

**Briefing document on employment at the
Culham Science Centre**

**Commissioned by *Save Culham Green Belt*,
a committee of the Culham Parish Council**

Collation page



For the attention of the Planning Inspector:

Opposition to South Oxfordshire Local Plan 2011–2034:

Briefing document on employment at the Culham Science Centre

I am a private individual and a resident of Culham in south Oxfordshire.

I have prepared this document in order to express my opposition to the Local Plan 2011–2034 that has been produced by South Oxfordshire District Council.

The document is an appraisal of the Culham Science Centre and the opportunities for employment that it might provide.

The document shows that the claim of ‘exceptional circumstances’ by the council in respect of the Culham Science Centre is false.

The document has been compiled from historical knowledge, public documents and official websites.

I have taken great care in the preparation of this document, and I believe that it is factually correct.

Peter Kirby

Document history:

This document was originally written in November 2017, in response to the October 2017 version of the Local Plan, LP2033.

The present document contains that original material, together with a new final section, in response to the January 2019 version of the Local Plan.

Note: in order that the integrity of the document is preserved, Sections 2–6 are unchanged from the November 2017 document. The new material is given in Section 7.

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Opposition to South Oxfordshire Local Plan 2011–2034:

Briefing document on employment at the Culham Science Centre

1 Introduction

This is an independent briefing document on employment at the Culham Science Centre.

The document has been written to register opposition to the plan by South Oxfordshire District Council (SODC) to build 3500 houses on green-belt land at Culham, Oxfordshire.

The applicable document is: South Oxfordshire Local Plan 2011–2034, Final Publication Version 2ND, January 2019.

1.1 Background

The relevant background information is:

1. SODC wishes to take 301 hectares of land out of the green belt at Culham, Oxfordshire
2. SODC wishes to build 3500 houses on 220 hectares of that land
3. SODC wishes to take the Culham Science Centre out of the green belt (73 hectares)
4. That construction of 3500 houses would create a new town near Abingdon

The political position is:

5. The formalities of the destruction of the green belt require that the plan is promoted in the context of ‘exceptional circumstances’
6. SODC’s primary vehicle for an attack on the green belt is the presence of the Culham Science Centre, which is adjacent to the proposed construction
7. Exaggerated claims about the importance of the Culham Science Centre and future employment are central to the ‘exceptional’ narrative

1.2 Purpose

The purpose of this document is to:

1. Give a factual account of the historical context
2. Set out the true position
3. Give a rebuttal of the rhetorical assertions of SODC

1.3 Clarification of intent

I should like to give this clarification of intent:

1. I worked at the Culham Science Centre (formerly Culham Laboratory) for many years and for different employers

2. I worked for the survival of Culham Laboratory when the UKAEA considered a plan in the early 1990s to leave the site
3. For these reasons, I have only goodwill towards the establishment itself

However, in the context of SODC's plan:

4. Employment at the Culham Science Centre has become a *political* issue
5. In particular, the existence of employment on this site is being used to justify the construction of several thousand houses on green-belt land
6. In that context, I believe that an examination of the scope of such employment is entirely reasonable
7. That *political* examination is the intention of this document
8. Absolutely no criticism of technical integrity, past or present, is implied

1.4 Crucial point

The overall crucial point that I wish to make is that:

1. Although the Culham Science Centre:
 - (a) has an unusual history
 - (b) demonstrably provides some employment, including:
 - (c) the receipt of some recent government funding
2. The Culham Science Centre:
 - (a) is small compared with the activities at Milton Park and the Harwell campus
 - (b) has a historical mission that is approaching the end of its natural life
 - (c) in no way provides a transcendent reason for the construction of a new town to provide local workers

The exposition below provides the evidence for this conclusion.

1.5 Personal details

My relevant personal details are:

1. I am a retired physicist
2. I have lived in Culham village since 1983
3. I worked at the Culham Science Centre (formerly Culham Laboratory) for the period 1978–2006
4. My employers were: UKAEA, AEA Technology plc and Cobham plc
5. I addressed the Full Council of SODC (35 councillors) in September 2017 about the present material, and was questioned on it

2 Historical context

The purpose of this section is to provide the historical context to the various entities that are central to the present discussion.

2.1 UKAEA

The United Kingdom Atomic Energy Authority (UKAEA) is the owner of the Culham Science Centre. The UKAEA has a complicated history:

1. It was created in 1954 in order to develop thermonuclear weapons (the 'H-bomb')
2. Its work extended to the development of civil nuclear power
3. It was a significant part of national infrastructure during this period
4. It undertook limited external commercial work from the mid 1960s

This historical position changed in the 1980s:

5. Margaret Thatcher moved to privatize the UK's electrical supply industry
6. The funding for the UKAEA was untenable in this new financial environment
7. UKAEA started to close its major nuclear research facilities

In addition, UKAEA adopted a commercial position:

8. UKAEA created the business 'AEA Technology' in 1989
9. AEA Technology was the trading name for those parts of its disparate collection of legacy technical work that might have a commercial future
10. Fusion was excluded from AEA Technology because it was wholly non-commercial

In later developments:

11. UKAEA considered a plan to leave Culham Laboratory for financial reasons, but was prevented by its commitments to JET (c. 1990)
12. AEA Technology was separated from the UKAEA and was floated on the London Stock Exchange in 1996 as AEA Technology plc (which ceased trading in 2012)
13. UKAEA sold its remaining nuclear work, except fusion, to Babcock International Group plc in 2009

The UKAEA's present position:

14. It is an 'executive non-departmental public body' under the Department for Business, Energy and Industrial Strategy
15. It is a residual body (twice over, from the disposals in 1996 and 2009) but has the fusion legacy for historical reasons
16. It cannot be considered to be national infrastructure except for the fusion legacy and its governmental obligations to JET
17. It is essentially a government-owned commercial landlord

SODC seeks to elevate the importance of UKAEA, in the context of the Culham Science Centre, and describes it as 'one of the major employers in southern Oxfordshire'. However:

18. The claim is not self-evident, and the basis for it is not given
19. SODC could rightly claim that the most prestigious single source of scientific funding in southern Oxfordshire is the Wellcome Trust
20. That organization is a major contributor to the *Diamond Light Source*
21. However, Diamond is on the Harwell campus, not at Culham, and that fact does not fit the 'exceptional' narrative

2.2 Fusion

The main activity at the Culham Science Centre is fusion research. The word ‘fusion’ is used here to mean ‘controlled thermonuclear fusion’. The subject has a long history:

1. Fusion attempts to exploit certain nuclear reactions in light elements for civil energy production
2. The nuclear reactions are the same as those used in the H-bomb
3. The subject was considered during the 1930s and 1940s, and experiments started in the 1950s in various places around the world
4. Fusion experiments, in decreasing numbers but of growing complexity and cost, have continued to the present time
5. After about seventy years of research, the subject remains a speculative scientific exercise with no practical outcome

Little practical progress has been made because:

6. The subject remains at, or possibly beyond, the boundaries of human ingenuity
7. The goal may not be physically achievable
8. The science dictates that the experimental devices are large and highly engineered, so that the costs are huge (indicative: £1–10 billion)
9. For the same reason, the time-scales are long (indicative: 10–30 years)
10. The material properties that may be needed for a practical fusion reactor might not exist in our physical world (and this aspect is still largely unknown)
11. For these reasons, there is an old, well-known saying: ‘fusion is thirty years in the future—and always will be’

A simple measure of progress in fusion research was provided by Baron Marshall of Goring. He was chairman of the UKAEA (1981) and chairman of the Central Electricity Generating Board (1982–89):

12. Marshall suggested† three stages of achievement:
 - (a) show a nett energy gain from the nuclear fuel alone
 - (b) show a nett energy gain from the whole system
 - (c) show an economic gain
 - (d) †House of Lords, Select Committee, Science and Technology 2nd report, 1988/89
13. No experiment in the world has yet achieved even the first stage

International collaboration is the only way in which the cost of the larger fusion experiments can be supported:

14. The importance of European funding was recognized in Culham Laboratory in 1970
15. The UK joined Euratom in 1973 and received 44% funding for some experiments
16. The House of Lords report, *ibid.*, stated that: ‘Fusion was unanimously seen as entirely impractical except by means of an international collaboration’
17. International collaboration was essential for JET and the future experiment ITER (under construction in France)

The clear conclusion is:

18. Any future UK fusion programme of comparable significance is inconceivable

2.3 Culham Science Centre

Culham Science Centre (formerly Culham Laboratory) is a central part of SODC's claim of 'exceptional' opportunities and is its chosen vehicle for an attack on the green belt. It has a varied history:

1. Culham Laboratory was built (1960–65) as an establishment for the UK national fusion research programme
2. The site is on land that was occupied by *HMS Hornbill*, a Royal Naval Air Station
3. The main buildings are characteristic because they are all interconnected by wide corridors, as in a hospital
4. Experimental fusion work started in 1961 (during site construction)
5. Some non-fusion commercial work started in the early 1970s, after a governmental review imposed funding cuts

In subsequent developments:

6. Culham Laboratory was chosen in 1977 as the site for the JET project
7. UKAEA considered a plan to leave Culham Laboratory for financial reasons, but was prevented by its commitments to JET (c. 1990)
8. Culham Laboratory was renamed Culham Science Centre in the mid 1990s

In the history of the UK national fusion programme to the present day:

9. A great range of experimental devices were built
10. The programme created a total of 32 major and 22 minor experimental devices over 56 years
11. All the experiments were about basic science, and they did not begin to address the stages of achievement in Section 2.2
12. The overall expenditure of this programme was of order £1 billion

Various types of non-fusion employment have existed on the site:

13. AEA Technology plc had a large presence until the late 1990s
14. Much of the site was then occupied by forensic science companies (early 2000s)
15. The forensic science companies did not remain, and any chance of a consolidation into a forensic science centre was lost
16. The site has never been adopted by any large external commercial organization
17. The typical commercial work comprises only small businesses
18. These businesses are *tenants* of the UKAEA, not spin-off enterprises

The Culham Science Centre also houses the headquarters of the Civil Nuclear Constabulary:

19. The police headquarters moved from Harwell in the mid 1990s
20. Although this is an important organization, it is not science and technology

The Culham Science Centre is not necessarily an attractive business proposition:

21. The buildings are old and their interconnection raises issues of access and security
22. In the mid 2000s, some tenants spoke openly of their plans to move to Milton Park

23. There have been some notable relocations:
 - (a) *Culham Lightning* (the oldest non-fusion work at Culham) moved to Abingdon
 - (b) *Tokamak Energy* moved to Milton Park
 - (c) *Reaction Engines* will have purpose-built facilities in the new National Satellite Testing Facility on the Harwell campus
24. Advertising boards offering office and laboratory space to let were a long-term feature at the site entrance until recently

The UKAEA is pursuing a diversification project at the Culham Science Centre. It started the project RACE (Remote Applications in Challenging Environments) in 2014:

25. The purpose is to exploit the operational knowledge gained in JET (about the use of a mechanical arm for remote maintenance) for use in ITER
26. However, the project has been diversified to include support for various consortia for research into autonomous vehicles
27. This work is entirely unrelated to fusion
28. Further discussion of this topic is given in Section 4.6, p. 25

SODC is extremely supportive of the UKAEA in the present planning process. However, this positive relationship may be new-found:

29. During the 1990s, the UKAEA wished to replace the old buildings at the Culham Science Centre (built to inferior, 1960s standards)
30. SODC resolutely rejected the idea of new buildings

The Culham Science Centre's present position:

31. The site provides accommodation for 2000 employees overall
32. The UK national fusion programme has one remaining experimental device, MAST
33. MAST is an experiment in basic science, and it does not begin to address the stages of achievement in Section 2.2
34. The fusion staff are now condensed into a single division
35. The fusion staff are concerned about their jobs because of Brexit and specifically the UK's uncertain position in Euratom (and staff have left)
36. The RACE project has been diversified to pursue research into autonomous vehicles

SODC seeks to elevate the importance of the Culham Science Centre, and describes it as 'the leading UK centre for fusion research and technology and is of international importance'.

37. However, the statement is merely tautologous rhetoric, because:
38. Culham Science Centre, as Culham Laboratory, was created specifically to be the UK centre for fusion research
39. It maintained this position because of large government funding (of order £1 billion cumulative)
40. Only JET is of international importance, but it is approaching the end of its life (current funding to 2018 only), and its importance has diminished

The international focus is demonstrably moving away from Culham because:

41. The description 'of international importance' now belongs to the successor machine, ITER
42. ITER is under construction at St-Paul-lez-Durance in France, not at Culham
43. Culham Science Centre has chosen to diversify away from fusion

2.4 JET

1. JET is the *Joint European Torus*
2. The JET project came from the desire in the 1970s for large-scale fusion research
3. European collaboration was essential because of the large cost (of order £1 billion)

The choice of site was a huge problem; disagreement almost killed the project after the design phase. The difficulty disappeared in an unexpected way:

4. Culham Laboratory was chosen as the JET site in 1977, for extraordinary reasons
5. The choice was a political gift to the UK from Germany (for assistance in response to an aircraft hijack) and was contrary to the technical ranking of Culham Laboratory

Planning permission for JET was granted subject to limitations:

6. Permission was granted on condition that the land used for JET would be returned to a green field at the end of the project
7. This temporary permission was recently relaxed for some of the JET buildings
8. However, temporary permission remains for the torus hall (the largest building)

The torus hall is unique:

9. It is a huge structure and is hardened to prevent the escape of nuclear radiation
10. Indicative data: 3 metre thick base, 2.8 metre thick walls, 5000 tonne roof
11. If the torus hall is used for some other project after JET, significant planning and (nuclear) regulatory issues may arise
12. LP2033 does not address this difficulty, although it is certainly within the time-frame of the document

JET has been a successful experiment in basic science:

13. JET operations started in 1983
14. A notable scientific result was obtained in 1997 (demonstration of nuclear reactions)
15. The result did not reach Marshall's first stage of achievement (Section 2.2) and the conditions lasted for only one second approximately

The management framework of JET changed over time:

16. The original legal framework was defined in 1978 (*JET Joint Undertaking*)
17. The framework was changed to the *European Fusion Development Agreement* (c. 2000)
18. This agreement changed subsequently to *EUROfusion*
19. JET is currently managed by the UKAEA on behalf of EUROfusion

The funding for JET is a crucial issue:

20. JET is funded mainly by Euratom
21. JET will come to the end of its current funding at the end of 2018
22. The European Union is considering an extension to JET funding from 2018 to 2020

JET is now subject to significant political uncertainty because of the UK's decision to leave the European Union:

23. The UK will leave the EU in 2019
24. A legal consequence is that the UK will also leave Euratom in 2019
25. These changes are damaging to JET because of the legal and financial ramifications
26. The movement of European technical staff will be made more difficult
27. There is speculation that the UK could remain in Euratom, but the wider negative impact of Brexit cannot be avoided

The present position of the UK government:

28. The *Department for Exiting the European Union* has issued a paper: ‘Collaboration on science and innovation, A FUTURE PARTNERSHIP PAPER’ (6 Sep 2017)
29. In respect of JET, the document states (in summary) that:
 - (a) the EU decision to extend JET funding from 2018 to 2020 is pending
 - (b) if that EU funding is agreed, the UK will pay its share of those costs after Brexit

The clear conclusion is:

30. This short time-scale (to 2020 only) shows that the life of JET is likely to be severely limited

2.5 ITER

1. ITER is the successor machine to JET
2. The machine comes from a suggestion in 1985 that fusion research would be suitable for a wide collaborative project between industrial nations
3. The project partners are China, the EU, India, Japan, Korea, Russia and the USA

The machine is a remarkable undertaking:

4. ITER is roughly twice the linear size of JET
5. The intention is to attain Marshall’s first stage of achievement (Section 2.2)
6. The cost of ITER cannot be expressed accurately in a single currency, but an indicative figure is €17 billion

The current state of development:

7. The project encountered significant delays but is now under construction in France
8. Operation of the machine is planned to start at the end of 2025
9. Experiments to obtain nuclear reactions are planned to start in 2035
10. ITER is now the international focus for fusion research, and will be for decades

2.6 DEMO

1. DEMO is a programmatic designation rather than a specific project
2. It refers to a hypothetical machine that would be the appropriate next step if ITER is successful
3. Such a machine would be used to address Marshall’s second stage of achievement
4. DEMO is not significant for present purposes because the likely time-frame is so distant (towards the end of this century, or possibly never)

2.7 MAST

1. MAST is the machine that constitutes the UK's national fusion research effort
2. It is an experiment in basic science
3. It is the successor to the prototype called START (1987–1998)

MAST has a long history:

4. MAST was proposed in 1993
5. It operated first in 1998 but suffered a major electrical failure
6. It restarted operation at the end of 1999
7. MAST is small compared with JET (8% by volume)

An important strategic point is that:

8. MAST is identical to JET (and ITER) in its fundamental operation
9. Its purpose is to investigate a question of basic physics whether a change of relative dimensions can give a certain improvement in performance
10. This research relates to Marshall's second stage of achievement, and can have an impact only in the longer time-frame (DEMO, Section 2.6)

MAST continues with a lengthy upgrade:

11. Approval for a £30 million upgrade was given in 2010
12. The completion of the upgrade was expected in 2015
13. Operation is now expected in 2018, after considerable delays
14. Two subsequent upgrades are planned, but are not funded

The funding of UK fusion research changed:

15. UKAEA was the historical funding body (subsequently with Euratom)
16. The current main funding body is the *Engineering and Physical Sciences Research Council* (EPSRC)

This change of funding, to the higher-education system, has given a change of emphasis in the fusion programme:

17. The historical programme was focused (at least notionally) on a directed development of nuclear power for practical purposes
18. MAST is now offered to scientific collaborators in the UK and from overseas:
 - (a) external staff will be able to conduct their own technical studies
 - (b) they may develop equipment for the upgrade
 - (c) MAST will be operated as a 'user facility'
 - (d) MAST will be available for use by universities and other laboratories
19. The involvement of the higher-education sector has clearly changed the focus to an academic purpose

3 Local business and science parks

This section gives a brief description of business and science parks that are local to the Culham Science Centre. The information allows an informed comparison to be made about employment prospects in the area.

3.1 Milton Park

Milton Park is a notable business park in south Oxfordshire:

1. Milton Park is a major enterprise of the area
2. It accommodates a wide range of businesses (small, medium and large), including many in science and technology
3. It has excellent transport links because it is very close to:
 - (a) the A34 (at Milton roundabout, junction with A4130)
 - (b) Didcot Parkway railway station
4. It provides many facilities for the site's occupants

The following items are noteworthy:

5. Culham Science Centre is nearby; approximate distances are:
 - (a) 7 km (shortest route)
 - (b) 14 km (via A34, Abingdon and A415)
6. South Oxfordshire District Council is currently at Milton Park

From the Milton Park website:

7. The site is recognized around the world
8. The site provides accommodation for 250 businesses and over 9000 employees
9. These businesses operate in a wide range of sectors
10. Indicative business activities are: physical and biological sciences, technology, medical, forensic science, energy, transport, financial services, general commerce
11. There is an 'Innovation Centre' that provides flexible terms in a high-tech building for small to medium-sized businesses

The following example shows the scale and nature of the development:

12. The three latest commercial buildings constitute one of the largest developments of its type in Oxfordshire
13. These three buildings provide more than 10 000 square metres of office, laboratory and high-tech space
14. A large fraction of this space is intended for scientific research and technology

The following example shows the large scale of the scientific activity:

15. *Immunocore* is a world leader in the development of biological drugs
16. The company was recently given \$40 million funding by the *Bill & Melinda Gates Foundation* for therapeutics for infectious diseases (September 2017)

17. The company has about 12 500 square metres of laboratory and office space currently
18. It will increase its total area to about 22 000 square metres, which will include new purpose-built premises

The essential points are:

19. The huge centre of commercial activity at Milton Park has been created with no damage to the green belt
20. Culham Science Centre is geographically close to Milton Park
21. The commercial activity at the Culham Science Centre is small in comparison with that at Milton Park

3.2 Harwell Campus

The *Harwell campus* is one of the most important scientific sites in the country:

1. Harwell campus is an important part of national scientific infrastructure
2. It accommodates major scientific and technical enterprises, including 'big science'
3. It has excellent transport links because it is close to:
 - (a) the A34 (at Chilton, junction with A4185)
 - (b) the A34 (at Milton roundabout, junction with A4130)
4. The site was previously the Atomic Energy Research Establishment (1946)

The following items are noteworthy:

5. Milton Park is nearby; approximate distances are:
 - (a) 6 km (shortest route)
 - (b) 8 km (via A34)
6. Culham Science Centre is nearby; approximate distances are:
 - (a) 14 km (shortest route)
 - (b) 20 km (via A34, Abingdon and A415)
7. The Harwell campus (287 hectares) is substantially larger than the Culham Science Centre (73 hectares)

From the Harwell campus website:

8. The site accommodates over £1 billion worth of research infrastructure
9. There are about 200 organizations and companies, and over 5000 employees
10. The commercial applications include healthcare, medical devices, detector systems, space, computing, green enterprise and new materials
11. The site is home to 'big science' through, for example, the following organizations:
 - (a) Diamond Light Source
 - (b) European Space Agency
 - (c) Medical Research Council
 - (d) Science and Technology Facilities Council
 - (e) UK Space Agency

12. The site is owned and managed by a joint venture that includes the UKAEA

The essential points are:

13. Culham Science Centre is geographically close to the Harwell campus
14. Scientific activity at the Culham Science Centre is small compared with that on the Harwell campus

3.3 Oxford Science Park

The *Oxford Science Park* is a relatively new centre of commercial activity:

1. The Oxford Science Park was created in 1991
2. It is owned and managed by Magdalen College, Oxford
3. The site comprises 30 hectares of landscaped grounds
4. It accommodates over 70 companies and 2500 employees

There is a range of businesses:

5. Start-ups, small and medium-sized companies, multi-national organizations
6. Example companies of note:
 - (a) IBM
 - (b) Oxford Nanopore
 - (c) Sharp Laboratories of Europe
 - (d) Winton Capital Management (\$30 billion of assets invested)
7. Breakdown by sector: bioscience 40%, computer technology 30%, other services 30%

From the political point of view:

8. The Oxford Science Park is the demesne of the Oxford City Council, not SODC
9. It is relevant here because of its importance to the *geographical* area
10. It raises the issue that developments that benefit a specific council do not necessarily benefit the geographical area as a whole
11. The issue is significant because the geographical area has three local councils:
 - (a) Oxford City Council
 - (b) Vale of White Horse District Council
 - (c) South Oxfordshire District Council

The significant points about the Oxford Science Park are:

12. It is an important centre of economic and scientific activity
13. It is close to the Culham Science Centre (approximate distance 9 km)
14. It is adjacent to *Grenoble Road* (a potential development site)
15. The natural boundaries of the geographical area, in terms of science parks, would be: Harwell campus, Milton Park, Oxford Science Park
16. However, Oxford Science Park is not mentioned in LP2033, not even in respect of coordinated local government, or transport links

3.4 Science Vale

Science Vale is a marketing name that is used prominently by SODC:

1. The name is the invention of the Vale of White Horse District Council and SODC
2. It is purely a marketing name, and does not exist historically
3. Its purpose is to promote development in and around Didcot
4. Didcot is a well-known railway town
5. The name is currently being advertized at railway stations in London

The name has an insidious use:

6. It is used as a catch-phrase, to imply a self-justifying reality instead of an aspiration
7. It appears 46 times in LP2033
8. It is used rhetorically by means of self-referral to give a false sense of importance
9. For instance: “Didcot is at the heart of Science Vale” means no more than ‘Didcot is in Didcot, which we wish to develop’ (LP2033, p. 34)

Science Vale has a hyperbolic website:

10. The precise meaning of ‘Science Vale’ is a victim of the presentation
11. The content is full of marketing language:
 - (a) “Science Vale is a community”
 - (b) “Science Vale is growing fast and we’re restless for more”
 - (c) “If you’re as hungry as we are to do things differently, the opportunities are limitless”
 - (d) “a vibrant blend of business innovation, social interaction and rural escapism”
 - (e) “We’re creating a lively and sustainable corner of southern Oxfordshire that you can call your own”
12. The underlying message is:
 - (a) Science Vale relates to the development of Didcot and immediate area
 - (b) the area already has the important sites: Harwell campus and Milton Park
 - (c) the University of Oxford and other organizations are in the wider area

More information can be obtained from the definition of the ‘enterprise zones’:

13. The given locations clearly show the focus on Didcot and its immediate locality:
 - (a) “a range of opportunities in and around the town of Didcot”
 - (b) “The largest single site is at Harwell”
 - (c) “one site is next to the A34 Milton Interchange”
 - (d) “several are at Milton Park”
 - (e) “the rest are to the north and west of Didcot”
 - (f) “in and around the area of the former Didcot A power station”
14. For the very hungry, there is an offer of a reduced business rate in these zones

The website describes the transport links:

15. It emphasizes the fast train service from Didcot Parkway to London Paddington

16. It promises improved transport infrastructure in respect of:
 - (a) upgrades to the railway stations at Didcot and Culham
 - (b) junction improvements to the A34
 - (c) new roads, bridges and cycleways
17. The combination of fast trains to London and the idea of ‘rural escapism’ is a clear invitation to residents of London to become commuters in south Oxfordshire
18. That movement of London money will not help the provision of affordable housing in south Oxfordshire
19. The promise of new bridges, in particular, shows the wider financial motive in the promotion of Science Vale

In respect of Culham:

20. Culham has little presence on the website (as far as can be established in the absence of an automatic search facility)
21. There are references merely to:
 - (a) JET (tacitly, as big science)
 - (b) Culham station (promised upgrade)
 - (c) external websites
22. This minor presence is inconsistent with the central position that Culham takes in LP2033:

“This activity is concentrated around the three centres for science at Harwell campus, Culham Science Centre, and Milton Park, but is supported by a number of important settlements including Didcot, Wantage and Grove” (p. 19)
23. On the website, Science Vale is focused on Didcot, but in LP2033, Didcot becomes merely a support to Culham

Science Vale (and LP2033) is clearly flawed:

24. The phrase ‘rural escapism’ is inconsistent with the construction of 3500 houses on green-belt land
25. The phrase ‘big-science research centre at Culham and Harwell’ ignores the fact that the life of JET is likely to be severely limited
26. The phrase ‘upgrades to the railway stations at Didcot and Culham’ ignores the fact that there is no actual plan to upgrade the station at Culham

4 Future employment

This section reviews the position on future employment at the Culham Science Centre. The material in Section 2 provides the historical context.

4.1 JET

A summary of the JET project is given in Section 2.4.

The crucial points about JET are:

1. JET has been used widely by SODC to imply exceptional employment prospects in fusion research at the Culham Science Centre

2. Two of SODC'S rhetorical devices are:
 - (a) the liberal use of the term 'big science'
 - (b) the use of the heroic phrase 'the hottest place in Oxfordshire!'
3. In addition, photographs of JET have been used by SODC for promotional purposes
4. The fact that JET obtained its most important result 20 years ago was not explained

SODC appears to have changed its view to one of greater realism; LP2033 makes a much weaker statement:

5. "Although the European Fusion Project (ITER) is being moved to France, the JET facility will continue to operate for some time and it is possible that Culham may be selected for further facilities linked to fusion research" (p. 38)
6. This bland statement clearly provides no offer of exceptional employment prospects

This change of presentation gives a wider concern:

7. SODC is developing a major plan that may alter our environment for ever
8. However, the analysis of the facts (all in the public domain) is entirely fluid:
 - (a) "the hottest place . . ." (certainty, May 2017)
 - (b) "it is possible that . . ." (uncertainty, October 2017)
9. This arbitrariness is inconsistent with the integrity that one would expect in this process

The essential points about JET are:

10. JET is reaching the end of its life because the world's focus is on ITER
11. JET is a European project that is subject to great uncertainty because of Brexit
12. Funding for JET is in place until 2018, and may be extended to 2020
13. The operational experience on JET will move to ITER in the early 2020s

The conclusions are:

14. JET will not provide employment (except decommissioning) in the longer term
15. JET provides absolutely no justification for:
 - (a) the construction of 3500 houses on the green belt at Culham
 - (b) the removal of Culham Science Centre from the green belt

4.2 ITER

A summary of the ITER project is given in Section 2.5.

The crucial points about ITER are:

1. ITER is the international focus for fusion research, and will be for decades
2. The Culham Science Centre can rightly seek support work for ITER (such as remote maintenance), however:
3. This is a limited, highly specialized activity for a unique project, so cannot provide large-scale employment

The conclusions are:

4. ITER will not provide large-scale employment at the Culham Science Centre
5. ITER provides absolutely no justification for:
 - (a) the construction of 3500 houses on the green belt at Culham
 - (b) the removal of Culham Science Centre from the green belt

4.3 DEMO

A summary of the DEMO concept is given in Section 2.6.

The crucial points about DEMO are:

1. DEMO refers to a *hypothetical* machine that might follow ITER
2. The time-frame is distant: towards the end of this century, or possibly never
3. At the SODC meeting on 28 September 2017, a view was expressed that the name 'DEMO' implies that:
 - (a) fusion is ready for commercial exploitation
 - (b) there would be engineering jobs at Culham as a result
4. This view is entirely erroneous, and is not informed by the actual developmental status of the subject (Sections 2.4, 2.5 and 2.6)

The conclusions are:

5. DEMO cannot possibly provide employment at the Culham Science Centre
6. DEMO provides absolutely no justification for:
 - (a) the construction of 3500 houses on the green belt at Culham
 - (b) the removal of Culham Science Centre from the green belt

4.4 MAST

A summary of the MAST project is given in Section 2.7.

MAST raises a number of fundamental issues of national policy:

1. Given the strategic position that:
 - (a) MAST represents the outcome of fusion research at Culham since 1961
 - (b) MAST remains an experiment in basic science
 - (c) all other UK machines have been superseded
 - (d) all other fusion concepts have been explored
 - (e) international collaboration is the only practical route (Section 2.2)
 - (f) the international focus is now ITER
2. One can pose the legitimate questions:
 - (a) is MAST the final machine in the UK national fusion programme?
 - (b) is the future in support work for ITER?
 - (c) if not, what is the next step?
3. Government support for a large UK national fusion programme is scarcely conceivable (particularly after Brexit), so:

4. The likely answer is that MAST is that final machine
5. Significant employment on MAST is therefore unlikely to continue into the long term

There is a highly speculative idea about nuclear testing using a MAST-like device:

6. A stated aim of MAST is to make the case for a fusion *Component Test Facility*
7. The idea is that the facility would extend fusion research into nuclear radiation testing of materials (i.e., research work on Marshall's stage 2 before stage 1 has been achieved)
8. The possibility raised in Item 5 of Section 4.1 may be a tacit reference to it
9. Such a project would be:
 - (a) hugely speculative technically
 - (b) highly expensive (c. £1 billion)
 - (c) grossly premature (pointless if ITER is unsuccessful)
 - (d) a nuclear installation specifically intended to generate radioactive waste
10. The UK government is most unlikely to agree to it

The conclusions are:

11. MAST cannot provide long-term employment at the Culham Science Centre
12. MAST provides absolutely no justification for:
 - (a) the construction of 3500 houses on the green belt at Culham
 - (b) the removal of Culham Science Centre from the green belt

4.5 Culham Science Centre

A summary of the Culham Science Centre is given in Section 2.3.

The crucial points about the Culham Science Centre are:

1. The occupants of the site may be considered in five categories:
 - (a) JET (European fusion project)
 - (b) MAST (UK national fusion programme)
 - (c) RACE:
 - i. engineering support for ITER
 - ii. diversified to autonomous vehicles
 - (d) the Civil Nuclear Constabulary
 - (e) other businesses (tenants of UKAEA)

In respect of fusion:

2. Large-scale fusion research at Culham is most unlikely to have a long-term future
3. Fifty-six years of fusion research at Culham has not given a practical outcome, and the subject remains a scientific aspiration
4. The historical importance of the Culham Science Centre in fusion is past; ITER in France is now the international focus
5. JET and MAST will not provide long-term employment (Sections 4.1 and 4.4)
6. RACE can rightly seek contracts from ITER, but the limited scope cannot provide large-scale employment

In respect of non-fusion activities:

7. The Civil Nuclear Constabulary:
 - (a) has its headquarters at Culham (instead of Harwell) for historical reasons
 - (b) its presence at Culham does not bring any special significance to the site
8. The site has never been adopted by any large external commercial organization; the tenant businesses are typically small, moreover:
9. A basic short-coming of the site: “the current [building] stock is outdated”, is freely admitted (LP2033, p. 38)
10. Culham Science Centre is a small enterprise compared with Milton Park and the Harwell campus
11. Culham Science Centre is close to Milton Park, the Harwell campus and the Oxford Science Park

The large relative size of Milton Park is clear from the following comparison:

12. The Culham ‘Visitor Guide’ allows an *indicative* estimate to be made of the overall floor space that is occupied by businesses at the Culham Science Centre
13. That indicative estimate in round figures (square metres) is:

service buildings:	1000
wooden building:	500
good office:	4000
lab/office:	5000

14. The indicative total of 10 500 m² is less than that (12 500 m²) occupied by just *one* business at Milton Park (Item 17, Section 3.1)

The importance of the Harwell campus for big science is shown by the recent development:

15. *Reaction Engines* is a notable aerospace company at the Culham Science Centre
16. The minister for Universities and Science announced in July 2017 that a *National Satellite Testing Facility* would be created (due in 2020)
17. Reaction Engines’ revolutionary rocket engine will be tested and built in this facility
18. This new facility will be on the Harwell campus

Analysis of these considerations shows that:

19. The ‘exceptional circumstances’ claimed by SODC simply do not exist
20. There is absolutely no reason why the existence of the Culham Science Centre justifies:
 - (a) the construction of 3500 houses on the green belt at Culham
 - (b) the removal of Culham Science Centre from the green belt
21. Any idea that the 3500 houses would be inhabited largely by employees of the Culham Science Centre, in the style of a Soviet ‘Atom City’, is entirely unrealistic
22. Indeed, younger employees are more likely to want to live in Oxford, to enjoy the amenities of the city

In consideration of housing generally:

23. Science Vale’s promise of ‘rural escapism’ is a clear invitation to residents of London to become commuters in south Oxfordshire

24. In practice, a development of 3500 houses would be a dormitory town for Reading and London
25. The consequence would be inflated house prices
26. High prices will maximize the financial gain by SODC for its own purposes, but will not help lower-paid staff at the Culham Science Centre

4.6 Autonomous vehicles

The UKAEA is pursuing a diversification project at the Culham Science Centre into research into autonomous vehicles:

1. Autonomous vehicles are a subject of world-wide research
2. The work is essential technical, however:
3. UKAEA has given its activities a political dimension in the local planning process

The relevant background history is:

4. UKAEA had a long-time interest in remote handling and hostile environments in the nuclear industry
5. This work was transferred to AEA Technology plc (and was later moved to the Culham Science Centre) but did not survive
6. Remote handling has been used in JET for many years because of the hazardous environment within the machine

In recent times:

7. UKAEA started the project RACE in 2014 to exploit the operational knowledge in remote handling that was gained in JET
8. The project has been directed towards ITER, and has recently won a five-year contract for an ITER test facility
9. However, the project has been diversified to include support for consortia for research into autonomous vehicles
10. This work is entirely unrelated to fusion

Further details of this diversification:

11. One of the consortia, *People in Autonomous Vehicles in Urban Environments* (PAVE) comprises RACE, Siemens, Amey, Oxbotica and Westbourne
12. Westbourne is a public-relations company
13. RACE has recently been awarded a share of £6.9 million for research into autonomous vehicles with Millbrook Proving Ground in Bedfordshire (Milton Keynes)
14. Funding for the work has been provided by the Department for Business, Energy and Industrial Strategy (the UKAEA's own parent department)

The research work has an entirely reasonable aspect:

15. A stated activity is the use of the private roads at the Culham Science Centre for test purposes
16. This use is entirely reasonable (historically, the Esso research laboratory at Milton Hill used the site, then just runways, for road tests in 1960)

17. Private roads could be used in principle on any private site (such as MoD land) and they are not special to the Culham Science Centre

The research work has an entirely implausible aspect:

18. UKAEA has made the suggestion that its research at the Culham Science Centre into autonomous vehicles *justifies* the present proposed housing development; indeed:
19. The UKAEA's response to the last SODC consultation was that their bid for their vehicle project was:
“predicated on there being sufficient housing adjacent to CSC to provide the economies of scale necessary to support investment in a long-term test-bed where integrated intelligent mobility can be tested in a range of real environments”
20. Moreover, the RACE/PAVE website has the phrase: “establishing secure foundations for *Culham City* as a national test facility”

There is also a convenient political concordance:

21. SODC/Vale has proposed a stream of autonomous vehicles between Didcot and the Culham Science Centre (*Didcot Garden Town Delivery Plan*, June 2017)
22. RACE promoted SODC's plan for new housing

The suggestion is absurd and requires a strong response:

23. The UKAEA seems to think that a new town (or ‘city’) should be built as a test facility to support start-up research ventures
24. Any such idea is ludicrous:
 - (a) speculative research work (at the level of c. £10 million) and construction of a new town are grossly incommensurate activities
 - (b) linkage of the two activities is wholly unrealistic
 - (c) the time-scales of the two activities are inconsistent
 - (d) the idea is too late: autonomous vehicles are already under test in UK cities
25. Furthermore:
 - (a) this research site is not unique
 - (b) there is no shortage of potential test locations in the locality
 - (c) there is huge international competition with large funding
 - (d) the green belt should not be destroyed in order to support a start-up venture

Further relevant information:

26. In respect of “sufficient housing adjacent to CSC ... a range of real environments”, the locality is not short of nearby housing and real environments:
 - (a) Berinsfield: 4 km
 - (b) Abingdon: 6 km (census pop. 33 000, with well-defined housing estates)
 - (c) Didcot: 10 km (census pop. 25 000, with a large housing estate)
27. The competition comes from multi-national companies such as:
 - (a) tech companies: Apple, intel, Samsung, Tesla, Uber, Waymo (Google/Alphabet)
 - (b) established car companies: BMW, Ford, General Motors, Jaguar Land Rover, Mercedes-Benz, Nissan, Tata Motors, Volkswagen, Volvo

28. The fact that autonomous vehicles are *already* under test in UK cities is evidenced by recent news reports (not exhaustive) about self-driving cars:
- (a) LUTZ Pathfinder project: Milton Keynes, October 2016
 - (b) Nissan: trials in east London, March 2017
 - (c) Jaguar Land Rover: trials in Coventry city centre, November 2017

The clear conclusion is that:

29. Research into autonomous vehicles provides absolutely no justification for:
- (a) the construction of 3500 houses on the green belt at Culham
 - (b) the removal of Culham Science Centre from the green belt

5 Summary

1. This document has examined the:
 - (a) relevant historical background
 - (b) development of fusion research at the Culham Science Centre
 - (c) scale of activity at the local science and business parks
 - (d) nature of employment at the Culham Science Centre
2. This examination shows that the Culham Science Centre:
 - (a) has an unusual history
 - (b) demonstrably provides gainful employment, including:
 - (c) government-funded research work
3. However the Culham Science Centre:
 - (a) is close to the major centres of economic and scientific activity at Milton Park, the Harwell campus and the Oxford Science Park
 - (b) is a small site (compared with Milton Park and the Harwell campus)
 - (c) has a long-term mission in fusion research that is near the end of its natural life
4. In addition, the Culham Science Centre:
 - (a) has old and outmoded buildings
 - (b) has started a diversification project away from fusion, but:
 - (c) that project is far from unique to the site or its consortia
5. Culham Science Centre in no way provides a transcendent reason for the removal of 315 hectares of land from the green belt at Culham

6 Conclusions

The conclusions of this document are that:

1. The claim of 'exceptional circumstances' by SODC in respect of the Culham Science Centre is false
2.

The document SODC LP2033 therefore fails the test of soundness
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7 Additional material, February 2019

This section contains additional material that was added in February 2019, following the re-issue of the SODC local plan in January 2019.

7.1 Background

The SODC local plan 2011–34 continues to be problematic:

1. The original version was issued in March 2017 (as local plan 2011–33)
2. A revised version was issued in October 2017 (the version for which this submission was originally prepared)
3. Both versions were subject to wide public criticism, in speeches at council meetings and in extensive written submissions

Moreover:

4. The soundness of the plan was also a concern to SODC and its advisors
5. In March 2018, SODC voted *not* to submit the plan to the planning inspector
6. The leader of SODC resigned his leadership shortly after the vote

Subsequently:

7. In May 2018, SODC voted to undertake an extended review and assessment of 15 sites
8. A revised plan was issued in early December 2018, and the three council meetings about it were rushed through before Christmas
9. A large number (c. 20) of public speakers spoke against the plan at each meeting

The vote:

10. SODC voted to adopt the revised plan on 20 December 2018
11. The vote, which was whipped (unusually), was carried by 22–9
12. This result showed considerable dissent within SODC
13. One of the voters against the plan was the former leader of SODC, who was the proponent of the October 2017 plan
14. He had expressed concern because the revised plan increased the area of green belt under threat
15. The council member for the ward that includes Culham voted against the plan, for the reasons:
 - (a) invalid housing numbers
 - (b) destruction of green belt
 - (c) urban sprawl
 - (d) inadequate infrastructure

A consequence:

16. An immediate consequence of the dissent was that six council members were suspended from the Conservative group (Jan 2019)
17. A local newspaper (*The Abingdon Herald*, 9 Jan 2019) carried the headline: ‘Six Suspended. Tories at War’

18. One suspended councillor said: 'We need the right plan for the right housing in the right places. The Local Plan does not give us that'

Pertinent points:

19. Six out of the seven strategic development sites are in the green belt
20. This fact may represent a strategy to attack the green belt simply by offering (almost) no other choice in the plan
21. The largest strategic site is in the green belt at Culham

For Culham in particular:

22. SODC wishes to take 301 hectares of land out of the green belt, to allow:
 - (a) The construction of 1850 houses, subsequent total 3500 houses (220 hectares)
 - (b) The inset of the Culham Science Centre from the green belt (73 hectares)
23. The reciprocal positions of SODC and UKAEA are clear in the plan
24. The presence of the Culham Science Centre is again being used to claim 'exceptional circumstances' to justify the housing development at Culham

This report:

25. This additional section of this report provides further information to show that these 'exceptional circumstances' are spurious

7.2 Green belt under threat

1. Culham Science Centre (CSC) is being used as a political tool to justify the destruction of the green belt for housing and commercial development
2. To that end, all the relevant public bodies have an interest in the promotion of CSC as an 'exceptional circumstance'
3. UKAEA will gain greatly because it will be able to build a commercial property portfolio in the green belt
4. SODC will gain financially and will pursue infrastructure projects that enable the expansion of Didcot northwards to Abingdon
5. Culham will be used as a forward base in that strategy ('Culham and Didcot Garden Town' has already appeared in SODC documents)
6. Oxfordshire County Council will gain financially, directly or indirectly, and will pursue its plan for a new northern road from Didcot
7. That road and a new Thames bridge will allow the northern expansion of Didcot to Abingdon
8. The Department of Business, Energy & Industrial Strategy (DBE&IS) will also gain because it is the parent body of UKAEA, and therefore has a direct financial interest
9. It is absurd that CSC, a small establishment that is engaged in the unlikely endeavour of nuclear fusion research, should acquire such an important political position

7.3 JET

1. The politics of JET are in a parlous state
2. The UK receives c. €60 million annually for JET because the UK is in Euratom

3. However, in the current Brexit negotiations, the UK will leave Euratom when the UK leaves the EU in March 2019; reference document:

Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, as endorsed by leaders at a special meeting of the European Council on 25 November 2018

4. This political position raises great uncertainty, and top-level JET staff have already left the project
5. The difficulties are discussed in recent editions of *Nature*, the international journal of science: vol. 557 no. 7707, 31 May 2018, p. 611; vol. 563 no. 7732, 22 Nov 2018, p. 444
6. The UK has pledged money for JET until 2020
7. JET is operating currently on a temporary EU budget that expires on 28 March 2019

JET programme:

8. JET is currently working toward an experiment, scheduled for 2020, to demonstrate nuclear reactions in deuterium-tritium (the requisite nuclear fuel for a fusion reactor)
9. The previous such experiment was in 1997
10. The experiment is unlikely to give strategically new results because the fundamental operation of the machine is unchanged
11. However, the interior of the machine will become highly radioactive, particularly with cobalt-60 (half-life 5.3 years)

Likely developments:

12. This radioactivity will have serious operational implications, and is likely to signal the end of JET operations and the movement of operational experience to ITER
13. The transition to ITER will have a negative impact on the employment prospects of the c. 700 staff on JET
14. The closure of JET will greatly reduce the political importance of CSC

Decommissioning plan:

15. The latest available UKAEA Annual Report (2017/18) in its financial statement makes clear that:
 - (a) a JET decommissioning plan will be available in 2018/19
 - (b) JET will be placed under the Nuclear Decommissioning Agency (NDA)
 - (c) the estimated cost of decommissioning is £301 million

The conclusions are:

16. JET is politically and technically in the final stage of its life
17. The closure of JET in the relatively near future cannot be ignored
18. JET cannot provide employment (except decommissioning) in the longer term
19. JET cannot be used to justify the SODC local plan
20. In particular, JET does not justify the removal of CSC from the green belt

7.4 ITER

1. Exaggerated statements about ITER have been used to promote CSC
2. In particular, the chief executive of the UKAEA gave a hyperbolic interview to Radio Oxford on 7 Dec 2017
3. He strongly implied that ITER is a working power-station and that it is to CSC's glory
4. In fact, ITER is not a power-plant and cannot possibly operate as a power-plant because it is not engineered to be one
5. ITER is purely a scientific experiment, and will not start its main research phase until at least 2035, which is beyond the time-frame of the local plan

Moreover, the ITER project has considerable risk:

6. ITER is extraordinarily complicated
7. It has had at least two existential threats and is about 10 years behind schedule
8. There is uncertainty over the commitment of the USA to ITER
9. The present recommendation (13 Dec 2018) from the American National Academy of Sciences is that the USA should continue to fund ITER
10. However, ITER continues to face scepticism from members of the US Congress

The UK's position has a major threat:

11. CSC is pursuing diversification projects in the form of contract research work for ITER
12. However, the UK is part of ITER because of the UK's membership of the EU, not in its own right
13. When the UK leaves the EU, the UK may be ineligible to bid for work from ITER (*Nature*, 22 Nov 2018, p. 444)
14. This will be a fundamental obstruction to the UKAEA's diversification strategy

More generally:

15. Fusion research remains wholly aspirational
16. There has been no practical progress worldwide in almost 70 years
17. The overall results from ITER will not be known for several more decades
18. Irrespective of any progress ITER may make, a fusion reactor would have fundamental weaknesses that will make it impossible to realize:
 - (a) A fusion reactor would be vastly more complicated than a nuclear fission reactor and essentially impractical
 - (b) neutron damage to the innermost structure of the reactor (specific to fusion) will give insurmountable engineering and economic problems
 - (c) The necessarily immense size of a fusion reactor will give a prohibitive capital cost (already a problem for fission reactors, e.g., Hinkley Point C, Wylfa B)

For these reasons:

19. Fusion research in general, and ITER in particular, cannot realistically be cited as a source of major employment at Culham
20. Any suggestion that CSC could become a centre for the design or manufacture of fusion reactors is completely untenable
21. ITER cannot be used to justify the SODC local plan
22. In particular, ITER does not justify the removal of CSC from the green belt

7.5 MAST

1. The upgrade to MAST was completed during 2018 (however, operations are not now expected until mid 2019)
2. The upgrade was several years late, had programme and financial problems and there was a change of UKAEA chief executive during that time
3. Nevertheless, an official opening with a royal visit took place in October 2018
4. The arrangement of a royal visit to an obscure piece of scientific equipment could be seen as a publicity stunt

The facts remain that:

5. MAST is purely an experiment in basic science
6. MAST will not be used to demonstrate nuclear fusion, but it may be used to produce PhD theses
7. Even then, the subject area is very specialized, as the EPSRC-UKRI website makes clear: 'Industrial demand for researchers with fusion experience is limited'

A wider point:

8. The UK national fusion programme at Culham has consumed c. £1 billion since 1960 but has never made strategic progress
9. In particular, deuterium-tritium (the requisite nuclear fuel) has never been used in a UK national fusion experiment
10. The lack of strategic progress after 58 years provides no basis for the use of CSC as a beacon of exceptional circumstances
11. In particular, MAST does not justify the removal of CSC from the green belt

7.6 UK support for ITER

1. DBE&IS has supported the UKAEA's plan to win contract work from ITER
2. The most notable support is the financial support of £86 million (over an unspecified time) that was announced in December 2017
3. The funding is for two projects (described in anticipation as 'centres of excellence') that will provide employment for 100 staff overall (indicative)

The projects:

4. The first project covers the handling of tritium (the radioactive isotope of hydrogen)
5. This is a singular undertaking, reminiscent of the first H-bomb device in the USA (1952), and is specific to ITER
6. The second project covers experiments to simulate neutron damage (without an actual neutron source) in materials that might be used in a fusion reactor
7. This project is highly specialized and is specific to fusion

The future:

8. The specialization of both projects means that they are most unlikely to provide any large-scale employment in the longer term
9. An existential risk to UK work in support of ITER is that the UK may be ineligible to bid for ITER contracts after 29 March 2019, when the UK leaves the EU

7.7 Robotics

1. DBE&IS continues to support robotics (RACE) at CSC, and there has been a growth in personnel in this activity
2. RACE is a government-backed, third-party consultancy service for industry, not a primary manufacturer of robots

Rationale:

3. The rationale for its location at CSC is that (through a questionable re-interpretation of history and technicalities) CSC is a centre of robotics expertise because of JET
4. In fact, the UKAEA disposed of its actual robotics expertise in 1996, and the present undertaking was created more recently (2014)
5. Furthermore, the link with fusion research is clearly weak
6. A UKAEA spokesman emphasised (Nov 2018) that DBE&IS has no interest in funding any really long-term robotics project, which fusion certainly is

Location:

7. A robotics advisory service could have been placed in a location other than rural Oxfordshire (for instance, a location relevant to smart manufacturing)
8. However, its placement at CSC does allow the UKAEA to establish a commercial property portfolio in the green belt

7.8 Apprentice training centre

1. UKAEA has started a new diversification project: an apprentice training centre
2. The project is funded by the Science and Technology Facilities Council (STFC), which is part of UK Research and Innovation (UKRI) under DBE&IS
3. The project has no link to fusion research

Location:

4. Although such training may be laudable, there is no good reason why a training centre has to be built in the Oxfordshire countryside
5. Moreover, the facility is for young students but the area has no accommodation and little public transport
6. The actual training will be done by an organisation in Coventry
7. The movement of training from an established area of manufacturing in the midlands to the Oxfordshire countryside is perverse

Claim of special circumstances:

8. The most telling point about this development is the application to SODC for planning permission (P17/S4193/FUL) for a non-residential training centre
9. The crucial justification ('unique selling points') is stated to be:
'specific power supplies for large scale projects, high security fence due to the JET project and its inclusion as part of Science Vale'
10. These irrelevancies are deemed to constitute 'very special circumstances' that 'outweigh the harm to the green belt'

11. This rhetoric epitomises the way in which the phrase ‘special circumstances’ (and similarly ‘exceptional circumstances’) can be subverted into a mere catch-phrase
12. The catch-phrase then acts as a password that gives access to financial gain from development in the green belt
13. In this case, the ‘very special circumstances’ refer to installed electrical equipment, an ordinary decades-old boundary fence and proximity to Didcot (but not Oxford)
14. These items are wholly irrelevant to the construction of a 3789 m² block of classrooms in the green belt
15. However, the ‘circumstances’ provide an opportunity for the UKAEA to establish a commercial property portfolio in the green belt

7.9 Employment at CSC

1. CSC continues to host a number of tenants (small independent businesses) and various government-funded programmes
2. The government-funded programmes are JET, MAST, work for ITER, and non-fusion diversification projects
3. There has been no strategic change in the independent businesses
4. No large commercial organization has moved on to the site

MAST:

5. Given the track record of the UK national fusion programme, for example the machines COMPASS and START (operational 1989–99, 1991–98 respectively):
6. MAST and related work is likely to provide employment for 50–100 people for ten years (indicative) and will then be terminated

JET:

7. JET is the biggest single source of employment on site (c. 700 staff)
8. It is subject to huge political uncertainty because it is a Euratom project, but the UK will leave Euratom when the UK leaves the EU
9. JET is likely to end soon after 2020, when the UK’s financial contribution to JET will end (and the machine will be highly radioactive)
10. Moreover, JET has a temporary budget in place to 28 March 2019, and could have an existential political problem on 29 March 2019 because of Brexit

Employment numbers:

11. The current overall number of people working at CSC is c. 2400 (informal UKAEA data, Nov 2018)
12. The contract work for ITER and the non-fusion diversification projects are expected to add some 100s (said by UKAEA to be up to 600 in the long term)
13. Against this, c. 700 will be lost in the short term when JET closes
14. In the middle term, losses c. 100 from the UK national fusion programme can be expected when MAST reaches the end of its life

Existential threat:

15. There is a major threat to employment on fusion at CSC

16. The EPSRC-UKRI website states that:

Funding currently encompasses support for the upgrade to Mega Amp Spherical Tokamak (MAST), the UK research programme and UK host funding for operating the Joint European Torus (JET, Europe's flagship fusion facility) which the programme operates for the EUROfusion initiative. Research undertaken includes plasma physics, chemistry and physics of deuterium and tritium, particle physics as related to fusion science, modelling of tokamak operations, tokamak engineering and design, materials research and development of remote maintenance techniques.

Overall, EPSRC provides around 30% of the income for the programme and facilities with the other 70% provided by the European Union's Euratom initiative.

17. This is crucial information: 70% of the funding for *all* fusion work at the CSC is from Euratom
18. However, in the current Brexit negotiations, the UK will leave Euratom when the UK leaves the EU in March 2019
19. This is an existential threat—fusion work at Culham has depended on Euratom funding since 1973
20. In addition, contract work for ITER will be in jeopardy when the UK leaves Euratom

Domestic threat:

21. The other 30% of fusion funding comes from the UK higher education research sector
22. However, UK research currently receives about €1.3 billion annually from the EU, and this funding is threatened by Brexit (*Nature*, 24 Jan 2019, p. 408)
23. EPSRC may well look for savings in its fusion funding, particularly as there is limited demand for fusion experience, and ITER (not MAST) is the world focus

Conclusions:

24. Employment at CSC is subject to considerable political and financial risk
25. The outlook is not the transcendent picture that UKAEA and SODC wish to portray
26. Employment prospects at CSC cannot honestly be used to justify the SODC local plan

7.10 Summary

1. SODC's local plan is subject to considerable dissent within SODC
2. CSC is being used as a political tool to subvert the protection of the green belt
3. The existence of CSC depends entirely on state funding (UK and EU)
4. Euratom funding covers 70% of all fusion work at CSC, but the UK will leave Euratom when the UK leaves the EU
5. The largest single source of employment and political importance is JET, which is likely to close in the short term
6. Contract work for ITER is singularly specialised, and may not be available to the UK when the UK leaves Euratom
7. The UK national fusion programme has never demonstrated fusion in the 60 years of its existence, and is probably in its final years
8. The UKAEA has started non-fusion industrial diversification projects that are not natural activities in the Oxfordshire countryside
9. UKAEA is seeking to develop a commercial property portfolio in the green belt
10. The use by SODC of CSC as an 'exceptional circumstance' to justify its local plan in respect of the green belt at Culham is entirely unsound

7.11 SODC's exceptional circumstances

SODC claims two 'exceptional circumstances' in support of its plan for Culham. This section examines those circumstances and shows that they are wholly insubstantial.

7.11.1 Circumstance 1

'The additional land provides an opportunity to deliver housing adjacent to one of the major employers in southern Oxfordshire'

1. This 'exceptional circumstance' is remarkably weak and does not bear scrutiny
2. Given that it is intended to justify the construction of a new *town*, it is risible

'provides an opportunity to deliver':

3. 'provides an opportunity' is a meaningless statement
4. Land is a given fixed asset and does not itself constitute a favourable circumstance
5. For example, St Paul's Cathedral does not provide an opportunity for the construction of a unique themed hotel in London
6. Moreover, for a very long time (until a sudden change in March 2017), SODC gave the green belt its full protection
7. The only opportunity here is for SODC to destroy the green belt for financial gain in the short term, and to join the towns of Didcot and Abingdon in the long term

'housing adjacent to':

8. This phrase implies that the proposed housing and the CSC would be closely linked
9. The suggestion that the existence of a single employer justifies a new town is absurd
10. It is reminiscent of 1950s Soviet atom cities, and is entirely unrealistic in the present context
11. Scientists and engineers are a small fraction of the general population, and only a small fraction of a new town could be expected to work at the adjacent site
12. The implied close link between housing and employment therefore fails on a simple point of logic
13. Moreover, the phrase makes the unproven tacit assumption that the 'major employer' will exist in a recognisable form over the time required to build a new town
14. Houses in the proposed development are certain to command a high price, irrespective of considerations of 'affordable housing' (80% of unaffordable is still unaffordable)
15. For that reason, they will be unaffordable by those on typical salaries of scientists, engineers and support staff at CSC
16. Furthermore, the chief executive of the UKAEA made the comment (9 August 2017) that the UKAEA does not pay high salaries
17. Apart from this financial obstacle, younger employees are much more likely to live in an established town (especially Oxford) for social reasons
18. Overall, the implied link between the proposed housing and adjacent employment is spurious—any development will become a commuter town for London via Didcot

'one of the major employers':

19. The phrase 'one of the major employers' (meaning the UKAEA at Culham) is wholly misleading because it is a gross simplification of a complicated and uncertain position

20. The UKAEA is not a ‘major employer’ in a conventional sense (such as Rolls Royce, BAE Systems, IBM)
21. It is a government-owned landlord with a legacy of fusion research
22. The actual non-governmental activity on the Culham site is tiny in strategic terms
23. The declared technical business of the ‘major employer’ is managing the fusion legacy, and that is funded by the UK government through DBE&IS and by the EU
24. The existence of the ‘major employer’ therefore depends wholly on state funding
25. Crucially, the EU provides 70% of the total fusion budget, that is, JET *and* the UK national fusion programme (EPSRC-UKRI data)
26. Given that the UK will leave the EU in 2019 the financial position of fusion and the ‘major employer’ is therefore under an existential threat
27. A specific point is that the UK government has pledged money for JET (the single biggest source of employment) only to 2020, beyond which point JET is likely to close
28. Furthermore, the UK national fusion programme is most unlikely to provide significant employment in the long term
29. An expansion of the UK national programme to fill the void left by JET would be financially impossible
30. Another difficulty is that the UK may be ineligible to bid for fusion research contracts from ITER after the UK has left the EU
31. For these reasons, the suggestion that the presence of the UKAEA at Culham provides an ‘exceptional circumstance’ is wholly disingenuous

7.11.2 Circumstance 2

‘Development in this location is at the heart of Science Vale and supports the delivery of much needed strategic infrastructure’

1. This exceptional circumstance is vague and largely meaningless

‘at the heart of Science Vale’:

2. ‘Science Vale’ is merely a marketing name for the commercial development of Didcot, as discussed in Section 3.4
3. Culham is not at the heart of such development, as is clear from any map of the area
4. The phrase is mere rhetoric to support the growth of Didcot northwards towards Abingdon, which will lead to the eventual merger of the two towns

‘supports the delivery’:

5. This phrase simply means that money can be made from the disposal of green-belt land for housing development
6. That premise is clearly true, but it is a mundane commercial fact, not an exceptional circumstance

‘much needed strategic infrastructure’:

7. The vagueness of this phrase is inconsistent with its supposed critical importance as an exceptional circumstance
8. It can be interpreted to mean the development of roads, particularly the A415 and connections, and a proposed new bridge over the river Thames

9. However, expenditure on infrastructure is not in itself an exceptional circumstance
10. SODC's vague suggestion that it might make an undefined financial contribution to an undefined project does not make an exceptional circumstance
11. The idea of a new bridge has already been developed by Oxfordshire County Council (OCC), which is the relevant transport authority
12. OCC has already applied to central government for full funding for this project, and believes that it can proceed independently (Jan 2019)
13. The road traffic from the proposed development at Culham will negate SODC's 'much needed' improvements to the *existing* traffic problem (with or without a new bridge)
14. For these reasons, this exceptional circumstance is without merit

Appendices

A List of websites

Culham Centre for Fusion Energy	www.ccfef.ac.uk
Culham Science Centre	www.culham.org.uk
EPSRC	www.epsrc.ukri.org/research/ourportfolio/ researchareas/ukmagfusion
Harwell campus	www.harwellcampus.com
ITER	www.iter.org
Immunocore	www.immunocore.com
JET	www.euro-fusion.org/jet
Milton Park	www.miltonpark.co.uk
Oxford Science Park	www.oxfordsp.com
RACE	www.race.ukaea.uk
Science Vale	www.sciencevale.com
UKAEA	www.gov.uk/government/organisations/ uk-atomic-energy-authority

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