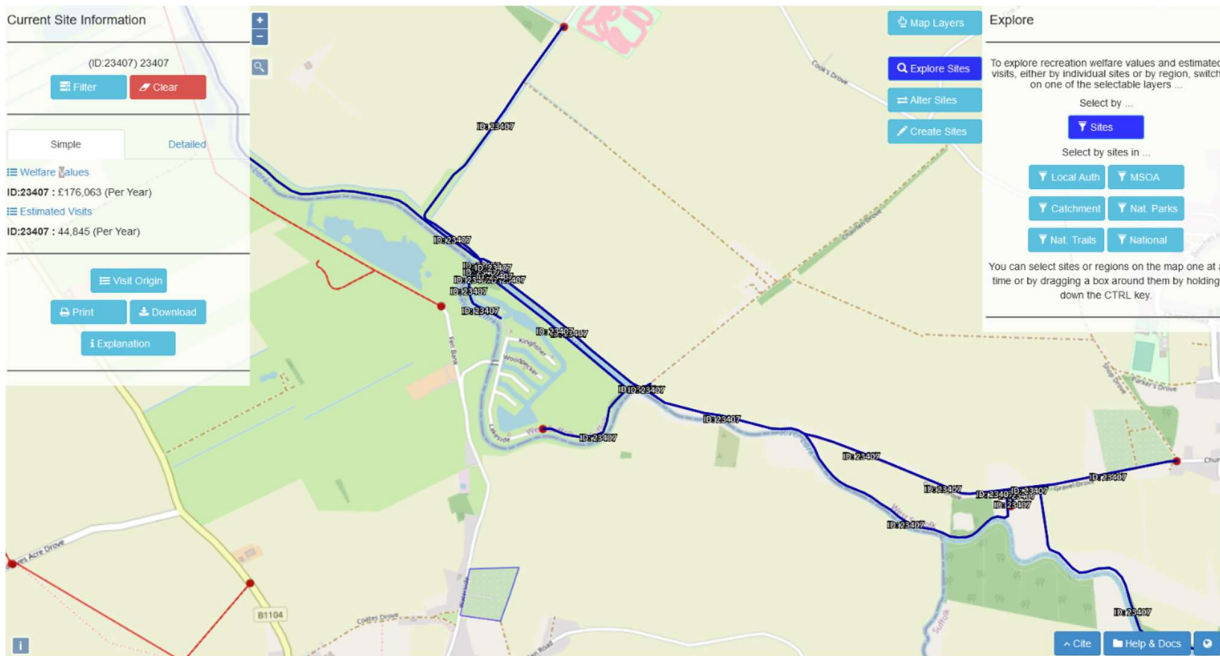


Figure 24. ORVal image showing Isleham marina and the River Lark footpaths

The River Lark chalk river is the only access route into/out of the Isleham Marina and on to the waterways beyond. Sunnica East A site is highly visible from the river, and from the elevated riverbanks in this area, as the view is unrestricted and far reaching, looking out onto farmland and abundant wildlife. It is a unique, unspoiled, peaceful setting.

The northern riverbank of the Lark (footpath W-398/003/0) is well used as it provides easy access for walkers and cyclists from Isleham to West Row and Mildenhall (heading East) and Prickwillow heading northwest. As well as being a lovely route for wildlife spotting and nature enthusiasts, it also has historical features including the ruins of the old Ferry Inn (where the Ferry used to take people across the river) and the Spurgeon memorial stone (Figures 25-28), which marks the area of the River Lark where the famous preacher, Charles Haddon Spurgeon, was baptized in the river. The annual “Spurgeon Trundle” is held on the Saturday closest to 3rd May (the date he was baptized), to commemorate the baptism of the great preacher in 1850. The ‘trundle’ is a guided walk, typically attended by 25-40 participants, following the old track that used to lead to the ferry and the Ferry public house to the stone, where they gather and hold a short service.

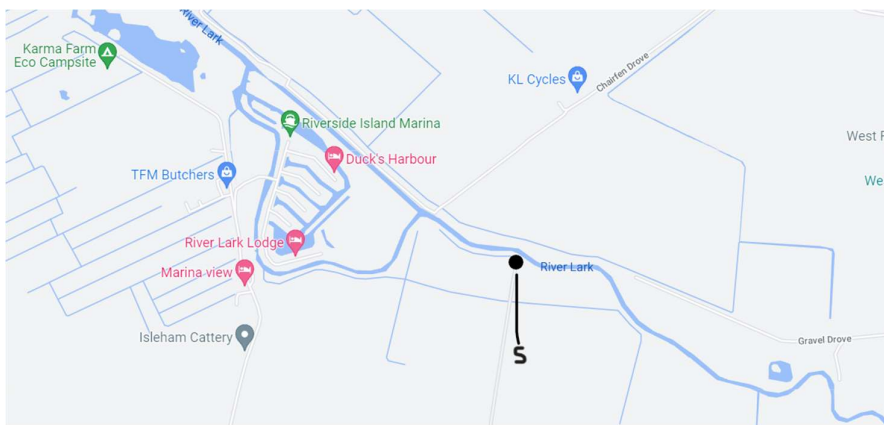


Figure 25. Isleham Marina and the River Lark. Black circle marks the site of the Spurgeon memorial stone and former Ferry Pub



Figure 26. Spurgeon stone, taken from northern riverbank. Marks the spot in the river where Spurgeon was baptized.



Figure 27. The Spurgeon stone. Keeping the local history alive for future generations.



Figure 28. Some of the participants of the annual “Spurgeon Trundle” this year (held on May 7th 2022)

The setting of the Spurgeon stone and this particular area of the River Lark is of significant importance to local residents from a recreational point of view but also to history enthusiasts since river baptisms at this site were hugely popular events (Figure 29). Baptisms here were attended by as many as 2000-4000 people, who would travel for miles to get here. This historic and unspoiled setting would be harmed by the East A development which begins at around 200 metres from the memorial stone. Other than the clump of trees close to the stone, the setting is open, with direct views over towards East Site A. The rural tranquility of the setting was a feature of these immersion baptisms, noted by Spurgeon himself in his memoirs. That unspoiled peace and tranquility, the open rural views are still as important today for anyone using these footpaths. To alter the landscape surrounding this historic site would have a damaging effect.



Figure 29. Full immersion baptisms were still continuing in the Lark for many years after Spurgeon’s baptism (e.g. this photo taken in 1909). They attracted large crowds of up to 4000 people who lined the riverbanks and even crowded onto barges to watch the event.

A survey of Isleham and Isleham marina residents in autumn 2021 evidenced the regular usage of the footpaths around the River Lark and Marina and the importance that people attach to them (Appendix 4). 92% of people who responded said they regularly used the footpaths along the banks of the Lark and Marina. 48% used them weekly and 21% used them daily. Mainly for recreation or exercise or dog walking, but also as a route to connect to nearby villages. The survey responders are likely to use these footpaths with other people – there are often family groups or groups of older children enjoying the footpaths and waterways in this area, especially at the weekend and in the holidays. This summer in particular it was easy to spot visiting kayakers and paddle boarders using the Lark around the marina, in addition to the marina inhabitants themselves (Figures 30-31).



Figure 30. Canoeing along the waterways at Isleham Marina and beyond to the River Lark



Figure 31 Kayaking along the River Lark. Cyclist and dog walkers also using the footpath along the riverbank. Isleham Marina is to the right of the centre of the photo

47% of survey responders said they used the footpaths around the Lark all year round. The landscape, wildlife and peace were the main points that people value about these footpaths.

There are no other footpaths in Isleham that follow the riverside. It is a uniquely peaceful environment to the villages of Isleham and West Row and should be preserved from industrial development.

As well as being a popular route for walking, wildlife spotting, water activities and heritage, the footpaths eastbound along the Lark offer an easy means of getting to West Row. The pathway along the northern bank offers one of the few circular routes in this area - for example, you can go by bike from Isleham Marina to West Row via Hayland drove or Chairfen drove and return either via Gravel drove (returning via the footpath along the river bank of the Lark back to the marina). Or by heading to The Green in West Row village, on to Chapel road and Ferry lane, and picking up Ferry Lane/ Un-named road back to Isleham (see sample cycling route taken from a recent family bike ride, courtesy of Isleham resident, Mr Fuga, Figure 32).



Figure 32 Example of a circular cycling route – Centre of Isleham to Isleham Marina, along Lark footpath to Chairfen drove, into West Row and then back to Isleham along the main road (Ferry Lane/Un-named Rd and Beck Rd). Option to stop off at Judes Ferry Pub (purple circle) on Ferry Lane. Green circle = approx. BESS compound and substation, Black outline is roughly where the panels and BESS/substation will be. This whole area is easily visible from the roadside and waterways.

If on foot, there are numerous options of circular routes from Isleham marina, heading along W-398/003/0 and using the various public footpaths in West Row village. It is easy to connect back to the footpath along the River Lark once at West Row (with a convenient stop at Judes Ferry pub) and head back to Isleham (westbound) along the river bank (W-398/003/0). Or the journey can continue eastbound along the riverbank to Mildenhall.

Judes Ferry Pub

This pub has a lovely riverside garden (Figures 33-34) with moorings along the river. It can be readily accessed from the W-398/003/0 footpath. The view from this riverside pub garden, which faces South, has beautiful views over the surrounding agricultural land, which could be transformed into Sunnica East A site. The garden is approx. 700m from the E04 area of panels and around 800-900m from the large BESS compound and substation. As with the other parts of East A, the views from here would become stark and industrial – certainly for the first 15 years. If mitigation planting were to succeed it would in itself block the far-reaching open views across to the south and southwest from this lovely garden and would spoil the enjoyment of sitting here. With the scale of the BESS and substations proposed, it is unlikely that mitigation would be effective in hiding the industrial equipment, and in any case this would take more than a generation to establish.

It is unlikely that people will choose to stop off here to sit and have a drink by the river if faced with looking out onto an industrial site, when they are used to looking out over tranquil arable farmland. This would be a significant loss as there are very few, if any, pubs in the immediate area that have a riverside setting. Mr Fuga, a keen cyclist who lives in Isleham said,

“It would be a real shame if Sunnica were allowed to build a substation and battery complex here. I often stop at this point when I’m out cycling to take in the views from the bridge and sometimes to have a drink before continuing on my route. There’d be no point in stopping here to just look out onto a substation.”



Figure 33. Popular riverside garden at Judes Ferry pub with moorings for boats. Looks out onto agricultural fields that could become Sunnica East A. The footpath leading to Isleham (west) or to Mildenhall (east) can be accessed from here.



Figure 34. Looking across to Sunnica East A site from popular Judes Ferry Pub garden

The Isleham Joggers are a group of around 55 local runners/joggers who regularly use the roads and footpaths in this area. Their enjoyment of running alongside open agricultural land will be drastically reduced – they will likely choose elsewhere to exercise. Some of their typical routes are shown in Appendix 5 . Almost the entire ‘jogging’ area is impacted by the various Sunnica sites, since the scheme is so spread out. The panels and BESS will be highly visible from numerous points along their exercise routes. One of the joggers describes these routes as her “head space” to

get out and free her mind of day to day pressures. She said that jogging through a barren, industrial area is unlikely to have the same liberating feeling. IPC fears that people's health and wellbeing would suffer as a result of this scheme.

2) Mortimer Lane, Isleham - Freckenham (Sunnica ref W-257/002/X)

This public footpath is accessed from Isleham by travelling a short distance eastbound along Beck Rd to the Beck Bridge and taking the first right turn the leads to the ECO2 field on the Sunnica maps. The footpath follows the Lee Brook to connect with Mortimer Lane in Freckenham. It is regularly used by dog walkers, joggers, horse riders, cyclists and for general exercise and recreation. The Isleham Joggers regularly pass through here to connect from Isleham to Freckenham, Chippenham and beyond as it is one of the few routes that lead off the main road to cut across to these neighbouring villages from the road (see sample jogging map Figure 35, plus others in Appendix 5).

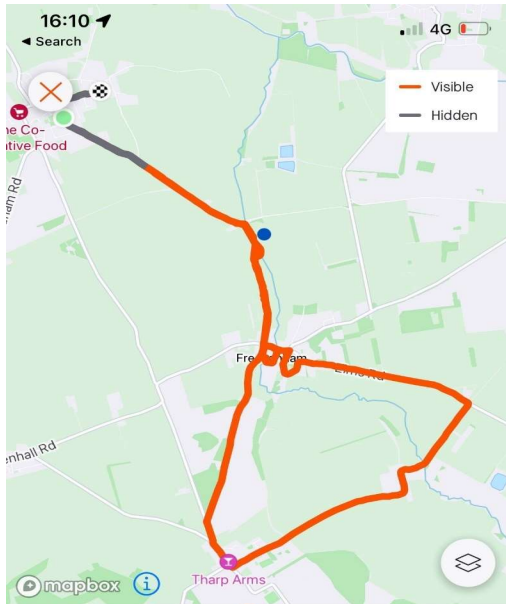


Figure 35 Typical route used by Isleham Joggers (blue circle is Mortimer Lane). Depart Isleham to Freckenham. Along Elms Rd (direction Red Lodge) to Badlingham, Chippenham and back to Freckenham and Isleham.

IPC was provided with the results of a survey using a trail camera that had been set up by the Say No to Sunnica group with the help of a Freckenham resident. It recorded usage along this footpath over a 46-hour period in June 2002 (24th June 1630 to 26th June 1430) and showed 29 visitors along Mortimer Lane, mainly dog walkers and casual joggers (not the Isleham Jogging group on this occasion).

Local residents have commented that they typically see several dog walkers over the course of the day, plus horse riders in the early mornings. Other Freckenham residents can readily name over 20 residents who use the route on a routine basis for dog walking, riding etc.

The Mortimer Lane footpath is often used by children to access the Lee Brook chalk stream, and for Isleham residents to meet up with friends in Freckenham. One child at Isleham primary school uses this route to travel from his home in Freckenham to attend the primary school in Isleham. Mr Fuga, an Isleham resident, said that his son *“often goes to Mortimer Land to meet his friend who lives in Mortimer Lane”* and that *“kids often meet up there to play around the Lee Brook, especially in the summer.”*

Another former Isleham resident, who now lives in Freckenham, said she regularly uses Mortimer Lane to visit her sister and 2 brothers. The Knowles family who live in Isleham regularly use this route to meet up with family, and found this so important during lockdown.

In summary, it is important to note that Isleham residents do not only use the footpaths in the immediate area surrounding their village for exercise and leisure, but they also travel short distances to nearby footpaths in our neighbouring villages to walk dogs, exercise as a family or to meet up with friends/ family from the surrounding communities. One of the most popular routes arguably being the Snailwell - Limekilns footpath, which is used year-round for many a dog walker from Isleham, as well rider, and to go on family walks in a different landscape. We are fortunate enough to have footpaths through a varied landscape within a short radius of Isleham – Fen Edge, Breckland, etc. We have tree lined footpaths, open aspect footpaths, riverside footpaths, elevated footpaths, all with their own charm and beauty. Residents here make good use of this variety and would not wish this to be replaced by a monotonous and dull landscape that Sunnica seeks to create.

Section 2.4 - What we have been told

2.4.1 IPC has communicated it's concerns about the inadequacies of Sunnica's consultation previously, and these are captured in the SNTS Adequacy of Consultation Representation (AoCR) which was appended to the host local authority AoCR during the acceptance phase. Amongst other points this included: our concerns about documentation not being readily available or in an accessible format for all to view, thus preventing fair participation (especially considering the age demographic of Isleham); inaccurate information being provided which would have skewed people's assessments of the scheme (e.g. inaccurate portrayal of the soil quality) and the lack of consultation on decommissioning due to deficient information available and concerns over the lack of a financial bond in the DCO to restore land to its current agricultural use at the end of the project lifetime. As this has previously been commented on, we shall not discuss this in further detail here.

2.4.2 In autumn 2021 SNTS, with the help of Isleham Parish Council, undertook a further survey of residents in Isleham village, including Isleham Marina residents, to gauge the impact of the Sunnica scheme on them. This was a mixed online/paper survey. 128 responses were received overall (see Appendix 4 for full details). 94% said that they felt the Sunnica scheme would have a negative impact on the area. 92% said they used the footpaths around the River Lark and Isleham Marina on a regular basis for reasons ranging from recreation and exercise to connecting to other villages and for hobbies and wildlife spotting etc. Residents identify with the landscape here and the strong links with the agricultural land and living as part of an agricultural community and being part of nature.

The comments from those who responded about the impacts on Isleham (in Appendix 4), are an indication of the strength of feeling here, with many stating that they moved to this area in order to live in a rural landscape and closer to nature, and that Sunnica would change all of this. Loss of countryside, loss of visual amenity, loss of wildlife etc were repeated throughout the survey results. Several mentioned that they would be forced to move from here if the scheme goes ahead.

Section 2.5 Battery Energy Storage (BESS) and Substations

Many residents have expressed concerns about the potential visual and noise impacts of the large-scale Lithium ion battery storage compounds and substations. Sunnica have not provided any information on possible layouts etc to allow people to adequately assess this. Residents are also deeply concerned about the current inadequacy of regulation with these Grid scale batteries and the very real risk of fire and explosion that they pose and the limited knowledge of how best to handle such events, as shown in the report into the Liverpool BESS fire and paper by Fordham et al. (Appendix 6 – Fordham et al Safety of Grid Scale Lithium-ion Battery Energy Storage Systems).

Sunnica's proposed battery storage systems would be amongst the biggest in the UK, if not Europe. We are understandably concerned about the risk of explosion and fire and lack of resource to deal with such an incident as the BESS site on East A is just over 1 Km from Isleham residents. Toxic gas emissions from such events resulting from a thermal runaway incident include hydrogen fluoride (HF), which is highly toxic in very small quantities, as well as a number of other toxic gases. In such an event, because of proximity, the village would likely need to be evacuated. IPC notes that some plume dispersion modelling has been carried out by Sunnica but consider this to be insufficient

since they have a) not yet established which batteries they will be using, b) not yet decided on the number of batteries and c) only based modelling on HF, but none of the other possible toxic emissions. IPC considers that substantial additional information is required in order for battery safety to truly be assessed and do not feel that *preventive* safety measures are being 'designed in' to this scheme as they should be. We support the submissions of SNTS on this matter.

Conclusion

We hope to have demonstrated in this report why we believe this scheme should not go ahead. We are not against renewable energy but it is clear to see that this proposal is lacking in detail and accuracy such that it cannot be approved.

IPC supports the position of the Say No to Sunnica Action Group Ltd. on this matter.

Isleham Parish Council Written Representation Appendix 1 – Statements from some Isleham residents whose homes look out onto East A

Mr and Mrs Minshull, Sheldricks Rd

"We chose the very outskirts of Isleham as our home nearly 20 years ago, this choice was made as we were near to the centre of a lovely community, but more importantly due to the stunning rural aspects of the fens. Since moving to the village we have become parents and our family enjoys the countryside on our doorstep daily.

"If the Sunnica project was to go ahead then this would have a huge impact on our daily family life, as the countryside that we enjoy very close to our doorstep would no longer exist. This would be detrimental to both our physical and mental wellbeing as we would no longer be able to enjoy this large aspect of our lives, which our children also hold very dear.

This change would bring a large question as to whether we could stay in our current home, in turn having a devastating effect on our family as a whole."

The Downey Family, Festival Rd

"Our back garden overlooks the fields behind Kennedy Road, Sheldrick's Road and Appleyard close. On a clear day we can see Elveden war memorial and the chimneys of the sugarbeet factory in Bury Saint Edmunds. We can also see Saint Mary's church at Mildenhall standing proud for all to see. I regularly sit and watch the planes take off and land at both RAF Lakenheath and Mildenhall. We get to see the changing in colour of the fields around us from the brown in winter, green in spring, golden in summer and being harvest in the late summer early autumn, only this week for the first time that I have lived in this property I got to watch a sugar beet harvester at work in these fields. Regularly we get to see red kites, sparrow hawks, buzzards, herons, barn owls, muntjacs and deer's using these fields to hunt for their food. In the late summer I take my nieces and we gather blackberries from the hedgerows of these fields and make jams, crumbles and cakes, and as a child myself I spent many hours on the grass verge along Sheldrick's Road watching the planes fly over while performing at RAF Mildenhall air shows. The colours of the sunrise we get to see in the mornings is beyond more than you can imagine, the pinks, oranges, reds, purples and blue colours of the sky are mesmerizing, especially watching it rise over the Ark church. To build any sort of building on these fields, and especially a solar farm and battery plant is so wrong. To take away the far reaching open views from me, my children

and grandchildren would take away the enjoyment of living in our home that we love so much. Taking away the hunting ground of the wildlife will have a detrimental impact for the generations to come and the habitats around us."

Mr Creasey, Station Rd

"I would like to say that forty years ago exactly, November 1982, I purchased my first house here in Station Road, Isleham, a three bedroom semi detached property. Apart from the price of the property I very much liked being able to look out both front and back over rural landscapes, watching wildlife where both animals and birds were free to roam or fly and was very content to raise my two children in this quiet rural setting.

Some fifteen years later I purchased my second house also in Station Road and was able to continue to enjoy the peace and quiet of a rural setting. I have remained in this second house for the past twenty five years. Being a country boy, living in the countryside is about as good as it gets for me. I have enjoyed raising my children in this setting and showing them where our food comes from and knowing that this Road is where I have lived.

Over the past two or more years this wretched company, Sunnica, is proposing to shatter these views that I have enjoyed over the last forty years by building an enormous solar farm/park, stretching over the many acres that will be in front of my house. I would need to add here that I have nothing against solar energy but strongly feel that this company is going about its business in a totally unacceptable way. I would be the first to say that having been a user of solar panels myself and I understand totally, their benefits. I have sixteen solar panels on the roof of my garage that can not be seen from the road or by my neighbours. They are not an eyesore, they have been erected on a single story roof and are to all intents and purposes hidden, out of sight. I feel strongly that there are plenty of unused roof space with this village and the surrounding villages that could be used for solar energy but I object most strongly to the proposal that vast areas of a rural landscape are going to be transformed into a solar farm / park. Not only that but the fact that, should this company get the go ahead, I feel strongly that in creating this eyesore it will have a devastating effect on the rural landscapes. I feel that the destruction of the land that residents such as myself have hitherto enjoyed will be shattered, as we will be forced to watch large lorries and all the paraphernalia that goes with them in the creation of such a site. This is to my way of thinking Wrong and thoughtless of the Sunnica company.

Not in my wildest dreams can I ever think that it is right or acceptable to turn good farming land into an eyesore with hundreds if not thousands of solar panels on it.

Judging by the intense feelings that villagers have not only here in Isleham but also in the surrounding villages by the number of placards in place outside peoples' homes saying, "Say No to Sunnica" I do feel that some people may be inclined to damage property should this scheme be given the go a head. Having worked with Cambridgeshire Constabulary for a number of years during the last forty years I do wonder if there is a hard core element within these villages that would like to, or may, or might take matters into their own hands and cause criminal damage to the erection of these panels. I'm not saying that this will happen but wonder if the Sunnica company has given due consideration to this possibility. Furthermore I wonder how the Constabulary will feel about having to spend their ever decreasing number of officers in "looking after" this area.

Finally in my view this proposal of a vast solar farm / park is a disaster from beginning to end. The depth of anti feeling that there is in this locality together with the destruction of prime, good quality land are just two of the factors that must be born on mind, that and the destruction of countryside views is in my humble opinion are some of the reasons why this land should not be given over to a solar park / farm. I feel strongly that there are plenty of roof spaces that have yet to be utilised where the same result could be obtained without the need to destroy a much loved rural setting. "

Mr Long, Nursery Close

(note: Mr Long's house on Nursery Close does not directly look over the Sunnica scheme but, being a gardener, he works at some of the houses that do)

"I moved to Isleham from Bury St.Edmunds in 1974 and I love living in this friendly village. You cannot beat living in this countryside, all that lovely fresh air, beautiful landscapes and the wonderful wildlife that I see every day. My parents chose to move here to start a new life in the countryside for their family (me, my brother and sister). They turned to the land to do this, since it is well known for being such good growing land round here, and set up a plant nursery. They ran this as a successful business, growing plants and flowers, which they supplied to the public and also Covent garden, Manchester, Sheffield and local market traders. When the flowers were cut local traders came to collect them or some local families had haulage businesses who would come to collect the flowers to take them to the above markets.

I worked at my parents nursery for 20years until they retired and my passion for the outdoor life goes on and always will. I love gardening,plants,trees, wildlife,all aspects of nature. I would be devastated to see our good growing land here covered over in solar panels, battery stores and substations. It would be such a waste of good growing land when the panels could just as easily go on rooftops and areas of barren land in the UK, like landfill sites etc that could house this proposal instead

Now I have had many holidays over the years across many lovely scenic areas of England including The Cotswolds,Devon/Cornwall,Yorkshire Dales and several other idyllic landscapes of the UK. But I love this landscape here - the open skies, the lovely views. Sunnica would ruin all of this. It would be an eyesore and would damage the countryside and wildlife habitats I love so much. It would really spoil the picturesque landscapes that we have in our area of East Anglia."

Isleham Parish Council Written Representation Appendix 2, a copy of IPCs response to the ExA questions

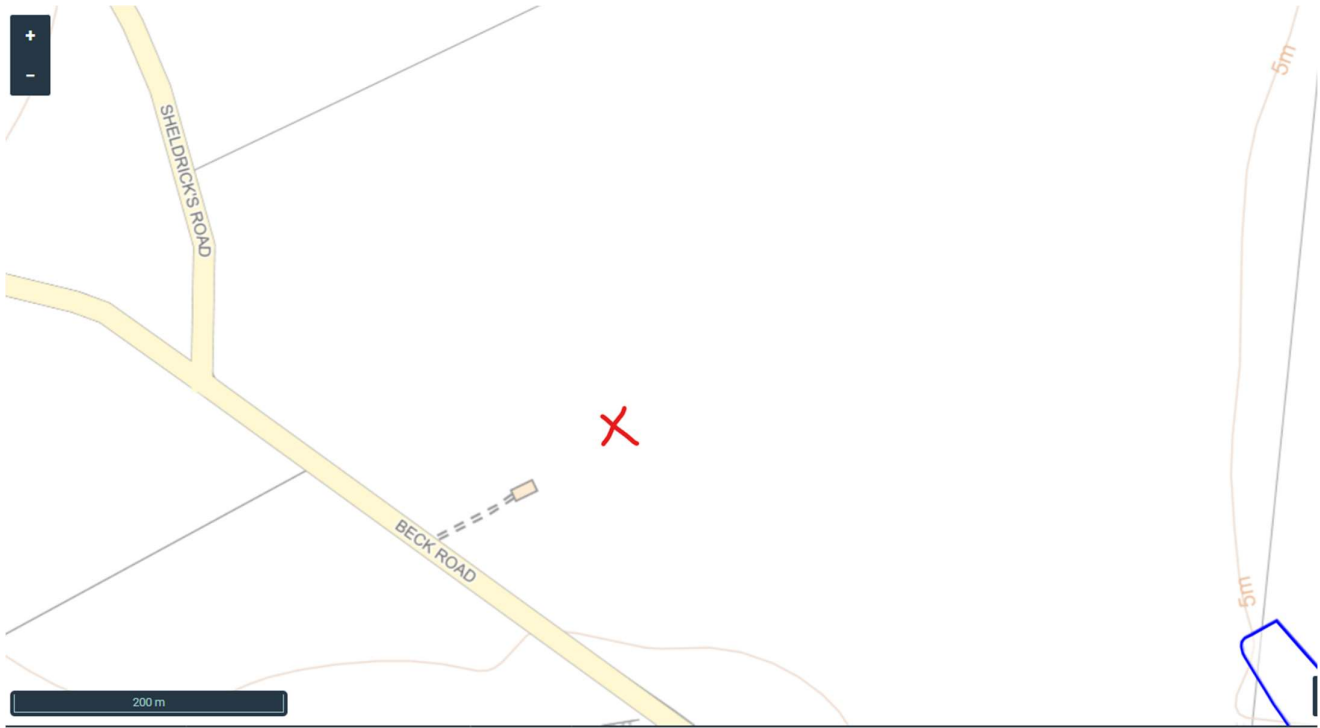
Sunnica Planning Application EXQ1 .

Q 1.4.13 Plane crash site

Please supply a map detailing the location of the military plane crash site, along with a statement explaining the importance of the site to the Parish.

Dear Sirs/ Madam

I am pleased to provide the following information in response to the above question.



The edge of the crash site is approximately 50m north east of the abandoned barns on Beck Rd Isleham. The closest post code is probably CB7 5QP. Please note that the site is on private (agricultural) land so it has not been possible to install a memorial stone at the crash site.

A view of the crash site from The Ark Church (first floor)



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Historical Information

As you can see from the evidence provided in appendices 1- 5 (Historical information) and appendices 6 -7 (personal testimonies) the crash remains a significant event in the history of our village.

In summary, the event occurred at the start of the Cold War era in October 1949 and involved a USAF B-50 bomber which took off from RAF Skulthorpe in Norfolk carrying three tons of live bombs.

The plane was due to undertake a practice mission involving a flight over the North Sea and home counties but shortly after take-off from RAF Lakenheath where it had undertaken a brief stop, the plane experienced significant technical difficulties.

The pilot was unable to land at any of the local air force bases and rather than crashing into the village (which would have had a catastrophic consequences) the pilot managed to fly the plane to the edge of the village where it crashed, killing all twelve crew members.

The explosion was heard in towns and villages over 12 miles away and resulted in the formation was a huge crater in the field. The crew consisted of eleven members of the USAF and one RAF observer.

The crash:

is commemorated in a Parish Council commissioned plaque located in The Beeches Community Centre Isleham (see appendix 6) This installation followed a campaign by members of the local community to honour the sacrifice made by these servicemen.

is distinctly remembered and regarded in the highest of appreciation by a large number of residents in the village. Over 30 individuals responded to our Facebook posting regarding the establishment of a memorial plaque (see appendix 7)

is remembered and has been visited by several US based relatives of the victims (see appendix 8)

is protected from development under our Neighbourhood Plan (see appendix 9)

forms an integral part of Isleham Primary Schools KS2 Local History study unit “ a study of an aspect of history or a site dating from a period beyond 1066 that is significant in the locality” see appendix 10 and https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/239035/PRIMARY_national_curriculum_-_History.pdf)

A Recognised Archaeological Military Grave?

This crash was of course, first and foremost an extremely tragic event.

From the crash site you can see the water towers of Mildenhall airbase, which borders RAF Lakenheath. It is therefore easy to get a real feel for the tragedy unfolding; the plane taking off, getting into trouble and eventually crashing into the field.

Sunnica's proposed mitigation planting would sever this connection forever.

The two water towers of RAF Mildenhall on the horizon



A military aircraft from RAF Mildenhall flying over the crash site



Despite the national attention given to the crash at the time, the fact that this crash took place during the cold war period means that it has almost certainly not received the wider recognition that it deserves. Isleham Parish Council and many local residents would regard this site as a potential (Cold War) grave

The severity of the post-crash explosions meant that it was impossible to recover not just the many smaller parts of the plane but more significantly all of the human remains of the servicemen.

A local expert has stated that “you can still easily spot pieces of the aircraft by just walking over the field but that metal detection has been limited due to it being private land” and that it is not beyond the realms of possibility for human remains to still be uncovered. As such we believe that this site should be preserved and not developed upon

These various factors have resulted in a strong and growing move among both residents and historians that the site should be regarded as an official archaeological site under the Ancient Monuments and Archaeological Areas Act 1979 and be protected in sacred memory of those who lost their lives.

As such, Isleham Parish Council have placed the land has been placed outside if the Development Envelope, published as part of The Isleham Neighbourhood Plan see appendix 10.

Appendices: The following articles, statements and photographs give a historical and personal perspective of the significance of this event and of the crash site.

Appendix 1 Article from the Isleham Informer, village magazine October 2011

THE DAY ISLEHAM SHOOK



Aerial view of the crash site to the north of Beck Road and east of Sheidrick's Road.

In view of its close proximity to the huge USAF airfields at Mildenhall and Lakenheath, Isleham is no stranger to the sound of aircraft flying overhead, a fact of village life for over 60 years. Today those aircraft sounds are of high powered jets such as the KC-135 Stratotankers from RAF Mildenhall and the F-15 Strike Eagle fighters from RAF Lakenheath. The aircraft sounds in the immediate post-war years, however, still included many piston-engined military aircraft.

On Thursday 13th October 1949, the 43rd Bomb Group was scheduled for a routine training mission that was to last for 10 hours. At briefing pilots had been told that there would be a formation take-off, assembly, climb to 25,000 feet, break up the formation then drop 16 500 lb high explosive bombs individually on the bombing target at Heligoland, then from there to the radar bombardment system (RBS) target at Heston, for RBS runs until the RBS site closed, and then return to Lakenheath in the evening. It was a typical autumn day in the United Kingdom. There was a low overcast, the base at a height of only 300 feet or so, which extended to height of around 1,100 feet, completely obscuring the sky from the ground. Visibility was restricted to only three quarters of a mile in fog, the temperature was a cool 54°F. The relative humidity was 100% with surface winds of 11 mph at 250°.

Instructor Major George H. Ingham, pilot of B-50 Superfortress 46-060 (6060), reported that everything was OK and acknowledged that he was taxiing into position for take-off at the end of 25 runway. 6060 lined up and contacted ground control unit (GCA) when in a take-off position, 6060 took off at 9.25am. Ingham reported that he was at 500 feet and that it was OK for the next aircraft, 6042, to take off. About a minute

called and said, "60 should be on top 3 1/2 miles out." There was a few moments pause and the reply came in a normal voice "60 on top at 1100 feet indicated." He noted 6060's position at five miles out at the time of reply and "almost immediately heard an excited scream and some unintelligible chatter." Bacon in 6039 was in a much better position to understand the transmission as he was airborne and much nearer to 6060. Bacon had heard GCA call Lakenheath control tower that 6060 should be breaking clear on top. At this Bacon heard a voice, which he recognised as Major Ingham's "in a very jovial manner" report to GCA that he was 'still in the soup' (i.e. still in the overcast). About 30 seconds after this Bacon heard Major Ingham report that 6060 was 'on top, everything OK'

Another minute, to a minute and a half, elapsed. The transmissions were noted in the control tower by Lt Mattson - "Red hat leader to Red hat 3", and Major Ingham was then heard to start a normal transmission to Bacon, "6039 this is..." followed by a break of a few seconds after which Ingham's voice was again heard but was now agitated and very excited, "Look at the son-of-a-bitch..." he said, followed by another break of a few seconds then he transmitted, still in an excited voice, "Shut the damned thing off." During this time Bacon had turned 6039 to the right (180°) to come back over the homing beacon to join the formation.

The day in the village of Isleham had got off to a normal start and young Vernon Place was preparing to cycle to the bank, whilst others were already at work. In view of the limited visibility, Vernon could not see the aircraft but he did hear the engine noise and it did not sound normal. Elizabeth Brown was standing on the land at the rear of her home at Broad View, Beck Road Isleham at about 9.30am that day, talking with girls. She became aware of the sound of a multi-engine aircraft overhead and looked up in the direction of Mildenhall "Look! It's on fire", she said. "It looked like a ball of fire," she later recalled, describing the last moments of 6060. She turned and ran back towards the house and heard a loud explosion.

Two farming brothers, George and John Thornalley were working at the far end of the sugar beet field beside the back road of Isleham, when they heard the aircraft. They stood and looked for it. George said that he could see along the ground for about a half mile, but could see up no more than a hundred or fifty feet. From the sound of the engines he could tell that something was wrong. When he first saw the plane

come from the direction of Isleham. George could see fire but could not tell what part was on fire. However, John stated that the right wing was on fire before, realising the plane was going to crash, he fell on the ground and covered his head with his arms. To George the aircraft "appeared to be broken" but he thought that could be due to "the angle I was looking at it." He heard one explosion after it hit the ground followed by a "big blast of flame." The next thing he knew he was on the ground, then he and his brother "ran around the burning plane to the farm building", a shed where the farm implements were stored. He could see that there was no hope for anyone in the plane. John had heard "the engines throb a couple of times" and the aircraft came into his view just before it crashed. He noted that the bomber struck in a "near vertical position." A haystack very near the shed was on fire and rounds of ammunition were exploding for several minutes.

Local civilians were first on the crash scene, which was just southeast of Isleham in a field of stubble at Lee Farm, Beck Road, Isleham. The first Americans on the scene were crash truck personnel from RAF Mildenhall, the nearest airfield who arrived at 10.00am. The fire was extinguished by 10.30am. The aircraft had been carrying 6,000 gallons of fuel and sixteen 500 lb bombs. On arrival the fire crew found that the plane had exploded at the point of impact and was completely demolished. There were small individual fires burning over an area of five acres. The ground area at the crash site was flat terrain. The crash crew reported that on arrival the weather was foggy, temperature was 60°, the relative humidity was 90%, wind direction 240°, velocity 9 mph. The obvious cause of this crash was a fire in flight, although what caused the fire could not be determined in view of the total destruction of the aircraft and the entire crew being killed. This aircraft type had been plagued with oil leak and exhaust problems and it is likely that this was the cause of the fire.

News of the crash made the national newspapers on Friday 14th October 1949, the heading in The Times reading **12 KILLED IN U.S. BOMBER - EXPLOSION SHAKES A VILLAGE.** The U.S. 3rd Air Division headquarters at Ruislip, Middlesex, issued an official press statement - "A B 50 strato-bomber of the U.S.A.F. stationed at Lakenheath crashed and burned out about a mile south-east of Isleham at 9.25 a.m. to-day. According to officials of the 3rd Air Division, wreckage indicated that there were 12 people on board. So far 12 bodies have been recovered. Weather at Lakenheath was three-quarters of a mile visibility with fog. The forecast weather in the vicinity of the crash was one-eighth of a mile visibility." The report ended with the fact that "the aircraft had crashed in a field of stubble. Several stacks were set on fire. A crater about 30ft. long and 20ft. across and about 10ft. deep was formed. R.A.F. and U.S.A.F. salvage workers sorted out the wreckage, which was strewn over a wide area. American Army security police formed a cordon.

"Villagers said that the aircraft came from the direction of Lakenheath and as it flew low over the village it was a 'mass of roaring flames'."

operational heavy bombers in the U.S.A.F. The first of those now in Britain arrived in August for the 90-day training period which the American 43rd Bombardment Group is undertaking at United States air bases in England. The B 50 is an enlarged, more powerful version of the B 29. It has a 141ft. wing span and is 99ft. in length. Some details are still on the secret list, but it has been stated that it is powered by four 3,500 h.p. engines and is capable of a top speed of about 400 m.p.h. The B 50 is one of the aircraft selected to carry the atom bomb."

A brief report in The Times of Saturday 15th October 1949 followed up with the heading **R.A.F. MAN DIED IN U.S. BOMBER** and reported that R.A.F. signaller D.J. Garrett, stationed at Lakenheath, was among the crew of 12 who died in the crash. A provisional inquest on Garrett had been fixed for that afternoon.

Stewart Evan

Energy Meters

Got better things to spend your money on than electricity bills? Borrow an energy meter from any Cambridgeshire library free of charge and find out how you could cut your electricity bills by as much as 15%. The meters are easy and safe to use and show how much electricity is being used in your home at any one time. Using a meter can help you see just how much energy is used, for example, by lights in empty rooms, appliances on stand-by or boiling a kettle. Armed with this information, studies show that households can reduce their bills by 5-15% by making small changes to use less electricity. Ask to borrow a meter at your local library today and start planning what to do with your savings!

Green Tip: We all have an impact on the environment through our use of resources and burning fossil fuels for everyday activities such as driving cars and heating our homes. For various tips on how to reduce carbon emission in the home, check out the Environment Agency website at the following address: <http://www.environmentagency.gov.uk/homeandleisure/climatechange>

Fiona Riggall, Direct line: 01223 71567;
Environment and Climate Change Office
Cambridgeshire County Council

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3-Ton Bomb Load's Blast Tears Craft Into Shreds

Lost Plane Belonged to 65th Squadron of 43rd
Bombardment Group Stationed at D-M Field;
Was on Training Flight to Helgoland

ISLEHAM, Eng., Oct. 13.—(AP)—Twelve airmen bound from Britain to Helgoland on a practice mission were blasted to death today by the plunge of their U. S. Air Force B-50 bomber into a wheatfield with three tons of live bombs aboard. Eleven were AF crew members from Davis-

Monthan field, Tucson, the 12th was an RAF observer.

The countryside for 12 miles around was jarred by the blast. None aboard escaped. Bodies of the men and parts of the plane were hurled over wide areas of the field. The main explosion gouged out a crater ten feet deep and 30 feet wide.

Hundreds of gallons of flaming high octane gasoline sprayed over the field, setting fire to nearby barns and several haystacks.

A-bomb Carrier

The B-50 is designed to carry the atom bomb. It is a larger version of the four-engined B-29 Superfort and ranks second among the American air force's bombers only to the controversial B-36.

The lost plane belonged to the 65th squadron of the 43rd Bombardment Group, which came to England Aug. 18, from its base at Tucson, for 90 days of operational training.

Crashed After Takeoff

The plane crashed a few minutes after taking off from its base at Sculthorpe, Norfolk county, with a load of twelve 500-pound practice bombs for the Allied bombing range on the island of Helgoland, former Nazi submarine base.

Headquarters of the U. S. Third Air Division, which controls the B-50 group and two groups of B-29s, in Britain, said visibility in the area was three-quarters of a mile. Witnesses said, however, that the plane came down through a light ground fog.

All 12 bodies were recovered two hours after the crash.

CASUALTY LIST

The casualty list of the D-M based B-50 bomber which crashed near Isleham, England, with no survivors included 11 members of the U. S. Air Force. The announcement was made at Davis-Monthan.

The dead:

1st Lt. John A. Dryer, pilot, 3156 North Richey boulevard,

1st Lt. Robert H. Short, navigator, 632 Washington street, Allentown, Penna.

1st Lt. Robert M. Stannard, pilot, Rural Route No. 2, Richard, Iowa.

1st Lt. Robert W. Chatfield, pilot, 2007 South Norris avenue.

Maj. George H. Ingham, pilot and operations officer of the 65th bomb squadron, 3629 East Elida avenue.

Tech/Sgt. Harold S. Morin, flight engineer, 3733 East 33rd street.

Tech/Sgt. Delmas F. Bise, gunner, 591 South Wilson avenue.

Tech/Sgt. Paul P. Butler Jr., bombardier, 1354 12th street, Douglas.

Staff/Sgt. Arthur L. Gilbreath, radio operator, P.O. Box 933, Porterville, Calif.

Staff Sgt. Julius V. Odegard, gunner, 33 South 13th street, Minneapolis, Minn.

Staff/Sgt. Robert C. Williams, gunner, 1129 North Tyndall avenue.

One name was being withheld pending notification of next of kin. The RAF has not released the name of the staff officer that was flying with the crew of

The day Isleham escaped mass destruction

Published in the Newmarket Journal 10:44 Thursday 22 October 2009

Sixty years ago this month, when the flaming fuselage of the world's heaviest bomber streaked across a foggy October sky, residents of Isleham had no idea just how close they had come to destruction or how much they owed to the "noble actions" of its American pilot. Every member of the 12-man crew of the B-50 Strato bomber which was out on a practice bombing mission and crashed in Beck Road, was killed, but the consequences could have been considerably worse for hundreds of others as the 16 500lb bombs it was carrying had been designed for mass destruction. The B-50 had taken off from RAF Lakenheath at 9.25am on October 13. It had been checked the day before and immediately before take off. It was carrying enough fuel for 10 hours in the air but had got into difficulties shortly after leaving the airfield. Knowing that he and all those aboard were doomed, the pilot, Major George Ingham managed to steer the burning plane away from the village below, knowing the explosive power of the weaponry would have spelt certain disaster for hundreds of residents below. At an inquest into the death of Signaller David Garrett, the only British crew member on board the doomed bomber, held two days after the crash, witnesses to the tragedy told their stories. One of the first at the scene was a reporter from the Newmarket Journal who had followed fire crews to the crash site. described the chaos which followed the crash. "It seemed unbelievable," he wrote, "that the biggest bomber in the world could be reduced to small pieces of debris in such a short space of time. "When I arrived a search was being made for bodies which still lay where they had been thrown. "Wherever you walked there was evidence of a terrific explosion, either the pieces of the bomber itself or the gruesome reminders of the mutilation of some of the crew." Farm worker Joseph Leonard, of Beck Road, Isleham, told the inquest he could not see the plane because of the thick low fog, but he had heard a "spluttering sort of noise". Turning round he saw the bomber emerge from the clouds with its fuselage on fire. James Goodchild, a farmer of the White Lion, East End, Isleham said he had seen a plane coming from the Mildenhall direction at a very low height. Flames were streaking from its fuselage, its tail was crumpled up and the plane nose-dived towards the ground. Mr Leonard fell off his tractor and lay flat on his face after hearing a large crack and seeing the engine of the mighty aircraft fall off. Housewife Vera Fenn of Croft Road, Isleham said she ran outside her house and saw the bomber, the starboard engines of which were on fire, losing height rapidly. She lost sight of it as it passed behind some houses and the next thing she saw was a brilliant yellow flash followed by a loud explosion. Another witness, police constable M Audley, said that when he arrived on the scene he found some villagers moving the body of an American to the edge of the field. He told the inquest that in a part of the plane which was not burning were two more bodies and in the fuselage, which was blazing fiercely, were a further four. Two messages had been initially received from the plane describing weather conditions, but the inquest heard of a third transmission received when the pilot was transmitting to another plane in his flight and unintentionally pressed the transmission button on his microphone, thus wirelessing back to base. The text of that message which stated that the bomber was in trouble was not disclosed but was written on a piece of paper and passed to the coroner. Recording a verdict of accidental death on behalf Signaller Garrett, Mr V Cade, the coroner paid his own tribute to the bravery of the pilot and his crew. "Although nothing has come out in this inquest, it would appear that the pilot took every step he could to avoid and save the damage to this village and we regard this as a noble action on his part. "If he had landed on this village, we do not know what the death toll and damage would have been but we do know it would have been colossal. "When we think of this tragedy in the future we should remember the gallant act of the pilot and the crew of this craft." And the villagers of Isleham remembered the crew and recorded their thanks in prayers when a large congregation gathered for a memorial service at St Andrew's Church on October 16 to pay tribute to all those aboard who had lost their lives.

Read more at: <http://www.newmarketjournal.co.uk/news/latest-news/looking-back-the-day-isleham-escaped-mass-destruction-1-550792>

November 28, 1949

Dear Jessie,

Occasionally we know people for whom we set aside a special place in our heart. Paul, or Percy as we affectionately knew him, will always have that place in my memory. I don't know whether you ever heard of our friendship, but during our year and a half in prison camp I got to know Paul as well as any man gets to know another. Not only were we in the same room under conditions which no doubt have been described to you, but we had bunks next to each other. During those months I was so glad to have the companionship of Paul if we both had to be there, and since that time I have thought so often of how much easier he made life there.

Obviously the qualities most needed in that situation were a sense of humor and the ability to get along easily with others. I say sincerely I have never known another to possess both these qualities to the degree that Paul did. But what was almost ^{as} important was his unselfishness, loyalty, and courage. Again these are attributes that show up quickly if they exist in a person.

Paul was the only person from our prison days that I still corresponded with in any degree of regularity. Though we only wrote 3 or 4 times a year I still thought of him often and looked forward to his letters. His last letter was written August 16th just before he left for England. I am sending you a clipping he sent with it in the event you missed it and would like to keep it with his things. I had planned to write him in another week or two in case he was spending Christmas in England. He seemed to be particularly happy and contented in this letter since he had just signed on under the career plan in the Air Force and had found a girl he was sure would be good for him.

In a sense it makes it harder thinking of him leaving that way, but he had had so many ups and downs I'm sure he was happy and realized he had done a good job when he did go.

Appendix 5 Official crew list, released by USAF following the crash

Aircraft No. 46-060 B-50A-25-BO

Strategic Air Command 8 AF 43rd Bomb Wing (M) 43rd Bomb Gp (M) 65th
 Bomb Squadron Manufactured 6 Nov 1948 Total Hours 391:SO

Pilot INGHAM, George H. Major USAF ASN 10111A Age 27
 Attached Station RAF Lakenheath, SAC, 8AF, 43rd Wing, 43rd Gp (M), 65th Squadron.
 Assigned Station Davis-Monthan AFB Tucson, Arizona

Crew –

IP Ingham, George H.	P	10111A	Maj USAF	8 AF	43d Gp (M)	Fatal
P Dryer, John A. Jr.	P	A402061651	1 st Lt USAF	8 AF	43d Gp (M)	Fatal
CP Stannard, Roger M.	P	A0781696	1 st Lt USAF	8 AF	43d Gp (M)	Fatal
N Short, Robert H.	N	A0801399	1 st Lt USAF	8 AF	43d Gp (M)	Fatal
VO Chatfield, Robert W.	VO	A0698263	1 st Lt USAF	8 AF	43d Gp (M)	Fatal
B Butler, Paul P. Jr	B	AF20845317	T/Sgt USAF	8 AF	43d Gp (M)	Fatal
FE Morin, Harold S.	FE	AF11024154	T/Sgt USAF	8 AF	43d Gp (M)	Fatal
RO Gilbreath, Arthur L.	RO	AF38343744	S/Sgt USAF	8 AF	43d Gp (M)	Fatal
CFC Bise, Delmas F.	CFC	AF6996842	T/Sgt USAF	8 AF	43d Gp (M)	Fatal
LG Odegard, Julias	LG	AF17258608	S/Sgt USAF	8 AF	43d Gp (M)	Fatal
RG Williams, Robert C.	RG	AF14057570	S/Sgt USAF	8 AF	43d Gp (M)	Fatal
X Garrett, Davis J.		1579867	S-2 RAF	1 Sq	3 Gp	RAF Fatal

Weather – Indefinite, 300 feet, sky obscured, visibility 3/4 mile in fog, temperature 54, relative humidity 100%. Surface winds 250 degrees 11 miles per hour.

Appendix 6 Photograph of the unveiling of the plaque in the Beeches Community Centre
Isleham, commemorating the brave victims whose sacrifice saved the lives of local residents – unveiled in
January 2020



Villagers honour American air crew heroes seventy years on

By [Alison Hayes](#)

alison.hayes@iliffepublishing.co.uk

Published: 11:48, 27 January 2020

| Updated: 11:49, 27 January 2020

The 12-man crew of a US bomber which crashed into a field near Isleham 70 years ago has been honoured with a memorial in the village's community centre.

A plaque bearing the names of the 11 American and one British airmen who died when their B-50A Superfortress hit the ground and exploded in a ball of fire on October 13, 1949, was unveiled on Thursday at the Beeches Centre by USAF chaplain Lt Col Kyle Hundley.

The aircraft, which was designed for long-distance bombing raids and was said to have been specially adapted to carry atom bombs, had been on a training flight but had got into difficulties shortly after leaving RAF Lakenheath.



Lt Col Kyle Hundley with, from left, campaigner Brian Challis, local historian Stewart Evans and Richard Radcliffe, Isleham Parish Council chairman.

Appendix 7 Personal testimonies

The plane crash should be preserved out of respect for the men who sacrificed their lives for the village. The Sunnica scheme shouldn't be allowed to be placed on consecrated ground. Building on top of the crash site is disrespectful to the history of the area and disrespectful to the brave crew and their families. Justin Fuga, Isleham resident

I think it's really important that we retain areas of historic interest in and around the village - older history and also more recent history as well. There is a real desire amongst residents of Isleham, including myself, to keep local history alive and I love the fact that generation after generation share their stories and pass them

on. The plane crash site as it stands has been preserved and it's integrity maintained for all of these years out of respect to the servicemen who bravely gave up their lives to save the village from what could have been significant destruction. The effects of the crash were profound and felt for many miles. They had a huge impact on the local community - not just from physical damage to the village buildings and peoples' homes but also emotionally from what people witnessed. Residents kept newspaper clippings from the time and passed them down to the next generation to make sure this tragic story was never forgotten. The site has not been under threat from development until now. Preserving the crash site and having it visible for all to see is really important to ensure this piece of village history is not eroded.

Often when I drive with my children out of the village along Beck Road or along Sheldrick's Road they ask, "Is that where the plane crash happened?" and it's in their thoughts and minds. It might just be a passing moment and we have a brief conversation about it but it's those kinds of conversations that keep that local history alive. This needs to be preserved.

I also think it's really important that we maintain historic sites in the village that tie in with what the local school children are learning in the village primary school. For example, they learn about the Bronze Age and Isleham is famous for the "Isleham hoard" - the largest Bronze Age collection. When they learn about World War II in Year 6 they are aware of the close connection this village has with our neighbouring air bases (Mildenhall and Lakenheath) and the military. Some of the American military children attend the primary school. So when they hear about bomber plane crash so close to their village and the brave actions of the crew on board, this really strengthens their understanding and their connection to the village and its historic events. They value where they live and what the people here stand for. I think that's really important to preserve this.

Catherine Judkins, Isleham resident

From Linda Dunbavin, Isleham Resident who was a young girl when the crash happened and remembers it well. She said she thinks about the crash every time she travels along Beck Rd/Sheldricks Rd and said this about the site: I consider this land to be sacred and should be preserved in memory of those who lost their lives there. Isleham village has a lot of history. One event which took place on the Sunnica East A site was a plane crash after WW2. The brave crew stayed on board the failing aircraft, which had bombs on it, and deliberately steered the plane away from the village to avoid substantial loss of life. In doing this huge act of bravery, all 12 crew perished. We have a plaque in the village to commemorate this and we hold regular memorial events to give thanks to the crew. I do not think that this land should be fenced off or drilled into and covered in solar panels. It should be preserved as it is and access should continue to be allowed in order to allow people to reflect and remember this event. Sunnica appears to have not considered this historic event, which is important to Isleham village. It is important that future generations can identify with the historic events that have taken place locally. This is passed on from generation to generation. We want this to continue and the future generations to have access to this land to keep the memory alive. To date, this site has been preserved to protect the memory and possible buried items on the site. Linda Dunbavin

I was at the school when it happened. I was about 7 or 8 at the time. I remember us all being told to get under the desks and my grandfather went to the site and came across an arm. The site should not be covered by Sunnica - the solar panels should go on the rooftops. Enid Sheldrick Church Lane Isleham.

Plane Crash Over Isleham

13th October 1949 9:30am

On 13th October 1949 at approximately 9:25am a Boeing B-50 Superfortress from the 65th BSqn /43d BGP United States Air Force, took off from RAF Lakenheath with 11 American and 1 British Airman on board, on a routine training mission to drop 16 x 500lb highly explosive bombs on a bombing target in Heligoland in the North Sea. As the B-50 climb through the clouds one of its engines caught fire. The pilot brought the plane down through the clouds and spotted the railway line round the back of Isleham, using this as his guide to avoid crashing the plane on the village and killing hundreds of people, the pilot aimed at the surrounding fields. The impact of the plane with its bombs and 6000 gallons of fuel was felt as far wide as Newmarket. Farm buildings and haystacks caught fire and the pieces of the plane was scattered across the neighbouring fields. All 12 on board died.

When I was growing up my parents would very often talk about how the pilot of a Boeing B-50 Superfortress who saved our village by flying his plane beside the railway line and crashing it into a farmer's field along Beck Road. My Mum lived in Croft Road at the time with her family and my brother as a small baby. She would always tell us how she feels the house shake when the plane hit the ground and shaking from the bomb that where on board exploding and seeing the smoke rising from the ground. My Auntie Vera, also spoke of seeing the plane come through the clouds with its engine on fire, before disappearing behind house, and waiting for the explosion. As for me I wasn't born till 1957 but I was brought up being told these account of the crash.

The 12 aircrew on board that day die instantly on impact, and in our villages, eyes is the last resting place of the 12 heroes that saved our village. In my eyes it is the graves of these brave young men.

I feel that over the years this story has been talked about more and more, by families, the village school and local groups. The families of the late crew come to visit the site of the crash to pay their respects. On the 70th Anniversary of the crash our village Church places a display inside its building in memory of the 12 heroes'. In January 2020 a brass plaque was placed on display in the Beeches community centre in the village as a reminder of the ultimate sacrifice the 12 aircrew gave to our village, each one of them with their name etched in the bronze forever for everyone to see. My Mum newspaper cutting from the local Newmarket Journal was used in the Churches display, she would have been so proud, especially to see the crew finally being honoured for the action that fatal day. I feel privilege that my Mum handed down the cutting to me to keep for the children of the future, and to tell the account of the 12 heroes' so it can be passed on to generation to generation and to keep those heroes names alive.

To now let anything be built on the fields where the crewman sacrificed their lives, including a solar farm is immorally wrong. Someone's son's, Grandson, nephew or cousin lost their lives to save our village and for it to be covered over and not be able to come to those fields and pay their respects is unforgivable. In my eyes, it's their graves and you wouldn't think

twice about building on top of a grave yard, so why build on top of our 12 heroes' last resting place.

We as a village will always be in debit to these 12 men, who saved our village and enabled it to be the place it is today.

Mrs Brenda Downey Isleham resident

Personal reflections included in 2018 & 2022 Isleham News Facebook Page

Facebook page 2022



Roger Badgery

I remember the large bang and the ceilings cracking in our classroom at Isleham school

3 y Like Reply

2



Terry Lister

Yes Brian there should be a memorial for these brave men

3 y Like Reply

1



Zoe Leeson

So glad this is coming together for you [Brian Challis](#) and for all those men who lost their lives ❤️

3 y Like Reply

1



Zoe Leeson

[Glenda Preece](#), it would be lovely to have an article about this in the Informer too 👍

3 y Like Reply



Lisa Stubbs Flemming

I think a memorial plaque is definitely needed.

3 y Like Reply

1



Glenda Preece

Stewart is talking at the Isleham Society in April [Brian Challis](#)

3 y Like Reply

2



Stewart Evans



3 y Like Reply

1



Clive Patterson

Hi [Brian Challis](#) thanks for raising this again. I agree that there needs to be something. I'm sure the Society and many others will support this. Can we arrange a meet up to discuss further?

4 y Like Reply

2



Brian Challis

[Richard Liddington](#) fyi

4 y Like Reply

1



Michael Kelly

Remember running down the croft.

4 y Like Reply

1



Maxwell Dunsmuir

The plane crashed on my third birthday 😞😞

4 y Like Reply

1



Derek Rust

I can remember this I was at Isleham school, we all ran down lane towards church.

4 y Like Reply

2



Frances Audus

i can remember sitting in school when the noise landed on my uncles field

4 y Like Reply

2



Terry Lister

[Brian Challis](#) I can remember this event I was in school in Freckenham when all the doors blew open it was a while before we found out the cause

4 y Like Reply

2



Brenda Downey

I have mums paper cutting...They also lived up croft road at the time...sorry I wasn't even a twinkle in dads eye..but they always spoke about it and now lucky isleham was that day...

4 y Like Reply

3



Brenda Downey

Like the sound of the church Brian...will p.m. you..



Angela Lister

I was picked up off the bedroom floor So my Mum always told me! I was 14 Months old! Remember Mum telling me the plane was on fire as it went over the village!

4 y Like Reply

3 🙌 😱 😭



Jackie Jacklin

We ought to fundraise for a memorial plaque to be on show up at The Beeches.

4 y Like Reply

1 ❤️



Patricia Bird

Trevor Bird remembers this well ,was at school and said the noise was terrible ,never heard anything like it ,and it just missed his mothers house as it went over and landed up beck road

4 y Like Reply

1 🙌



Richard Tonkinson

I guess it's because there are still large USAF planes flying over Isleham on a daily basis and they don't want people reminding of what might happen.

4 y Like Reply

1 🙌



Brian Challis

Amazing thing is that the inquest was held the day after the crash.....

4 y Like Reply

2 🙌 😱



Anita Clarke Scarrow

My father has spoken about this ..

4 y Like Reply

1 🙌



Paula Garden

I don't remember my Father mentioning this.

4 y Like Reply

1 😱



Mary Rolfe

Like many others I remember it well, when the aircraft hit the ground a lump of plaster fell onto my desk at school. People cycled up Beck Road in the evening to have a look and scavenge for pieces of wreckage. There was just one local policeman guarding the site; how things change.

4 y Like Reply

2 🙌 😱



Ina Hayes

I remember it well. We, the children in the school were terrified and it was also my little brothers birthday, Maxie, 🧒

4 y Like Reply

2



Wicky John

My mother in law saw and heard it go over part of the village, then heard the Big Bang.

4 y Like Reply

2



Brenda Downey

I think alot of people still don't know about this...my mum always spoke about it....I have passed it on to my family..
Be good to have something for this brave team of men..Isleham could have been so different. ..

4 y Like Reply

2



Walter Gunston



4 y Like Reply



Brian Challis

<http://www.isleham-village.co.uk/mischistory.html>



Isleham misc history

isleham-village.co.uk

4 y Like Reply



Walter Gunston



Having first posted about this in 2016...I'd like to publicly thank Richard Radcliffe, Chairman, and Councillors on Isleham Parish Council for agreeing to fund a Plaque to commemorate this "incident" which happened in 1949.

I'd been asking around for a while why there wasn't something in the Village marking the crash, but never got an answer. When I went to the Parish Council early in 2019 to ask if anyone on the Council had an answer, it was agreed that, within limits, they would be prepared to consider funding a Plaque.

Many thanks also, to Parish Clerk Richard Liddington who sorted things out, and to Stewart Evans whose presentation in 2016 drew my attention to the crash, and for his subsequent presentation to The Isleham Society in 2019.

Stewart has been provider of most, if not all, of the detailed information.

NOW, ON THURSDAY 16th JANUARY 2020 at 7pm
a Plaque was unveiled in The Community Centre Foyer.

Photo of which is now attached.

.....
.....

On 13th October 1949, Isleham was nearly wiped out but for the bravery of a pilot (Major George Ingham) who sacrificed his own life and those of his crew to steer the B50 Bomber, fully loaded with 500lb live bombs, away from the centre of the village before crashing in a field off Beck Road.

Yet there is still not a memorial to this - as far as I'm aware. Why?

THERE IS NOW!



Stacey Miller

🔍 Susan Smith doesn't grandad remember this? Will have to ask him

Like Reply 1 w



Samantha Myers-Bruce



Like Reply 2 d



Mandy Naomi Childerley



Like Reply 1 w

Samantha Myers-Bruce



Like Reply 2 d



John Shead
Informer page16

<http://isleham-village.co.uk/.../2011/Informer201110.pdf>

Like Reply 1 w Edited



Richard Liddington
John Shead yes thank you, I have this.

Like Reply 1 w



AnnetteandGerry Flindall
John Shead page 16&17 thank you John

Like Reply 1 w



Kat Pohl
My neighbor Linda remembers the crash - her dad responded to it

Like Reply 1 w



Brenda Downey
I have my Mum's newspaper cutting..

Like Reply 1 w



Appendix 8 Children' Statements

The plane crash is a special part of Isleham's history and it was brave men who gave their lives away to save ours during a faulty plane crash that killed all of the crew. The plane was at the time the country's (and one of the world's) biggest aircraft, the B50 Stratofortress the biggest bomber, with a payload of three tons of live bombs which would have caused a lot of destruction to the village if these men didn't divert the plane away from it. To think that it could be covered in solar panels is just really sad and actually very angering due to it being such an important site for Isleham. At school we learnt about WW2 in the first term of Year Six and it is a very important subject in history in my opinion as it teaches children, including me, about what

happened in our past and what this country has been like and the many lives brave people have saved and also given their own lives for us. These 12 crew members made a big sacrifice because that plane could have hit Isleham almost dead centre with all its payload which would have made a big crater in the middle of the village - no houses, no church, gone in a few seconds including many lives and we wouldn't be here if they didn't move that plane away. They were our saviours so we should reward them with a memorial towards all their families and them themselves to commemorate them over their sacrifice and keep their memory around. If you change the site it's not good. It should be kept there exactly how it was out of respect due to them sacrificing their lives. If it's covered over it's like their story would just be covered up and they'll be forgotten which is an awful thing to think of because if you were somebody that saved people by giving your life away, your one and only life, you should be commemorated and respected all across the nation and even the world.

Reuben Fuga, age 12

It was a bomber with 12 people on board and a lot bombs, They took off from Lakenheath and it was very foggy. It got into trouble and was nosediving down and it was heading straight for Isleham so then the pilot decided that they weren't going to survive so they turned away as far as they can away from Isleham to not kill everybody in Isleham. It was a really brave thing to do. The pilot was a hero because he saved lots of people's lives. The village shook because the explosion was so big. The field where they crashed should be kept the way it is because it's a memory of the people who saved our village. It should be preserved in memory of the people and their families. Sophia Fuga, age 9.

Appendix 9 Personal testimonies of US relatives of the crash victims

My grandfather gave his life in service to my country and sacrificed bailing out so as to save a village and the lives therein, the land should be respected for that and maintained as the farmland it was. I'm sure a better plot can be found.

Mr Brien Chatfield, (grandson of 1st Lt Robert W Chatfield) Los Angeles California

Appendix 10 Reference in Isleham Neighbourhood Plan (pg 51)

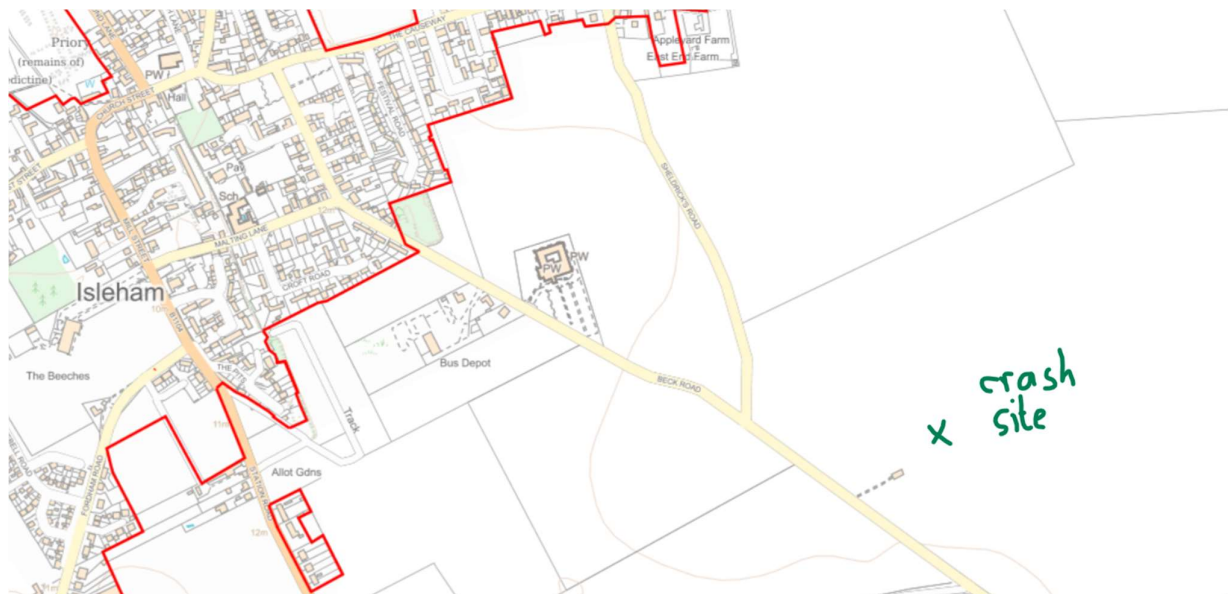
Map 10 Other sites of historical interest



Key:

1. Site of Roman villa
2. Site of Middle Age Canal Cut
3. Roman Earth Bank
4. Site of Middle Age Canal Cut
5. Site for former ferry.
6. Ley Brook chalk stream
7. Site of crashed USAF plane
8. Railway embankment

Isleham Development Envelope



Also see: Neighbourhood Plan (isleham-village.co.uk)

Isleham Parish Council Written Representation Appendix 3 – Comments from landlord at the Rising Sun pub in Isleham

Pat Pearce, owner of the Rising Sun pub was asked by regular patron (Catherine Durance) about his business. These were the responses he gave to the questions that were asked.

Rising Sun, Isleham

Local Business Questions

Introduce yourself. I am conducting a short survey concerning the businesses in the area.

Can I ask you a few questions about your business?

1) Are you the owner or manager of the business? Y N

If Yes, proceed and ask the following questions. If No, thank the person and terminate the interview.

2) What type of business is it?

- Pub
- Hotel
- Restaurant
- Other (specify):

3) [For Pubs, hotels and restaurants (food and beverage):-]

- a) Do you provide accommodation? Y N
- b) Do you serve food? Y N
- c) Are your premises licensed (to serve alcohol for consumption on the premises) Y N

4) Who are your clients? (tick all that apply):

- Local residents
- Tourists (i.e. people who live outside the local area and visit the area for leisure, recreation, or pleasure)
- Others (specify): *clubs, military, general public*

5) Regarding tourists and non-local visitors, when do they typically visit you? (Circle all that apply):

Spring Summer Autumn Winter

6) How reliant on tourism are you to cover your overheads?

- very substantially
- substantially
- not substantially
- not at all

7) Are you aware of the Sunnica solar scheme (show map) Y N

8) What effect do you think the Sunnica Scheme would have on attracting tourists to the area?

- very positive
- positive
- neutral
- negative
- very negative

9) What do you consider the effect of the Sunnica Scheme on attracting tourists to **your business** would be?

- Very beneficial
- Beneficial
- Neutral
- Harmful
- Very harmful

(End of interview survey). Thank interviewee.

Interviewer - Sign: *[Signature]*

Date: *9/11/22*

Isleham Parish Council Written Representation Appendix 4 - SNTS AG Ltd Autumn 2021 survey of Isleham and Isleham Marina residents

We undertook a survey of local residents in Isleham and the Marina area to capture their usage and views on the impact of Sunnica

Method:

Paper copies of the survey were distributed in Isleham and in the Marina area using collection points or on request

The survey was also made available online using Freeonlinesurvey

The link to the online version was distributed via the village Facebook group (Isleham News) in November 2021

Result Summary:

Overall we had 128 responses. This comprised 12 from the paper survey and 116 from the online survey.

The questions and responses are summarised below.

Q1. Do you consent to our using your personal data YES / NO. If NO then please proceed to questions 2-15 only

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Yes	92	70%
No	39	30%
Total	131	

Q2. Do you use the footpaths/ Public Rights of Way (PRoW) around the Isleham Marina and along the banks of the River Lark?

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Yes	117	92%
No	10	8%
Total	127	

Q3. How often do you use these footpaths?

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Daily	26	21%
Weekly	58	48%
Monthly	28	23%
Other	10	8%
Total	122	

Q4. What do you use them for? (tick all that apply)

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Recreation	80	66%
Jogging/Walking	75	61%
Dog Walking	62	51%
Riding	3	2%
Cycling	22	18%
To access neighbouring villages	27	22%
Going to work/school	5	4%
Other	4	3%
Total	122	

"Other" responses included Mental health, health and bird watching

Q5 What times of year do you use them? (tick all that apply)

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Spring	30	25%
Summer	37	30%
Autumn	27	22%
Winter	17	14%
All year round	98	80%
Total	122	

Q6 What do you particularly value about these footpaths/ PRow? (tick all that apply)

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Accessibility	64	53%
Landscape	110	92%
Views	100	83%
Wildlife	106	88%
Peace	102	85%
Provide connection to neighbouring villages	38	32%
Other	5	4%
Total	120	

Q7 Are you aware of the Sunnica solar and battery plant proposal?

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Yes	128	98%
No	2	2%
Total	130	

Q8 Did you receive a copy of the Sunnica Consultation Booklet?

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Yes	91	71%
No	37	29%
Total	128	

Q9. Were you aware of the same, and more, information on the Sunnica website (Sunnica.co.uk)?

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Yes	49	39%
No	78	61%
Total	127	

Q10 Were you made aware of the size/ acres/ hectares of the Sunnica scheme (around 2500 acres)?

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Yes	65	55%
No	54	45%
Total	119	

Q11 From the information provided by Sunnica in the Sunnica Consultation Booklet, how easy was it for you to visualise the impact of the scheme?

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Easy	29	23%
Difficult	90	71%
Other	8	6%
Total	127	

Q12 Do you think that Sunnica’s plans will have a positive or negative impact on this area?

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Negative	119	94%
Positive	8	6%
Total	127	

Q13 If negative, which of the following do you think will have the greatest negative impact? (tick all that apply)

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Solar panels	92	77%
Solar stations	94	79%
Battery Energy Storage Systems	102	86%
Fencing and security	96	81%
Impact on wildlife habitats	101	85%
Noise	94	79%
Other	15	13%
Total	119	

Q14. Thinking about the Statutory Consultation, did you feel adequately consulted about this scheme (i.e. were you provided with sufficient information to enable you to fully assess the impact)? (tick all that apply)

<u>Response</u>	<u>Total</u>	<u>Percentage</u>
Yes	20	16%
No	108	84%
Total	128	

Q15. Please state briefly what impact, if any, you feel this scheme will have on you.

119 responders considered the impact would be Negative, commenting (97 responses):

- It will totally change the way of life we have, walking and enjoying the surrounding areas of the village we bought our home in. It’s not good for our well-being, for our children, it’s harmful to the wildlife, will remove habitats for lots of animals and insects. It’ll cause depression for those who only see the surrounding area of the village due to their age, of whom there are many we know and some we are related to. There are more suitable areas for solar panels, not surrounding villages and farms.
- Ruin our village visually, destroy wildlife’s natural habitat
- Ruin the countryside feel, views and wildlife in the area. Construction also in the short to medium term with vehicles etc
- It will ruin the area, and I know 1st hand there are many factory & warehouse roofing that the solar panels could be installed on but it’s cheaper to destroy open land.
- Pity same objections weren’t made to Bloor Homes site in village which has done more damage than Sunnica In destroying the natural habitats of lots of wildlife , using farming land and a huge blot on the landscape !!!
- It will reduce the number of walking routes available around the villages and will spoil the countryside views and variety of wildlife available to view on the walks that are left
- Fire risk, and detrimental effect on landscape and natural habitats

- Disruption to this beautiful rural area when there are less intrusive and damaging alternatives.
- Horrendous will change the area forever, the reason we moved here was give our children a village life...Sunnica will devastate the area forever, danger from batteries, farming community will lose the use of good agricultural soil, wildlife disrupted never to return, recreational amenities lost, reduction in house prices, already vendors losing their prospective purchasers.....research proves it not even carbon neutral...I could go on.
- Misery
- Construction vehicle impact, ruining good farm land and destroying nature habitats
- Loss of views, loss of access to countryside, loss of wildlife, noise, increased traffic, negative impact on value of property
- I just feel a solar farm of this size is unnecessary in this area
- Potentially de value house and worried how will affect my asthma
- It will affect some of the local walks accessed currently and if not all the paths then it will impact on views; the creation of the scheme will create a lot of extra traffic and noise locally; feel there are lots of unknowns about battery storage so close to people on a scale like this; feel it could affect the value of our property negatively; very worried about the impact on my children ; the land is rich in wildlife currently so habitats would be destroyed; Sunnica's lack of seemingly being prepared to engage with locals is worrying and disrespectful; what will be left of our beautiful surrounding countryside in 30years time? There is a rich history to the land and surrounding area which would be such a shame to lose-not just for now but for our children and future generations.
- The destruction of good arable land, thus reducing essential food production.
- It's incredible that this Sunnica has got this far in the process. The impact will be huge on many levels, the environment, the unknowns and risks around batteries, impact on wildlife and the health risks and not to minimise the huge impact of a proposal of this scale on what Isleham will look like.
- Construction disruption, house value depreciation, local wildlife walks disruption, no benefit for the consumer, just greed driven short sighted project under the banner of 'renewables'. Incentivise brown site roof top solar power generation.
- Impact to house prices, agricultural /farming land and history of the area and noise pollution/construction to name just a few. The size of the site in comparison to the small villages is simply too large. I am not against solar just not such a large site in one area.
- Over powering size damaging our beautiful area & nature
- It having a big impact on my mental health, causing anxiety thinking about the damage it might do to the environment around me and what could happen if something went wrong, especially with the batteries
- We may move away from the area as we chose to live here for the countryside, space and green areas.
- It will spoil the village and surrounding villages/countryside. It will impact on enjoyment of living in a rural/agricultural community. It will impact on house prices. The construction noise and traffic will have a negative impact on people going about their daily lives. The roads in this area are not designed for this amount of traffic and it will impact on people's travel to work/school. There is much concern over the safety of batteries and eventual decommissioning. The loss of agricultural land for growing food would be a terrible loss for this area and the country
- Danger from battery plant. Loss of wildlife and countryside. Loss of farming land

- It will impact on my personal enjoyment of my surroundings, on my personal access to certain areas and wildlife. The scale makes me worry regarding the management and sustainability of the batteries etc.
- Noise and traffic during construction, loss of valuable countryside and wildlife.
- It will have an adverse effect on the landscape and change the character of a large part of the paths and views from the roads I'm using.
- Negative: Impact on value of my home, access to wide open spaces, damaging to environment and wildlife,
- It will have a negative mental impact
- Loss of natural landscape
- It will affect my mental health. I live for walking the footpaths, enjoying the countryside and seeing wildlife habitats. I despair at the heavy impact the scheme will have on already diminishing wildlife habitats and displacement of wildlife. The UK needs to be more sustainable in terms of food produce. I despair at seeming farmland disappear. All of this will impact my welfare, cost of living and mental health
- Detract immensely from rural life
- Make Isleham an unpleasant place to live - impact on property investment
- Mental health issues, financial implications, disruption to wildlife-killing it and not letting all animals roam freely that they like and are used to. I love the wildlife around here that's why I live here.
- The scheme will mean that my family will unlikely stay in the area due to the detrimental effects to our way of life and safety.
- To surround small villages with this when there are lots of more remote areas that could be used is disgusting
- Claustrophobic- enveloped by a solar farm, depressed due to the loss of view. I chose to live in the countryside and not a solar farm.
- The scheme itself is far too large impacting local scene, wildlife and a distraction to our longterm way of life here. There are massive safety issues with proposed battery's, no plan of how the farm will be cleaned up at the end of its life. I question the need due to so many other solar farms already here and also with the improvement of solar technologies this will be out of date before it is even built. Add panels to housing and commercial building this is a better way of supporting our energy needs. Do not take farm land which is needed to provide food. What about the carbon foot print to import food?
- I travel along the Beck road regularly and enjoy the wide open vistas across to Mildenhall and Freckenham. My family also uses the footpaths along the River Lark regularly. It will be a travesty for this landscape to be re-written from open agricultural land and wildlife habitats, to miles of deer fencing and fields of solar panels and huge industrial shipping containers of battery stores. Instead of being sited discretely, this development engulfs multiple villages - right up to village boundaries and peoples' homes - and will have such a negative effect on the landscape, wildlife and people's mental health.
- Construction disturbance will be horrendous. This will permanently impact the environment/countryside in which my family lives in. The Battery Storage is unsafe and noisy. The proposed scale of this project is excessive and the proximity of the proposed plant to the villages demonstrates a total lack of consideration for the people that live here. Sunnica have positioned this proposal as a green project, but there has been no evidence to show that this will be a carbon-neutral or even carbon negative project. Therefore the construction of this project will only further damage the environment which we are living in. The proposal is flawed and propped up by a facade of a green project. The tech is wrong, alternatives need to be considered.

- Negative to local environment
- Force me to sell my property and move away
- The inevitable battery fire, toxic fumes and poisoned land will be extremely damaging to human life and natural life forever.
- Detrimental to the whole area
- Reduction in walk options around the village plus eye sore. Reduction in value of homes.
- Significant impact on recreation and enjoyment of the natural landscape, vital for mental and physical health. Huge concern about loss of crucially important farmland at a time when we should be reducing food miles.
- Moved to the country - now the fields are changing to panels.
- Taking food away that we even cattle need
- I think it is a very shortsighted scheme to use land that could be better purposed for food or even housing. I think that solar panels should be put on large areas that are already under industrial or commercial use, like super store parking lots and warehouses, etc to have less of an ecological impact
- The peace and quiet but more importantly the loss of good arable land to feed us. Planning laws could be changed to insist that all new builds both residential or commercial have solar panels incorporated in the design.
- Impact on the views and sense of openness I moved here for.
- Plenty of isolated fields across the fens when we fly over east anglia to put solar panels
- No one can envisage what it is going to look like until it is there. Then it will be too late.
- Wildlife & nature. It will be sad for the children in the area....
- The area is import for agriculture, as such it provides wildlife habitats and some diversity. Peace, connection with nature and big horizons all lost. There are many urban or reclaimed areas that vital solar energy can be collected from. Albeit at a slightly greater financial cost....but at less environmental cost.
- Negative impact on surrounding countryside, including pollution, devastation of wildlife and agricultural land, and for negligible benefit. Wind turbines would be vastly preferable.
- Definitely, a hugely, detrimental impact on the rural character of the area
- Negative impact on the environment because of vast size of the development. Would prefer to have seen wind turbines.
- I'm very concerned about the risk of batteries exploding as we live very close to a proposed site. I'm also worried about the loss of wild life and the fact thee at y the land will never be safe to use for farming, housing due to the toxins and damage to the soil/ground. I'm concerned for my young family and the impact it will have on them.
- Complete change of the country side from beauty to industry
- It will take away the joy of seeing the open countryside, the views, the wildlife particularly the deer around here. Constant worry about the huge batteries, the acres and acres of unsightly solar panels, and the devaluation of our house. It depresses me that good arable land will be taken away for this scheme.
- Disruptive to everyday life in the area
- Spoil visually the area we live in and devalue all local properties.

- Access, visual impact, negative impact on wildlife, reduction in access to countryside, less likely to go for walks to enjoy the countryside. Less likely to walk/take the dogs for walks on these routes.
- Loss of rural aspect of area surrounding the villages. Dangerous safety risk caused by the batteries. Noise, pollution and traffic impact during construction
- Concerned about the size of the proposed site and the impact on the local villages.
- It will spoil the peace and tranquillity of the area. We particularly enjoy the wildlife and the scenery and to see it replaced by solar panels on what is presently farmland would be a travesty.
- Loss of agricultural land together with the imposition of potential loss of integral nature and wildlife.
- Immense impact both during construction and ongoing during operation.
- Severely reduced enjoyment of the local environment, probably reducing the desire to exercise/walk. Bring an atmosphere of fear, particularly surrounding the battery storage systems, impact my daily living during construction and damage the historic and long established wildlife and ecosystems for decades to come. I suspect it will also devalue my house as who is going to want to come and live in such an unappealing area.
- I think I will find it an unattractive use of what is at the moment attractive farmland. I am concerned about the construction traffic and the effect it will all have on animal wildlife and flora.
- Unsightly industrial landscape, impacting our village because of its closeness and sheer scale of the site. Unknown safety issues with batteries storage and longterm impact on the farming quality soil
- I am most worried about contamination of the River Lark, as East Site A runs extremely close to the river. We have finally got the river into a good state, proven with the wide range of wildlife, including otters, that live in or near the river. My garden borders the River Lark so any contamination would directly impact me and my use of the river (swimming, water sports etc.).
- Would impact on our daily lives
- We moved here for the rural landscapes and peace and quiet
- It affects all of us as it will alter this area forever. We need to work towards a carbon neutral future, not hinder it!
- Loss of our beautiful countryside
- None
- This will destroy the wildlife around this area and contribute directly to pollution in the River Lark and surrounding waterways.
- I think it will result in a great deal of building works for an extended period, and once completed I feel the scale of the proposal will impact on the amenity and outlook of the area. If I was in the market for a new home, I'd be avoiding the areas that Sunnica impacts, so I suspect the development - or even the idea of the development - could affect the prices of our properties in the area.
- It will destroy good farming land and wildlife habitats. Potential for dangerous emissions or fire at the substations. There are much better ways to use solar which doesn't impact the land.
- I live on the marina. I chose an exceptionally rural existence. This is a huge factory in disguise. Not that it's a particularly good disguise
- It has a negative impact on whole area
- Access, wildlife, scenery, waste of good farmland, etc

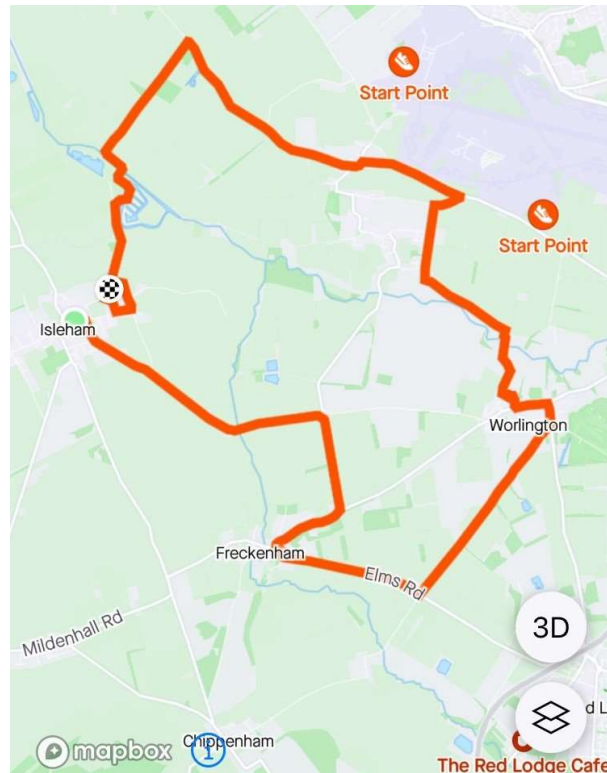
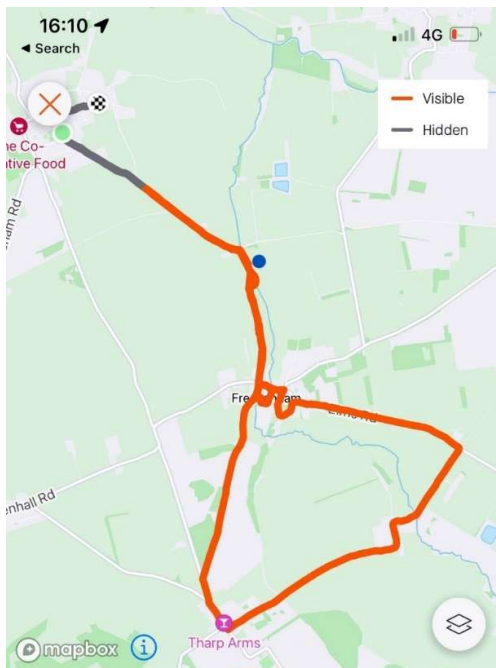
- Impact on our daily life
- 1) Poor return of energy for output costs 2) Looks like near-perfect way of making unjustified profit 3) Because of subsidy it would appear that we are paying twice for our electricity. 4) What kind of farmer (historic) would want his land wasted this way 5) How propitious it was to have easy access to pipeline Burwell-Mildenhall 6) We are supposed to be looking after our children's future, not profiteering. We must do better
- It is not just about me. It is about the whole rural area. Solar panels should be on the roofs of factories, office blocks and houses. Fields are meant for planting crops and trees, grazing animals and the pleasure of nature.
- Our well-being - the noise and disturbance, the affect on wildlife and countryside views.
- The noise and the buzzing from the storage conversion units or batteries and what about the interference to the airways regarding wireless or radio waves. As above also people, open space, people mental health, along with health air if there is a fire with any of the batteries (i.e. air pollution for people with breathing problems!). That why a lot of people moved here. Beautiful surroundings of this village.
- Many of my neighbours and the majority of people living in this area have moved from towns and cities to live a more peaceful and healthy lifestyle. Being able to walk in the clean air of the countryside is good for everyone's physical and mental health. This has been especially vital in the last 2 years.
- Lower our quality of life with the negative impact of less wildlife and tranquillity. Pollution from the construction. Possible danger from battery storage if there is a fire and many other factors.
- Total carnage and mess on the roads during construction - huge volume of traffic through the village. Sun glare from solar panels, loss of natural wildlife. There is no financial gain for the community. This is purely a money-making scheme for Sunnica
- The pros and cons of solar energy are well documented now and the advantages are obviously outweighed by the disadvantages to the environment and population. Solar panels only have a place on building roofs. This is plain for all to see (except those with a vested interest)
- A lot more heavy traffic on narrow roads. Vast areas of landscape covered in panels. Ongoing worry about safety of Battery energy storage systems.
- Disruption and inconvenience during construction, views ruined across the land. Wildlife habitats destroyed. Peace and quiet destroyed. Farming stopped causing more imports. This area will never be the same if this happens. I am horrified and distressed about it.
- The solar sites will impact some of the walks we do in the area. I worry about the size of the battery and also the long term affects it may have on me and my family. I feel the sheer size of the sites will really impact how the landscape looks, supports wildlife and feeds the population!
- Too close to Isleham

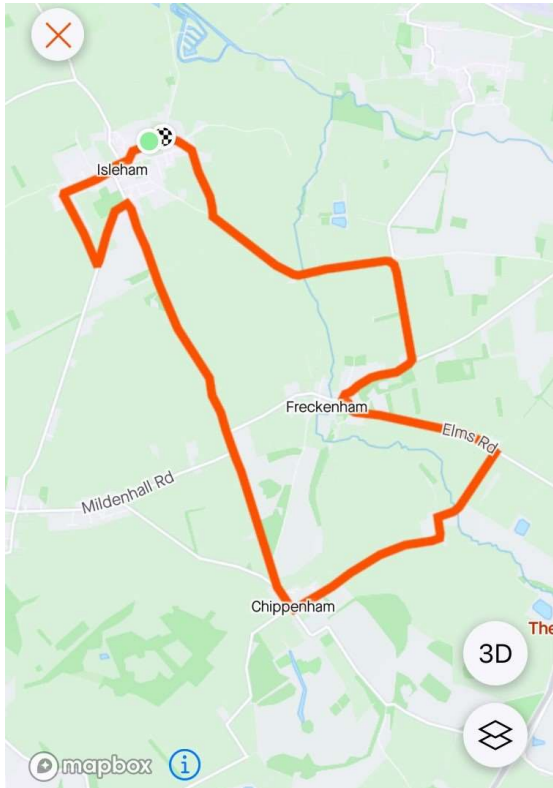
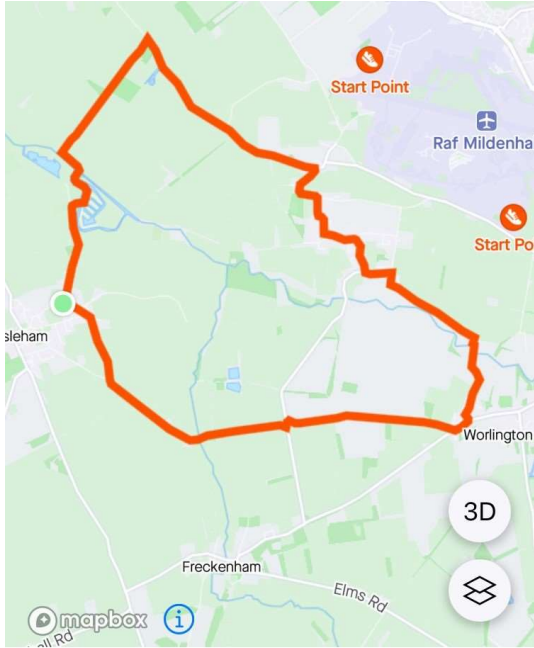
5 comments were received from those who considered the impact would be Positive (8 responses):

- Very little apart from changing the appearance of the landscape. AN equivalent acreage is already used for bio-fuel in the area which has a much greater impact. Once construction is complete a valuable crop of clean electricity will be produced with no disruption caused by agricultural vehicles
- Bring affordable, sustainable energy to the local or wider area. As we've seen with the COP26 this week, we will all have huge sacrifices to make and it saddens me this means our local views, albeit just a small minority of the thousands we have, but the world is about us all, not just our precious local area.

- None but it will help the world
- Improve biodiversity of the current landscape which is suffering from intensive agricultural use.
- It will help ensure a green energy transition. The change to the local countryside (not an Area of Outstanding Natural Beauty) is definitely worthwhile in order to limit the climate crisis created by older generations.

Isleham Parish Council Written Representation Appendix 5 – Commonly used routes by the Isleham Joggers group





Appendix 6 – Safety of Grid Scale Lithium-ion Battery Energy Storage Systems - Fordham et al.

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Safety of Grid Scale Lithium-ion Battery Energy Storage Systems

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Safety of Grid Scale Lithium-ion Battery Energy Storage Systems

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Sources of wind and solar electrical power need large energy storage, most often provided by Lithium-Ion batteries of unprecedented capacity.
Incidents of serious fire and explosion suggest that the danger of these to the public, and emergency services, should be properly examined.

5 June 2021

Executive Summary

1. Li-ion batteries are dominant in large, grid-scale, Battery Energy Storage Systems (BESS) of several MWh and upwards in capacity. Several proposals for large-scale solar photovoltaic (PV) "energy farms" are current, incorporating very large capacity BESS. These "mega-scale" BESS have capacities many times the Hornsdale Power Reserve in S. Australia (193 MWh), which was the largest BESS in the world at its installation in 2017.
2. Despite storing electrochemical energy of many hundreds of tons of TNT equivalent, and several times the energy released in the August 2020 Beirut explosion, these BESS are regarded as "articles" by the Health and Safety Executive (HSE), in defiance of the Control of Major Accident Hazards Regulations (COMAH) 2015, intended to safeguard public health, property and the environment. The HSE currently makes no representations on BESS to Planning Examinations.
3. Li-ion batteries can fail by "thermal runaway" where overheating in a single faulty cell can propagate to neighbours with energy releases popularly known as "battery fires". These are not strictly "fires" at all, requiring no oxygen to propagate. They are uncontrollable except by extravagant water cooling. They evolve toxic gases such as Hydrogen Fluoride (HF) and highly inflammable gases including Hydrogen (H₂), Methane (CH₄), Ethylene (C₂H₄) and Carbon Monoxide (CO). These in turn may cause further explosions or fires upon ignition. The chemical energy then released can be up to 20 times the stored electrochemical energy. Acute Toxic gases and Inflammable Gases are "dangerous substances" controlled by COMAH 2015. Quantities present "if control of the process is lost" determine the applicability of COMAH.
4. We believe that the approach of the HSE is scientifically mistaken and legally incorrect.
5. "Battery fires" in grid scale BESS have occurred in South Korea, Belgium (2017), Arizona (2019) and in urban Liverpool (Sept 2020). The reports into the Arizona explosion [8, 9] are revelatory, and essential reading for accident planning. A report into the Liverpool "fire" though promised for New Year 2021, has not yet been released by Merseyside Fire and Rescue Service or the operator Ørsted; it is vital for public safety that it be published very soon.
6. No existing engineering standards address thermal runaway adequately, or require measures (such as those already used in EV batteries) to pre-empt propagation of runaway events.
7. Lacking oversight by the HSE, the entire responsibility for major accident planning currently lies with local Fire and Rescue Services. Current plans may be inadequate in respect of water supplies, or for protection of the local public against toxic plumes.
8. The scale of Li-ion BESS energy storage envisioned at "mega scale" energy farms is unprecedented and requires urgent review. The explosion potential and the lack of engineering standards to prevent thermal runaway may put control of "battery fires" beyond the knowledge, experience and capabilities of local Fire and Rescue Services. BESS present special hazards to fire-fighters; four sustained life-limiting injuries in the Arizona incident.
9. We identify the well-established hazards of large-scale Li-ion BESS and review authoritative accounts and analyses of BESS incidents. An internet video [10] is essential initial instruction.
10. We review engineering standards relating to Li-ion BESS and concur with other authorities that these are inadequate to prevent the known hazard of "thermal runaway". We conclude that large-scale BESS should be COMAH establishments and regulated appropriately. We respectfully request evidence from the HSE that "mega-scale" BESS are *not* within the scope of COMAH.
11. We seek the considered response of relevant Government Departments as well as senior fire safety professionals to these concerns.

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1. Introduction

Lithium-ion (Li-ion) batteries are currently the battery of choice in the ‘electrification’ of our transport, energy storage, mobile telephones, mobility scooters etc. Working as designed, their operation is uneventful, but there are growing concerns about the use of Lithium-ion batteries in large scale applications, especially as Battery Energy Storage Systems (BESS) linked to renewable energy projects and grid energy storage. These concerns arise from the simple consideration that large quantities of energy are being stored, which if released uncontrollably in fault situations could cause major damage to health, life, property and the environment.

Table 1. Comparison of some recent “battery fires” since 2014.
Note: this is not a comprehensive list of all Li-ion BESS battery “fires.”

Location	Size	“Battery fire” cause	Time to bring under control	Water needed for cooling	Comments
Houston, Texas, April 2021	0.1 MWh	Driverless vehicle crash	4 hours	30,000 (US) gallons	Tesla Model S
South Korea	Various; 21 fires during 2018-19	Not known to Korean Ministry of Trade Industry and Energy	various	Not known	522 out of 1490 ESS facilities in Korea suspended (Korea Times 2 May 2019)
Drogenbos, Belgium. 2017	1 MWh	Not known.	“rapidly extinguished”	Not known	Occurred during commissioning of system by ENGIE
McMicken Facility Arizona, USA. 2019	2 MWh	Thermal runaway in a single rack out of 27 that were in the cabin – hence 74 kWh electrochemical energy released – less than the Tesla Model S crash.	2 hours from first report to “deflagration”		Explosion as H ₂ and CO mixed with air and ignited. Critically injured 4 fire-fighters. Extensive forensic report.
Carnegie Rd, Liverpool, UK, 2020	20 MWh	Not known	11 hours		Full report [1] delayed 4 months; still unpublished.

Even battery electric vehicle (BEV) batteries store energy sufficient for “fires” that have taken hours to control. A Tesla Model S crashed in Texas on the weekend of 17-18 April 2021 igniting a BEV battery fire that took 4 hours to control with water quantities variously reported [2] as 23,000 (US) gallons or 30,000 gallons (87 -115 m³). Yet the energy storage capacity in even the latest Tesla Model S vehicles is only 100 kWh. This is 1/20 the size of the BESS in Arizona [3] which failed in 2019, and 1/200 the size of the BESS in Liverpool [4] which caught fire [5] in September 2020, and 1/7000 the capacity of the Cleve Hill Solar Farm and Battery Store [6] approved in May 2020.

The past decade has seen a number of serious incidents in grid-scale BESS, which are summarised in Table 1. Despite these incidents, and our growing understanding of these, these large scale Li-ion BESS are not currently regarded by HSE as regulated under the COMAH

Regulations 2015. The legal basis for this attitude is unclear – simple calculations summarised in this paper argue that they should be – and the issue may yet be challenged in judicial review.

The reason the COMAH regulations should apply is the scale of evolution of toxic or inflammable gases that will arise in BESS “fires”. In the Drogenbos incident (2017, Table 1), the inhabitants of Drogenbos and surrounding towns were asked to keep all windows and doors shut; 50 emergency calls were made from people with irritation of the throat and airways¹. A chemical cloud which “initially had been enormous”, was charted by helicopter. The Belgian Fire Services could not control what was described as “the chemical reaction” and filled the cabin with water. Fears of an explosion with 20 metre flames kept people confined for an hour. Although the initial visible flames were controlled quickly, cooling continued over the next 36 hours.

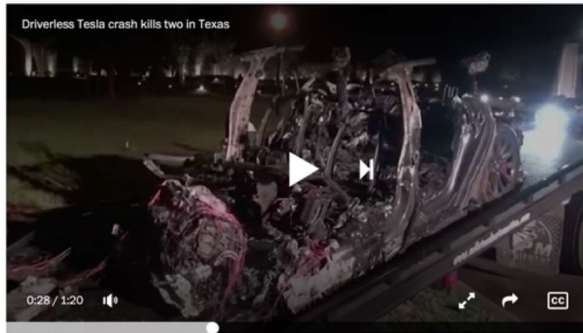


Figure 1: Remains of the Tesla Model S crash and fire, 17 Apr 2021, after 4 hours and 30,000 gallons. Battery capacity 100 kWh.

Two men died after a Tesla vehicle, which authorities said was operating without a driver, crashed into a tree in a Houston suburb on April 17. (Reuters)



Figure 2: Remains of a Korean BESS destroyed by a “battery fire”. An energy storage system was destroyed at the Asia Cement plant in Jecheon, North Chungcheong Province, on Dec. 17. Courtesy of North Chungcheong Province Fire Service Headquarters (Korea Times 2 May 2019)

¹ Tom Vierendeels (2017) “Explosiegevaar by brand in Drogenbos geweken : 50-tal oproepen van mensen die zich onwel voelen door rook.” *Het Laatste Nieuws*, 11 November 2017

Figure 3: "Battery Fire" at Drogenbos, Belgium 11 Nov 2017. Taken at the start of the incident and 15 minutes later (eye-witness footage). 1 MWh facility; fire occurred during commissioning.



Figure 4: The 2 MWh McMicken (Arizona) BESS after the explosion on 19 April 2019





Figure 5: The 20 MWh BESS at Carnegie Rd, Liverpool. Courtesy Ørsted.



Figure 6: The fire at Carnegie Road, 15 Sep 2020. Liverpool Echo report, which took 11 hours to control.

The incidents recorded in Table 1 are all in relatively small BESS or a single BEV. Yet “mega-scale” BESS are now planned on a very large scale in many current proposals in the UK, listed in Table 2 and illustrated in the subsequent Figures.

And no engineering standards are currently applied to pre-empt future accidents in grid-scale BESS, the most critical of which would be design features aimed at preventing the phenomenon of “thermal runaway”, the process whereby failure in single cell causes over-heating and then propagates to neighbouring cells so long as a temperature (which can be as low as 150 °C) is maintained.

BEV batteries do now include thermal barriers or liquid cooling channels between all cells to safeguard against this phenomenon, but no such engineering standards exist for grid-scale BESS. A large BESS can pass all existing engineering design and fire safety test codes and still fail in thermal runaway – by now a well-known failure mode. This must be urgently addressed.

The consequences of major BESS accidents could be significant and emergency services need adequate plans in place to handle any such incident.

Table 2. “Mega” scale solar plant and/or Li-ion BESS in Australia and the UK*

Project	Location	Status	Solar PV Scheme Size	Battery Stores	Battery type	Battery capacity
Hornsedale Power Reserve	S. Australia	Operational	Not directly associated	Single site	Li-ion	193 MWh
Cleve Hill Solar + Battery Store	Kent	Permission granted (2020)	350 MW; land coverage 890 acres	Single site	Li-ion	700 MWh
Sunnica Solar + Battery Store(2)	Cambridgeshire/ Suffolk	Pending submission	500 MW; land coverage approx. 2792 acres	31.5 ha of land over 3 compounds [7] of 5.2, 10.7 and 15.6 ha	Li-ion	Undeclared. Estimate 1500 – 3000 MWh
Longfield Solar + Battery Store	Essex	Pending statutory consultation	500 MW; land coverage approx. 1400 acres	Stated as 3.7 acres: number of sites TBD	Li-ion	Undeclared. Estimate: 150 MWh

* Li-ion technology has been assumed in all these proposals as Li-ion battery electrochemistry is dominant in grid-scale BESS applications (deployment at this scale is unlikely to involve technologies with lesser experience). Estimated values for Battery Capacity for the Sunnica are calculated based on the McMicken facility in Arizona (Appendix 1) and the Cleve Hill DCO. For the Longfield site it is estimated from Energy Institute guidance on energy density [25] at about 100 MWh ha⁻¹. The exact specification for the battery units has not been disclosed by the developers at this present time.



Figure 7: The Hornsdale Power Reserve (South Australia) in the process of expansion from 100 MW/129 MWh to 150 MW/193.5 MWh, as of November 2017.



Figure 8: a "typical" BESS compound (abstracted from Sunnica PEIR, Ch 3)

Plate 3-10. Typical battery storage compound configuration (image reproduced courtesy of Fluence Energy).



Figure 9: Artists impression of Tesla 250 MWh "Megapack". Sunnica may have 3 x this capacity in just one of its three BESS compounds.

2. Leading Concerns

The main concerns regarding large scale Li-ion BESS are:

- 1) The potential for failure in a single cell (out of many thousands) to propagate to neighbouring cells by the process known as “thermal runaway”. Believed to be initiated by lithium metal dendrites growing internally to the cell, a cell may simply discharge internally releasing its stored energy as heat. Even sound Li-ion cells will spontaneously discharge internally if heated to temperatures which can be as low as 150 °C, releasing their stored electrical energy, thus overheating neighbouring cells and so on. Temperatures sufficient to melt aluminium (660 °C) at least have been inferred from analyses of such thermal runaway accidents. Eye-witness reports consistently speak of repeated “re-ignition” which is inevitable, even in the complete absence of oxygen, so long as the temperature anywhere exceeds the thermal runaway initiation threshold.
- 2) The emission of highly toxic gases – principally Hydrogen Fluoride – for prolonged periods, in the event of thermal runaway or other battery fires. At a minimum, respirators and complete skin protection would be required by any fire-fighters. Measures to protect the public from toxic plumes would also be necessary.
- 3) The emission of large quantities of highly inflammable gases such as Hydrogen, Methane, Ethylene and Carbon Monoxide even if a fire suppression system is deployed. These gases will be evolved from a thermal runaway accident regardless of such measures, with explosion potential as soon as they are mixed with air and in contact with hot surfaces. Such an explosion was the cause of the “deflagration event” at McMicken, Arizona in 2019 in a 2 MWh BESS, which critically injured four fire-fighters and was triggered simply by opening the cabin door.
- 4) The absence of any adequate engineering and regulatory standards to prevent or mitigate the consequences of “thermal runaway” accidents in Li-ion BESS.
- 5) The potential for thermal runaway in one cabin propagating to a neighbouring cabin. In Arizona [3] there were reports of *“fires with 10-15 feet flame lengths that grew into 50 - 75 feet flame lengths appearing to be fed by flammable liquids coming from the cabinets”*.
- 6) The significant volumes of water required to thoroughly cool the system in the event of a “fire”, and how this water will be contained and disposed of (since this will be contaminated with highly corrosive hydrofluoric acid and, therefore, must not be allowed to drain into the surrounding environment).

Such incidents are routinely and repeatedly described in the Press as “battery fires” though they are not “fires” at all in the usual sense of the word; oxygen is completely uninvolved. They represent an electrochemical discharge between chemical components that are self-reactive. They do not require air or oxygen at all to proceed.

Hence the traditional “fire triangle” of “Heat, Oxygen, Fuel” simply does not apply, and conventional fire-fighting strategies are likely to fail (Figure 10, over).

Thermal runaway events are uncontrollable except by *cooling* all parts of the structure affected – even the deepest internal parts – below 150 °C. This basically requires water, in large volumes.

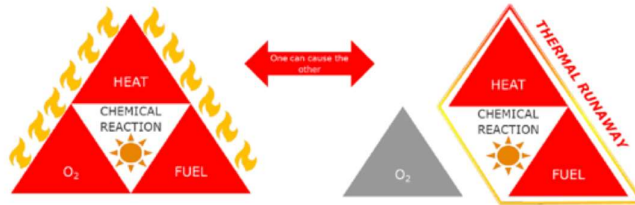


Figure 11 The fire triangle and its relationship to thermal runaway

Figure 10: The traditional “fire triangle” does not apply to “thermal runaway”.

3. Thermal Runaway (Battery “fires”)

Li-ion batteries are sensitive to mechanical damage and electrical surges, both in over-charging and discharging. Most of this can however be safeguarded by an appropriate Battery Management System (BMS) and mechanical damage (unless deliberate and malicious) should not be a hazard. Internal cell failures can arise from manufacturing defects or natural changes in electrodes over time; these must be regarded as unavoidable in principle. Subsequent escalation into major incidents can propagate from such apparently trivial initiation.

In July 2020 a thorough failure analysis by Dr Davion Hill of DNV GL [8] was prepared for the Arizona Public Service (APS), following the April 2019 thermal runaway and explosion incident in the 2 MWh Li-ion BESS facility at McMicken, Arizona. This report is revelatory and more detailed than any other failure analysis known to us. It is essential reading for any professional involved in fire safety planning for major BESS. (Figures 11 to 13).

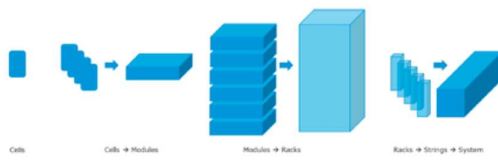


Figure 11: Cells stack into Modules; Modules into Racks; Racks into Strings; Strings into Systems.

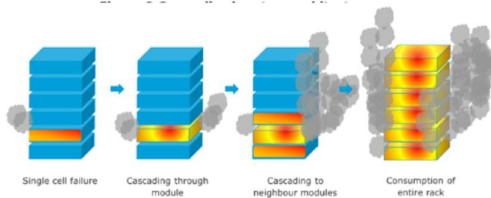


Figure12: Propagation of single Cell failure through Module; cascade to entire Rack.

Figure 25 A single cell failure propagated through Module 2, then consumed the whole rack, releasing a large plume of explosive gases. This process could have occurred without visible flame, which would explain why the gases were not burned as they were emitted.

A report by Underwriters Laboratories (UL) on the same incident [9] is less technical on the physics and engineering of the underlying causes and failure modes, but more comprehensive in terms of practical situations and consequences found, and suffered, by the "first-responders". Two fire-fighters suffered life-limiting brain injuries, one suffered spinal damage and fourth facial lacerations. This report is similarly essential reading for any fire and emergency response planning.

Figure 13: Destruction of Rack at McMicken.



Rack 17 Rack 15 Rack 13

Detail: molten aluminium pools (exceeded 660 °C)



Figure A.1: Photograph taken during decommissioning of the ESS shows a pool of solidified aluminum on the floor in front of Rack 15 [1].

Forensic analysis [8] of the 2019 Arizona "fire" identified a failure mode different from mechanical abuse or electrical mis-management. The initiating failure was localised to a single cell at a known position in the rack. Although the cell itself was of course destroyed during the incident, the failure

mode is believed to have been lithium metal deposition and abnormal growth of lithium metal dendrites. These phenomena were also found in randomly selected *undamaged* cells from the same BESS and also from a different BESS of the same manufacture elsewhere. These phenomena must be regarded as common, and inherent to the cells themselves.

The lithium metal deposits will react with air moisture, causing overheating and smoke. Battery swelling, electrolyte degradation, and internal short circuits are all possible modes of failure with internal discharge and generation of locally intense heat.

Because of the known thermal breakdown of even non-faulty cells, above a threshold temperature (which can be as low as 150 °C), the loss of even a single individual cell can rapidly cascade to surrounding cells, resulting in a larger scale "fire." This is "thermal runaway" in which failures propagate from cell to cell within "modules" and from module to module within a "rack".

This is what happened at McMicken [8], with temperatures sufficient to melt Aluminium (660 °C) being reached. Such "fires" can be extremely dangerous to fire fighters and other first responders because, in addition to the immediate fire and explosion risks, they would have to deal with toxic gases (principally hydrogen fluoride HF, also hydrogen cyanide HCN and other fluorine compounds such as phosphoryl fluoride POF₃) and exposure to other hazardous materials.

Rack to rack propagation fortunately did not happen at McMicken, though an explosion did [8]. A local conventional fire involving the plastics materials or gases evolved from them could have

initiated rack-to-rack propagation; the only essential factor would have been sufficient heat to trigger thermal breakdown in just one cell in a neighbouring rack. Li-ion cells have been observed to eject molten metal during thermal runaway, another possible mode of propagation over distance. Propagation through a subsequent rack would then occur by exactly the same thermal runaway mechanisms, and potentially beyond between neighbouring cabins in large-scale BESS.

Thermal runaway is illustrated in dramatic fashion with tiny commercial Li-ion cells in a useful internet video [10] (Figure 14). The commercial cells involved in this demonstration have tiny capacities: a mere 2.6 Ah or about 10 Wh for typical terminal voltages.

A Tesla Model S would have the capacity of about **10,000** such cells.
A 20 MWh BESS has the capacity of about **2 million** such cells.

In the video, the cell is deliberately over-heated on a small electric stove. The fully charged cell goes into thermal breakdown, eventually rupturing the can. The cell flies off as a rocket and seconds later is discharged but red hot and will burn anything combustible. Although not illustrated, it is evidently hot enough to produce the same thermal breakdown in an adjacent cell within a battery.

This illustrates the damage done to a non-faulty cell, simply by overheating externally.



4. Toxic and flammable gas emissions

During a Li-ion “battery fire,” multiple toxic gases including Hydrogen Fluoride (HF) [11], Hydrogen Cyanide (HCN) [13] and Phosphoryl Fluoride (POF₃) [11] may be evolved. The most important is Hydrogen Fluoride (HF), which may be evolved in quantities [11] up to 200 mg per Wh of energy storage capacity.

HF is toxic in ppm quantities and forms a notoriously corrosive acid (Hydrofluoric Acid) in contact with water. It is toxic or lethal by inhalation, ingestion and by skin contact. The ERPG-2 concentration (1 hour exposure causing irreversible health effects) given by Public Health England is just 20 ppm; the workplace STEL (15 minute Short-Term Exposure Limit) is just 3 ppm [12]. Major emissions of HF would form highly toxic plumes that could easily threaten nearby population centres, workplaces and schools.

Appendix 3 contains calculations of projected toxic gas quantities for 3 grid-scale battery stores that have been approved or are pending review by the Planning Inspectorate (Table 2).

The calculated capacities at the “mega-scale” sites listed in Table 2 are tens, or even hundreds, of times larger than the facilities in Table 1, which experienced significant fires or explosions.

In addition to evolution of toxic gases, even in an inert atmosphere (without Oxygen), multiple flammable gases (such as Hydrogen H₂, Carbon Monoxide CO, Methane CH₄, and Ethylene C₂H₄) would be evolved during thermal runaway. These are “typical of plastics fires” [8] and have been measured in sealed vessel tests [13]. As noted by Hill/DNV [8] and others [13], the proportions of H₂, CO, CH₄ and C₂H₄ do not in fact vary greatly between different cell technologies, simply because the chemical nature of the envelope polymers, separators, electrolyte solvents and electrolytes themselves do not differ greatly. The variations between Li-ion technologies are in the electrode systems, which are typically not polymeric.

Such inflammables can clearly create (ordinary, air-fuel) fires or explosions once mixed with air/oxygen. It is important to note that the Heats of Combustion of the inflammables may be up to 15 – 20 × the rated electrical energy storage capacity of the BESS. This has been demonstrated by the same tests which determined the quantities of HF evolved [11]. These were fire tests, not sealed vessel tests [13]. The stored electrical energy is therefore by no means a conservative estimate of the total energy release which could be released in a major (air-fuel) fire in a BESS, irrespective of whether the initiating cause was a conventional fire or Li-ion cell thermal runaway.

Appendix 2 estimates the inflammables potentially evolved from the BESS given in Table 2.

5. Total Energy Release Potential

Any large energy storage system has the risk that energy released in malfunction will be uncontrollable in ways that will do major damage. BESS can release electrochemical energy in the form of thermal runaway or “battery fires”. In addition they can release chemical energy in the form of explosions or conventional fires of inflammable gases, or of polymer components. Many thermal runaway “fires” have now happened, as has explosion of evolved inflammable gases.

An important indicator of the foreseeable scale of a “worst credible hazard” is provided by the total stored energy in the system. For BESS, this comprises two components:

- (i) The stored electrical energy which might be released in the event of thermal runaway incidents, a self-reactive electrochemical energy release not requiring oxygen at all, and
- (ii) Stored chemical (fuel) energy which might be released in complete combustion of the inflammable gases which might be released by (i).

Electrochemical energy release is uncontrollable once started, by any measure except cooling – of all cells and cell parts – below about 150°C. Water is the only fire-fighting substance with the necessary heat capacity. Concurrent conventional fire would first heat cells above the thermal runaway temperature, causing more thermal runaway. Chemical energy release from inflammable gases is also uncontrollable once those gases are mixed with air and ignited: explosions result.

What might be the scale of such energy releases? The Sunnica proposal is estimated to have a stored energy between 1.5 – 3.0 GWh in total, spread across 3 separate sites called Sunnica East A, Sunnica East B and Sunnica West A (see calculations in Appendix 1). It is between 2 – 4 times the capacity projected for Cleve Hill (700 MWh). It is 8 – 15 times the capacity (193 MWh) of the “Hornsedale Power Reserve” in Australia, at installation (2017) the world’s largest.

Compared to other energy storage technologies, the Dinorwig Pumped Storage Scheme in Snowdonia stores about 9 GWh [14]; the Sunnica BESS corresponds to 17 – 33 % of Dinorwig.

Compared to major explosions, the energy released in the Beirut warehouse explosion of August 2020 has been estimated [15] by Sheffield University at about 0.5 kilotons of TNT (best estimate) with a credible upper limit of 1.12 kilotons. A totally independent estimate [16] (based on seismic propagation instead of eye-witness footage) gives the same range, without specifying a “best” estimate. The popular measure of major explosions in “kilotons of TNT” has an agreed definition² of 1.162 GWh of released energy; in this paper we shall take “one Beirut” to be an explosive energy of 0.5 kilotons of TNT or about 580 MWh of released energy.

The projected BESS storage at Sunnica corresponds to 1.4 – 2.7 kilotons of TNT in total, across all three sites. In the “low” case, this would be “0.92 Beiruts” at the Sunnica West A site alone, or “2.7 Beiruts” over the whole scheme. In the “high” case “2.7 Beiruts” could be stored in the Sunnica East B site alone. Note that these are stored electrochemical energy only; the potential for conventional fire or explosion of evolved inflammables could be **up to 20 × larger** [11]. See Table 3, Appendix 1.

This is plainly a quantity of stored energy which, if released uncontrollably, could do major damage. Explosions and fires at individual BESS are matters of record. They can propagate from failure in a single cell out of many thousands. Cell-to-cell and module-to-module propagation occurred at McMicken. Rack-to-rack propagation was avoided, but could readily occur if continuous

² See e.g. Wikipedia.

fires start. Cabin-to-cabin propagation of a major BESS “battery fire” would be the critical link that would escalate major but manageable fires into catastrophes.

Yet this propagation route remains unanalysed. Significantly, Commissioner Sandra D Kennedy of the Arizona State Commission [3] reviewed reports on the 2019 McMicken battery fire and also a 2012 battery fire at the APS Eldon substation facility in Flagstaff, AZ. She quotes the Flagstaff fire department report on the latter incident as referencing :

“Fires with 10-15 feet flame lengths that grew into 50 - 75 feet flame lengths appearing to be fed by flammable liquids coming from the cabinets”.

Finally, in the context of BESS, “Stranded Energy” will remain a hazard at any affected BESS cabins even assuming an initial incident is controlled. The accident investigation at McMicken required nearly 3 months, simply to discharge “stranded energy” safely [8].

“Mega-scale” Li-ion BESS should, in all prudence, require the highest level of regulation. The COMAH regulations are designed for this, including establishments where dangerous substances may be generated “if control of the process is lost” [17] in a thermal runaway accident.

6. Applicability of the COMAH (Control of Major Accident Hazard) Regulations 2015

The governing criteria for application of the COMAH Regulations [17] are:

1. The presence of hazardous materials, or their generation, “if control of the process is lost.”
2. The quantity of such hazardous materials present or that could be potentially generated.

There is no doubt that hazardous substances such Hydrogen Fluoride (an Acute Toxic controlled by COMAH) would be generated in a BESS accident (i.e., in “battery fires”). Similarly highly Inflammable Gases (also controlled by COMAH) would be evolved even if the atmosphere remained oxygen-free. Depending on the size of the “establishment” these could be produced in sufficient quantities to be in the scope of COMAH. In Appendix 2 we estimate quantities guided by the literature, where fire tests have directly measured evolution of the hazardous gases.

For small capacity BESS installations, under 25 MWh capacity, the quantities (“inventory”) of the evolved hazardous substances might be outside COMAH. This paper however addresses the recent trend towards “mega-scale” Li-ion BESS (Table 2) with very large quantities of stored energy, where the inventory should be large enough to bring the installation within scope.

Broadly speaking, the threshold for applicability of COMAH will be dependent on the precise BESS technology chosen, but likely to be for BESS in the region of 20 – 50 MWh. See Appendix 2.

A letter to the HSE regarding applicability of COMAH to large-scale BESS (dated 25 Nov 2020 [18]) received no reply until follow-up letters were sent addressed personally to the Chief Executive on 7 February 2021, with the intervention of Mrs Lucy Frazer MP. The reply from the Chief Executive [19] dated 22 February 2021 stated that “*Li-ion batteries are considered articles and are not in scope of COMAH*”.

We believe the current attitude of the HSE – that even large-scale Li-ion BESS are “articles” best regulated by operators – is not consistent with the law.

Unless tested in the Courts however, this throws the entire responsibility for ensuring the safety of major BESS “battery fires” onto the Fire and Rescue Services. Currently the HSE makes no representation to the Planning Inspectorate in respect of BESS hazards.

7. Engineering standards for BESS

As with any hazard, the basic principles of Prevention and Mitigation must be applied to minimise the risk to life, property and the environment. A major contribution of the Hill/DNV report [8] is a review of current engineering and fire protection standards. This did not concern planning, siting and electrical standards, but simply addresses the question: which standards, if any, offer Prevention or Mitigation of the phenomenon of thermal runaway? The answer appears to be none.

“Thermal runaway” is an electrochemical reaction, well-known in Li-ion BESS, that is largely uncontrollable once started. Since failures in single cells (among many thousands) can be sufficient to initiate thermal runaway, the only known Prevention measure is that adopted by the BEV industry, viz. thermal isolation of neighbouring cells, so that if failure occurs in any one cell, insulation or water cooling prevents easy thermal spread to neighbouring cells. Various design strategies have been adopted in BEV Li-ion batteries, usually involving some form of thermal barrier.

However these are not widely used in grid-scale Li-ion BESS. Current practice is the assembly of stacks of cells, typically “pouch” cells which are externally flat polymer bags, that are stacked side by side in low profile modules with no thermal isolation. This is not the construction adopted in current generation BEV batteries; BEV practice (*with* thermal isolation) extended to grid-scale BESS would obviously increase costs and complexity considerably.

The engineering standards reviewed by Hill/DNV [8] included NFPA 855, UL 1973 and UL 9540/9540A. UL 9540A is a US standard that is widely used in grid-scale BESS engineering, is routinely recommended by insurance and risk consultants [20] and was appealed to by the developer of the Cleve Hill solar farm (Table 2). The problem is that UL9540A is fundamentally a test procedure. It mandates no design features. It requires absolutely nothing that would prevent thermal runaway in any BESS design. This means that an operator can say truthfully that a given BESS is “fully compliant” with UL9540A, yet this would provide no assurances at all regarding thermal runaway prevention. It is therefore wholly insufficient as a safeguard to either the operator, the public, or to emergency services.

NFPA 855 [21], uniquely, requires evaluation of thermal runaway in a single module, array or unit and recognises the need for thermal runaway protection. However, it assigns that role, with complete futility, to the Battery Management System (BMS). Thermal runaway is an electrochemical reaction which once started cannot be stopped electrically. It is uncontrollable by electronics or switchgear. A BMS can locate faults, report and trigger alarms, but it cannot stop thermal runaway.

The Hill/DNV report [8] highlights the many shortcomings of existing standards, see Appendix 4. The basic issue is simple:

- (1) Thermal Runaway has very few means of Mitigation once started.
- (2) It is therefore essential to address Prevention as a priority.
- (3) ***No current engineering or industry standards require the Prevention of thermal runaway events by thermal isolation barriers.***

Nothing in existing standards prevents runaway incidents happening again, requiring for initiation only single-cell failures from known common defects in cell manufacture.

8. Fire Safety Planning for BESS “fires”

Taking the recent Sunnica BESS proposal as an example, a joint statutory consultation response has been submitted by the four Local Authorities concerned. The Local Authorities in this case are Cambridgeshire and Suffolk County Councils, and West Suffolk and East Cambridgeshire District Councils. This joint consultation response [22] included a section on Battery Safety (pp 74-75) and states as follows:

Suffolk Fire and Rescue Service (SFRS) will work and engage with the developer as this project develops to ensure it complies with the statutory responsibilities that we enforce.

Sunnica should produce a risk reduction strategy as the responsible person for the scheme as stated in the Regulatory Reform (Fire Safety) Order 2005. It is expected that safety measures and risk mitigation is developed in collaboration with services across both counties.

The response also later states: *As with all new and emerging practices within UK industry, the SFRS would like to work with the developers to better understand any risks that may be posed and develop strategies and procedures to mitigate these risks.*

It is clear that local Fire and Rescue Services have been given the lead responsibility for independent emergency planning, in concert with the developers. Because of the attitude of the HSE refusing to exercise regulatory control over BESS safety, local Fire and Rescue Services become the sole independent public body able to influence BESS safety issues at the planning stage.

Many detailed recommendations have been made by the Local Authorities in the case of Sunnica. It is unclear how much opportunity or input Suffolk FRS has had in these. However the recommendations offered betray some serious misunderstandings and a complete lack of awareness of the lessons and recommendations made in publicly available documents such as the Hill/DNV report [8] into the McMicken explosion.

These are taken point by point in Appendix 4 but some general points are made here.

1. Thermal runaway cannot be controlled like a regular (air-fuel) fire. The only way to mitigate “re-ignition” (a regular report of eye-witnesses) is by thorough cooling. Water is the only fire-fighting material with the necessary thermal capacity. Sprinkler systems, though with good records in conventional building fires, are likely to be completely inadequate. The purpose of the water is absorbing a colossal release of energy. The Hill/DNV report [8] called for so-called “dry pipe” systems allowing first responders to connect very large water sources to the interior without having to access the interior.

It is critical to appreciate that all parts of the battery system must be cooled down. Playing water on a battery “fire” may cool the surface, but so long as Li-ion cells deep inside the battery remain above about 150°C, “re-ignition” events will continue. It is not sufficient to estimate water requirements on the basis of calculations assuming water reaches everywhere, uniformly.

For example, in the recent Tesla car fire [2] the BEV battery kept re-igniting, took 4 hours to bring under control and used 30,000 (US) gallons of water (115 m³). This was for a 100 kWh BEV battery, designed with inter-cell thermal isolation barriers.

In the case of Sunnica, the Local Authorities have suggested that water supplies of 1900 litres per minute for 2 hours (228 m³) will be needed [22]. But this is grossly inadequate. Using the above Tesla BEV fire experience, this amount of water would suffice for just **two** Tesla Model S car fires. Scaling this up to even the smallest 2 MWh BESS (such as that in McMicken [8]), which contains

stored energy equivalent to **twenty** Tesla Model S cars, it is clear to see that a much greater amount of water would be needed.

The actual amount of water required will depend on the energy storage capacity per cabin which, in the case of Sunnica, is still unstated. Some simple estimates are, however, made below. **The requirements suggested to date by the Local Authorities for the Sunnica installation are completely inadequate and, if not addressed, would leave Suffolk FRS without the means to control a major BESS “fire”.**

Taking a storage capacity of 10 MWh in just one of the Sunnica cabins (see Appendix 1), a complete thermal runaway accident in such a BESS would release that stored electrochemical energy, plus an indeterminate quantity of heat from combustion of hydrocarbon polymer materials or inflammable gases evolved from them. Such Total Heat Release may be up to twenty times the amount of the stored electrochemical energy in the BESS [11].

The thermal capacity of water is $4.2 \text{ kJ kg}^{-1} \text{ K}^{-1}$ or in kWh terms, about $1.17 \text{ kWh m}^{-3} \text{ K}^{-1}$. If heated from 25 °C to boiling point about 87.8 kWh m^{-3} of thermal energy is required.

Hence the water volume required to absorb 10 MWh of released energy without boiling is about 114 m^3 or 30,000 US gallons, the same amount as required in practice to control a fire in a single Tesla Model S car with a mere 100 kWh battery, 100 times smaller than a 10 MWh BESS.

The quantity suggested by the Local Authorities’ joint response is 228 m^3 (1900 L min^{-1} for 2 hours), twice the above estimate, which would naively be sufficient for a 20 MWh BESS fire. **However, from the experience of recent BEV fires, it could be insufficient by a factor of 100.**

No such calculations were presented in the Examination of the 700MWh Cleve Hill BESS [6].

2. “Clean agent” fire suppression systems are a common fire suppression system in BESS, but are **totally ineffective** to stop “thermal runaway” accidents. The McMicken explosion was an object lesson in this: the installed “clean agent” system operated correctly, as designed, on detection of a hot fault in the cabin [8]. There was no malfunction in the fire suppression system. But it was completely useless because the problem was not a conventional fuel-air fire, it was a thermal runaway event. Only water will serve in thermal runaway.

Indeed in the McMicken explosion the “Novec 1230” clean agent arguably contributed to the explosion by creating a stratified atmosphere with an air/Novec 1230 mixture at the bottom and inflammable gases accumulating at the cabin top.

The most probable cause of the explosion was mixing caused by the opening of the door by first responders. The explosive mixture contacted hot surfaces and ignited [8].

3. A further recommendation of the Hill/DNV report [8] into the McMicken explosion is for a means of **controlled venting** of inflammable gases **before** first responders attempt access. In the Local Authority response to the Sunnica consultation, ventilation is listed as a BESS requirement [22] but the reason given, bizarrely, is “to control the temperature” – at which ventilation or air-conditioning (also listed) would be totally ineffective, lacking any significant thermal capacity.

The critical reason for controlled ventilation is the removal of inflammable gases **before** an explosive mixture forms. Deflagration panels (to decrease the pressure of explosions that do occur) are also recommended.

It should be noted that although controlled venting provisions would mitigate the consequence of inflammable gas evolution, they would also require simultaneous venting of Hydrogen Fluoride that would be evolved concomitantly.

Toxic gas hazard would continue to present a risk to the community and the environment for the duration of the incident. Fire-water will be contaminated with, *inter alia*, highly corrosive Hydrofluoric Acid. Contamination of water supplies and waterways **must** be prevented.

It is strongly recommended that Fire Services study the Hill/DNV report [8], and the related Underwriters Labs report [9], act upon their recommendations, and make realistic, physics-based, calculations of the water quantities required to be available at every single BESS cabin. There could be as many as 150 BESS cabins at the Sunnica East B site alone – see Appendix 1; each of these would need a sufficient water supply.

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Appendix 1: Battery Capacity Calculations for the Grid-scale BESS proposed at the “Sunnica” site.

The Sunnica scheme will be taken as an example of a “mega-scale” solar plant with BESS. If approved, it would cover approximately 2800 acres and will include BESS on 3 separate sites.

The proposed BESS capacity in the Sunnica scheme has not been specified. Estimates of storage capacity can be made on the basis of the land areas allocated to the BESS compounds, assuming full use (per meeting with Parish Councillors, 30 October 2020 [23]). Li-ion battery technology has also been assumed because it is the most widely used in the industry today. Li-ion batteries have a high energy density, and the costs of these have fallen significantly over the past few years [24].

Land areas and cabin size are quoted in the Sunnica Scheme Description as:

Sunnica East A:	5.23 ha
Sunnica East B:	15.6 ha
Sunnica West A:	10.65 ha
Total:	31.48 hectares.

One storage cabin size is 15 m length × 5 m width × 6 m height. This height is *double* that of a so-called “hi-cube” shipping container and has a larger footprint (75 m² vs 30 m² for a standard 40-foot shipping container).

Storage capacity can be estimated based on other BESS and storage cabin volumes:

Single cabin energy storage capacity:

The McMicken, Arizona, Li-ion BESS was a single cabin, footprint of 60 m² and ‘shipping container’ height. The Sunnica BESS cabins are 75 m², with ‘double shipping container’ height (6 m). Energy storage at McMicken was 2 MWh.

Scaling by footprint and height yields a *single cabin* energy storage capacity estimate of 5 MWh for each of the “Sunnica” BESS cabins.

The Arizona cabin had empty space for expansion racks, so a larger single cabin energy storage capacity, up to say 10 MWh, is entirely conceivable.

Density of BESS cabins on allocated land:

This is unstated by Sunnica. We assume that 7.5% of the allocated land area will be occupied by the BESS cabins themselves (this allows for safety separations, fire access routes, Battery Management Systems (BMS) and other electrical plant, bunding for firewater in the event of incidents). This implies a total of 315 BESS cabins allocated over the three sites.

Total scheme storage capacity:

5 MWh (single cabin capacity) × 315 cabins yields a total energy storage capacity of **1575 MWh** (or 1.574 GWh), distributed over 3 separate battery compounds of unequal size (31.48 ha total). If the single cabin capacity were 10 MWh, the total doubles to **3150 MWh**.

A storage capacity between 1500 – 3000 MWh is therefore credible for the Sunnica proposal, depending on single cabin storage and the density of cabins on the land.

The area density of storage at this cabin density would be 50 MWh ha⁻¹ for a single-cabin storage of 5 MWh. This figure of 50 MWh ha⁻¹ is independent of the total area allocated; it depends only on the assumed fraction (7.5%) occupied.

For comparison, the corresponding density at Cleve Hill [3] is a very similar 69.2 MWh ha⁻¹.

The Energy Institute [25] gives 100 MWh ha⁻¹ as ‘typical’ for Li-ion BESS planning. This density would be reached in our assumptions if the single cabin capacity were 10 MWh. The latter figure is entirely conceivable because the “base estimate” derives from an incompletely populated cabin. It is also readily achievable if the spacing of cabins is closer than implied by the assumption of 7.5% land occupancy.

The “base case” estimate of 315 cabins and 1574 MWh is an overestimate *only if* the project does *not* fully occupy the allocated land (i.e. BESS cabin density is less than the 7.5% assumed), but this would be contrary to advice from the developer in meetings with local Councillors.

It is also an overestimate if the single cabin storage capacity is less than 5 MWh. This is unlikely because it is estimated from a BESS cabin still incompletely populated.

These estimates are summarised in the following Table.

Table 3. Estimates of electrical stored energy under various assumptions at Sunnica.
 Note: “1 kiloton TNT” is equivalent to 1.163 GWh. “One Beirut” is equivalent to 580 MWh.

Compound	Area	No. of cabins at area density of 7.5%	Energy storage capacity		Comments
(Single cabin) (per cabin land)	75 m ² 1000 m ²	1	5 MWh	10 MWh	Per cabin assumptions
Sunnica East A	5.23 ha	52	260 MWh	520 MWh	Per compound estimates of stored energy
Sunnica East B	15.6 ha	156	780 MWh	1560 MWh	
Sunnica West A	10.7 ha	107	535 MWh	1070 MWh	
Whole Scheme	31.5 ha	315	1575 MWh 1.575 GWh 1.36 kilotons 2.72 “Beiruts”	3150 MWh 3.150 GWh 2.71 kilotons 5.44 “Beiruts”	Stored electrochemical energy only. Does not include chemical energy from inflammables.

Appendix 2: Applicability of the COMAH Regulations to large-scale BESS

The COMAH regulations (2015): COMAH regulates establishments with quantities of dangerous substances (categorised as toxic, flammable or environmentally damaging) that are present above defined thresholds. The substances do not need to be present in normal operation. If dangerous substances could be generated “if control of the process is lost”, the likely quantity generated thereby must be considered. If the mass of dangerous substances that could be generated in loss of control exceeds the COMAH thresholds, the Regulations apply.

There are two “tiers” to COMAH, the “upper tier” imposing more stringent controls. Thresholds of hazardous substances are listed with thresholds for both tiers.

The regulations specify aggregation rules when more than one substance in a hazard category (e.g. flammables) may be present; even if all such substance are below the COMAH thresholds, others in the same hazard category must be quantified and the proportions of the threshold aggregated. If the total exceeds one, the establishment is subject to COMAH. It is also clear that the inventories of all “installations” – including pipework – must be considered as a whole.

Extracts from COMAH Regulations [26] 2(1) (definitions):

“establishment” means the whole location under the control of an operator where a dangerous substance is present in one or more installations, including common or related infrastructures or activities, in a quantity equal to or in excess of the quantity listed in the entry for that substance in column 2 of Part 1 or in column 2 of Part 2 of Schedule 1, where applicable using the rule laid down in note 4 in Part 3 of that Schedule;

“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;

Application to grid-scale BESS: The Regulations refer to “a dangerous substance which it is reasonable to foresee may be generated during loss of control of the processes”. Both Flammable Gases (P2) and Acute Toxic (H1 and H2) are certainly “reasonable to foresee” in thermal runaway incidents which are now well-documented. The evolution of regulated, named and categorised hazardous substances from Li-ion battery cells in thermal runaway is also well-documented. A “worst credible accident” would have to consider that the entire inventory of Li-ion cells would be destroyed in a single BESS cabin at least. Cabin-to-cabin propagation should also be considered.

The Regulations apply to the entire “establishment”, controlled by a single operator. Whilst the individual BESS compounds at Sunnica might be regarded as separate establishments, it is less reasonable that individual BESS cabins should be regarded as separate “establishments”. They are separate “installations” but “establishment” means the entire area under control of an “operator”.

Only if the most stringent safeguards were in place to ensure that the disastrous consequences of cabin-to-cabin propagation of “battery fires” could not conceivably occur, could it be argued that dangerous substances, exceeding the COMAH thresholds in quantity, were not “reasonable to foresee [being] generated during loss of control of the process”.

We believe the COMAH regulations apply to BESS and that the approach of HSE is wrong in law.

Dangerous substances “reasonable to foresee ... generated during loss of control of the processes”: The literature and known experience of BESS accidents is clear that dangerous

substances in the hazard categories H1 and H2 (Acute Toxic) and P2 (Flammable Gases) are foreseeable in the event of thermal runaway accidents. One of the Flammable Gases is Hydrogen, which is a “Named Dangerous Substance” in Part 2 of Schedule 1 of the COMAH Regulations 2015. Lower thresholds are specified for Hydrogen than for other P2 Inflammable Gases.

It remains therefore to consider the quantities of dangerous substances which could be generated if “control of the process is lost” in a thermal runaway incident. Published literature sources quantify evolution of flammable gases from tests of various Li-ion cells in sealed vessels. Open “fire tests” quantify the evolution of toxic gases particularly Hydrogen Fluoride. Many other test results exist in the records of specialist test laboratories, but here we rely upon two primary published sources.

Golubkov *et al.* (2014) [13] report quantities of evolved inflammables from Li-ion cells of three different electrode chemistries in thermal runaway situations. The proportion of Hydrogen (H₂), Methane (CH₄), Ethylene (C₂H₄) and Carbon Monoxide (CO) does not in fact vary greatly between different types of Li-ion cell, reflecting an underlying inventory of hydro-carbon material (plastics, electrolyte solvents etc) that remain similar in all Li-ion technologies. This is consistent with DNV/GL test data cited in the Hill/DNV report [8]. The quantitative estimates here are taken from results derived from cells with Nickel-Manganese-Cobalt (NMC) electrodes, as used in the McMicken BESS. It was not possible in the apparatus of Golubkov *et al.* to determine the concentrations of HF evolved.

Larsson *et al.* [11] report evolved quantities of Hydrogen Fluoride (HF) from Li-ion cells in open “fire tests”, and also the Total Heat Released (THR) from combustion of the inflammables. Again these vary between cell technologies and “form factors”, especially whether the cells have an outer metal canister or are in the “pouch” format. Quantities between 20 – 200 mg / Wh are reported. The worst case figure is used in the following estimates; the lowest evolution reported for “pouch” cells was 43 mg/Wh.

Both sources report evolved gas quantities on a per Wh basis. We scale these to a Li-ion BESS cell size on the basis of stored energy since this will be roughly proportional to the electrolyte solvents and other polymer materials in the cell. Scaling on a per mass basis would be preferable, but this would require further information on the exact composition of the cells in the literature tests, and indeed those for the BESS in question. During the McMicken investigation, the cell manufacturers refused to release such data.

H1 and H2 Acute Toxics. The applicability of COMAH is easiest to determine in respect of Hydrogen Fluoride (HF). This has a dual hazard classification [12] as H1 Acute Toxic (skin exposure) and H2 Acute Toxic (inhalation) and both exposure routes would apply to the general public nearby. The lower tier COMAH threshold for H1 Acute Toxics is 5 tonnes [27]; using the upper estimate of 200 mg/Wh from Larsson, the BESS capacity at which a BESS enters the scope of COMAH (lower tier) is 25 MWh.

This is far below the projected storage capacities given in Table 3 (Appendix 1). With high storage capacity cabins (of e.g. 12.5 MWh), it would require propagation of a fire from just one cabin to a second, to generate HF above the COMAH threshold. It is not necessary to foresee a major conflagration involving multiple cabin-to-cabin propagation to bring the establishment within scope of COMAH; just two cabins would suffice. If 25 MWh were stored in a single large cabin, the question of cabin-to-cabin propagation is irrelevant.

The upper tier for “H1 Acute Toxic” is entered at four times higher capacity (100 MWh), which is well below the estimated capacity of Cleve Hill, and is also below *each* of the three Sunnica BESS compounds individually.

Even on the lowest evolution figure of 43 mg/Wh reported by Larsson *et al.* for “pouch” cells, the lower tier of COMAH is entered at a storage capacity of 120 MWh, again well within the “low case” capacity of each of the Sunnica BESS compounds, and Cleve Hill.

There is little doubt that either the lower or upper tier of COMAH is applicable to Cleve Hill and all three of the Sunnica BESS compounds, on the basis of “H1 Acute Toxic” (HF, skin route) alone.

Carbon Monoxide (CO) is categorised as an H2 Acute Toxic as well as a P2 Inflammable Gas, and will also be evolved, but in application of the aggregation rule its presence does not materially alter these conclusions. It is sufficient to consider HF alone.

P2 Inflammable Gases. Assessing applicability of COMAH on the basis of inflammable gases is more complicated because of the evolution of Hydrogen (H₂), Methane (CH₄), Ethylene (C₂H₄) and Carbon Monoxide (CO) in significant quantities, and because Hydrogen is a “named dangerous substance” for which different COMAH thresholds apply. These must be taken into account when applying the Aggregation Rule. Although proportions are generally similar, quantities do depend on the different electrode chemistries in the different Li-ion cell types.

Taking the largest evolutions reported by Golubkov *et al.* [13] for the LCO/NMC electrode type tested by them these are equivalent to 335 mg/Wh of P2 inflammables. For the NMC cells tested (the McMicken cells were NMC) the evolution was 214 mg/Wh. Taking the higher figure and applying the aggregation rule, grid-scale BESS enter the lower tier of COMAH at about 30 MWh capacity. Taking the lower figure, they enter the lower tier at 45 MWh capacity.

Hence there is little doubt that grid-scale BESS are lower tier COMAH establishments on the basis of “P2 Inflammable Gases” at storage capacities between 30 – 45 MWh.

Because of the variability between cell types, and the difficulty of scaling laboratory tests to actual BESS cells without detailed composition data, there is room for adjustment. However the calculated estimates of the thresholds for applicability of COMAH are so far below the projected capacities that it is inconceivable that the Cleve Hill and Sunnica BESS compounds would *not* be COMAH establishments, in lower tier at the very least, and probably the upper tier also.

Conclusion: Grid-scale Li-ion BESS should be considered COMAH establishments in the lower tier on the basis of “H1 Acute Toxic” (HF) alone, at energy storage capacities in the region of **25 MWh**. Upper tier would apply at about **100 MWh**. They should be lower-tier COMAH establishments on the basis of “P2 inflammable gases” alone, at storage capacities between **30 – 45 MWh**. Again larger establishments could become upper tier COMAH. Laboratory closed vessel and fire tests on actual Li-ion BESS cells proposed to be deployed would be required to refine these estimates definitively.

It is difficult to see how these conclusions could be avoided if tested in litigation.

Appendix 3: Shortcomings of Existing Engineering Standards for Li-ion BESS

The July 2020 report for the Arizona Public Service by Dr D Hill [8] provides a comprehensive discussion of existing engineering standards relating to BESS, and how they are *inadequate* to address the known hazards of “thermal runaway” incidents in Li-ion BESS. This was the failure mode leading to the explosion at McMicken, Arizona.

Unfortunately, when the UK’s first “mega-scale” solar plant and battery storage site was granted approval in May 2020, this paper had not been published. The Cleve Hill solar developers cited one standard, UL 9540A [3]. This is also cited by some insurance and risk consultants [20].

It is important to be clear that nothing in UL 9540A addresses thermal runaway, and as a test method standard, it can provide no “safety certification” for Li-ion BESS.

Specific criticisms made in the Hill/DNV report include the following:

1. UL 1973 allows for the complete destruction of a BESS and the creation of an explosive atmosphere so long as no explosion or external flame is observed. An installation can do all these things but still “pass” UL 1973. At McMicken one rack was completely destroyed and an explosive atmosphere created but no flame or explosion occurred until first-responders opened the cabin door.
2. UL 9540A is merely a test method for generating data. It does not define any “pass/fail” criteria for interpreting results. Specifically, it does not address cell-to-cell cascading in thermal runaway, nor the evolution of a potentially explosive atmosphere. It does not even prescribe that the cell-to-cell cascading rate be measured. It allows that thermal runaway may proceed to an entire rack (as at McMicken) and offers testing of fire suppression systems (which operated correctly at McMicken but cannot prevent thermal runaway, and did not prevent an explosion). Presentation of data generated under UL 9540A to an “AHJ” (Authority Having Jurisdiction) does not translate to a succinct understanding of potential risks.
3. NFPA 855 [21] does require evaluation of thermal runaway in a single module, array or unit and does acknowledge the need for thermal runaway protection. However, it assigns that role to the Battery Management System (BMS). Yet thermal runaway is an electrochemical reaction that once started cannot be stopped electrically. It is uncontrollable by electronics or switchgear, only by water cooling.

The evolution of engineering and safety standards has not yet incorporated the lessons of experience arising from the McMicken explosion [8] or explosion incidents in the UK like the Liverpool explosion and fire of 15 September 2020 [1]. Compliance with existing standards does not prevent such incidents happening again.

Articles in the industry press³ do now recognise and discuss the problem of thermal runaway but make proposals such as: “*If off-gases can be detected and batteries shut down before thermal runaway can begin, it is possible that fire danger can be averted*”.

Such statements betray a dangerous misunderstanding. Batteries cannot be “shut down”, except by complete discharge, which cannot be done quickly. Taking cells “out of circuit” is useless; thermal breakdown and runaway will still occur.

³ <https://www.energy-storage.news/blogs/preventing-thermal-runaway-in-lithium-ion-energy-storage-systems>

Appendix 4 – Fire Safety Planning requirements in the Local Authorities' Joint Response to the Sunnica statutory consultation

This Appendix deals point by point with the BESS requirements in the Local Authority response (text in blue) pp 74 – 75.

Sunnica should produce a risk reduction strategy as the responsible person for the scheme as stated in the Regulatory Reform (Fire Safety) Order 2005. It is expected that safety measures and risk mitigation is developed in collaboration with services across both counties.

The Local Authorities require that the Fire Services work with Sunnica to prepare fire safety and risk mitigation measures. The Cambridgeshire and Suffolk Fire Services are therefore the only public bodies with independent oversight of BESS safety.

The use of batteries (including lithium-ion) as Energy Storage Systems (ESS) is a relatively new practice in the global renewable energy sector. As with all new and emerging practices within UK industry, the SFRS would like to work with the developers to better understand any risks that may be posed and develop strategies and procedures to mitigate these risks.

This paper is provided as input to this process, which appears to be insufficiently understood.

The promoter must ensure the risk of fire is minimised by:

- Procuring components and using construction techniques which comply with all relevant legislation.

This overlooks the points made in this paper that (i) existing legislation is being ignored by the statutory regulatory body, the HSE (ii) no adequate engineering standards exist to exercise Prevention measures over what is by now a very well-known hazard, viz. thermal runaway. Public Health and Safety cannot be assured whilst either of these situations continues.

- Developing an emergency response plan with both counties fire services to minimise the impact of an incident during construction, operation and decommissioning of the facility.
- Ensuring the BESS is located away from residential areas. Prevailing wind directions should be factored into the location of the BESS to minimise the impact of a fire involving lithium-ion batteries due to the toxic fumes produced.

This is impossible to satisfy. All the BESS compounds in the Sunnica proposal are sufficiently close to residential areas to present a major danger of toxic fumes in the event of an accident. Plume dispersal modelling should be performed to ensure that concentrations of HF cannot exceed dangerous thresholds in the event of the worst credible accident in a BESS compound.

- The emergency response plan should include details of the hazards associated with lithium-ion batteries, isolation of electrical sources to enable firefighting activities, measures to extinguish or cool batteries involved in fire, management of toxic or flammable gases, minimise the environmental impact of an incident, containment of fire water run-off, handling and responsibility for disposal of damaged batteries, establishment of regular onsite training exercises.

This requirement is very broad but insufficiently detailed. Means of cooling would require water volumes many times in excess of those requested. Management of inflammable gases is best addressed by venting, but that exacerbates the hazard of toxic gas plumes. Large water volumes may lead to unrealistic or impossible requirements for the containment, and subsequent disposal, of the contaminated water resulting from the fire-fighting activity. Other sections of this paper address these points.

- The emergency response plan should be maintained and regularly reviewed by Sunnica and any material changes notified to SFRS and CFRS.

- Environmental impact should include the prevention of ground contamination, water course pollution, and the release of toxic gases.

Preventing the release of toxic gases is all but impossible. A thermal runaway event WILL release toxic gases. If inflammables are vented to avoid /mitigate explosion risk, toxic gases WILL be vented. Ground contamination and water course pollution is almost certain to occur if sufficient water to control a major thermal runaway event is deployed. It will pose a significant challenge to contain, and safely dispose of, such large volumes of contaminated fire water.

The BESS facilities should be designed to provide:

- Automatic fire detection and suppression systems. Various types of suppression systems are available, but the Service's preferred system would be a water drenching system as fires involving Lithium-ion batteries have the potential for thermal runaway.

This is a correct precaution, but no specification is made of likely water volume requirements, nor for a "dry pipe" system allowing water to be deployed without cabin entry. We provide some water estimates elsewhere in this paper.

- Other systems, such as inert gas, would be less effective in preventing reignition.

This is also a correct insight. The so-called "clean-agent" fire suppression system at McMicken was triggered correctly, but was useless to control thermal runaway. Moreover the stratified atmosphere created allowed the build-up of inflammables to a dangerous level, before the explosion occurred.

- Redundancy in the design to provide multiple layers of protection.
- Design measures to contain and restrict the spread of fire through the use of fire-resistant materials, and adequate separation between elements of the BESS.

This comment only vaguely considers the true essentials. The "elements of the BESS" could be: cells, modules, racks, strings, and the entire system. As discussed in the Hill/DNV report what is required is for the industry as a whole to accept that thermal runaway in an unacceptable hazard, and demand engineering standards that Prevent thermal runaway by design, or if it occurs, Prevent its cascade or escalation to larger system elements. This requires

- a. Thermal barriers (i.e. Low thermal conductivity barriers, not merely refractory barriers, ideally with water cooling, between all cells, so that propagation from cell to cell cannot occur. This is precisely the requirement the industry has so far **NOT** made in the development of its engineering standards.
 - b. Separation of modules by similar barriers to Prevent module-to-module cascade.
 - c. Separation of Racks to prevent rack-to-rack cascade, even with ejection of molten metals.
 - d. Spacing of BESS cabins such that even with "75 foot flame lengths" cabin to cabin escalation is impossible. This is probably the most critical of all, since cabin-to-cabin escalation could turn a major fire incident into an unprecedented catastrophe, on the scale of the Beirut explosion or a small nuclear weapon.
- Provide adequate thermal barriers between switch gear and batteries,
 - Install adequate ventilation or an air conditioning system to control the temperature. Ventilation is important since batteries will continue to generate flammable gas as long as they are hot. Also, carbon monoxide will be generated until the batteries are completely cooled through to their core.

This comment is very strange. There is no possibility whatsoever that air conditioning could be adequate "to control the temperature". The importance of ventilation is however recognised, as is

the generation of carbon monoxide (toxic as well as inflammable). However the generation of Hydrogen Fluoride will also continue until the batteries are “completely cooled” and HF (H1 Acute Toxic by skin exposure) is much more toxic than CO (H2 Acute Toxic).

- Install a very early warning fire detection system, such as aspirating smoke detection.

The “very early warning” fire detection system required should be thermocouples to report continuously on the local temperature at every cell in the entire system. A single cell overheating can escalate via thermal runaway. By the time smoke is generated, this will be a “very late”, rather than “very early” detection system. Just as thermal runaway events do not necessarily generate flame, neither do they necessarily generate smoke, until nearby combustibles are ignited.

- Install carbon monoxide (CO) detection within the BESS containers.

This is a good straightforward measure, but detectors for other gases expected (HF, H₂, CH₄) could equally well serve and multiple gas detection would provide additional security.

- Install sprinkler protection within BESS containers. The sprinkler system should be designed to adequately contain and extinguish a fire.

The excellent record of sprinkler systems in ordinary building fires shows they would help contain fire in regular combustible parts of the structure. However as discussed earlier in this paper, a mere sprinkler system would be useless to contain thermal runaway. Much larger water quantities would be needed.

- Ensure that sufficient water is available for manual firefighting. An external fire hydrant should be located in close proximity of the BESS containers. The water supply should be able to provide a minimum of 1,900 l/min for at least 2 hours. Further hydrants should be strategically located across the development. These should be tested and regularly serviced by the operator.

As discussed elsewhere, we believe these water requirements to be **under-specified by a factor of 100**, based on real experience with BEV fires. “Strategic location” is inadequate. Every single BESS cabin (potentially up to 150 of these at Sunnica East B alone) should have such a hydrant.

We remark elsewhere on the recommendation made by Hill/DNV for a “dry pipe” system to deploy water drenching inside via external connections, without cabin entry being needed.

- A safe access route for fire appliances to manoeuvre within the site (including turning circles). An alternative access point and approach route should be provided and maintained to enable appliances to approach from an up wind direction. Please note that SFRS requires a minimum carrying capacity for hardstanding for pumping/high reach appliances of 15/26 tonnes, not 12.5 tonnes as detailed in the Building Regulations 2000 Approved Document B, 2006 Edition, due to the specification of our appliances.

The requirement for safe access routes and space for appliances to manoeuvre could usefully be expanded into requirements for safe spacing of BESS cabins and thermal or flame barriers between cabins, to Prevent the “disaster scenario” of cabin-to-cabin propagation.

Final Comment: (over)

Final Comment:

The fundamental failure mode of Li-ion batteries presenting major hazard is thermal runaway. This paper is far from the first to identify the risk which is now well-known.

However the BESS industry as a whole has still not agreed or implemented adequate engineering standards to address basic Prevention measures to pre-empt thermal runaway accidents.

Until it does, Mitigation of major accidents by the Fire Services will remain the sole recourse for public protection and safety.