

## Compliance Assessment Report

Report ID:  
CAR\_NRW0032875

This form will report compliance with your permit as determined by an NRW officer

|                              |                                                                 |             |            |     |       |
|------------------------------|-----------------------------------------------------------------|-------------|------------|-----|-------|
| Site                         | St Mellons EPR/BJ69681Y                                         | Permit Ref  | BJ69681Y   |     |       |
| Operator/Permit holder       | IQE Silicon Compounds Ltd                                       |             |            |     |       |
| Regime                       | Installations                                                   |             |            |     |       |
| Date of assessment           | 26/01/2018                                                      | Time in     | 10:30      | Out | 12:30 |
| Assessment type              | Report/Data Review                                              |             |            |     |       |
| Parts of the permit assessed | Annual returns                                                  |             |            |     |       |
| Lead officer's name          | Willey, David                                                   |             |            |     |       |
| Accompanied by               |                                                                 |             |            |     |       |
| Recipient's name/position    | Moz Fisher, Paul Carrol/ General Manager, Manufacturing Manager | Date issued | 13/02/2018 |     |       |

### Section 1 – Compliance Assessment Summary

This is based on the requirements of the permit under the Environmental Permitting Regulations or the licence under the Water Resources Act 1991 as amended by the Water Act 2003. A detailed explanation is captured in "Compliance Assessment Report Detail" (Section 2) and any actions you may need to take are given in the "Action(s)" (section 4). This summary details where we believe any non-compliance with the permit has occurred, the relevant condition and how the non-compliance has been categorised using our Compliance Classification Scheme (CCS). CCS Scores can be consolidated or suspended where appropriate, to reflect the impact of some non-compliances more accurately. For more details of our CCS scheme, contact your local office.

| Permit conditions and compliance summary  | CCS Category | Condition(s) breached |
|-------------------------------------------|--------------|-----------------------|
| B5 - Infrastructure - Plant and equipment | C3           | 2.1.2                 |

**KEY:** See Section 5 for breach categories, suspended scores will be indicated as such.

**A** = Assessed or assessed in part (no evidence of non-compliance), **X** = Action only,

**O** = Ongoing non-compliance, not scored.

|                             |   |                                                              |   |
|-----------------------------|---|--------------------------------------------------------------|---|
| Number of breaches recorded | 1 | Total compliance score<br>(see section 5 for scoring scheme) | 4 |
|-----------------------------|---|--------------------------------------------------------------|---|

If the Number of breaches recorded is greater than zero, please see Section 3 for our proposed enforcement response

## Section 2 – Compliance Assessment Report Detail

This section contains a report of our findings and will usually include information on:

- The part(s) of the permit that were assessed (eg. Maintenance, training, combustion plant, etc)
- Where the type of assessment was 'Data Review' details of the report/results triggering the assessment
- Any non-compliances identified
- Any non-compliances with directly applicable legislation
- Details of any multiple non-compliances
- Information on the compliance score accrued inc.
- Details of advice given
- Any other areas of concern
- Any actions requested
- Any examples of good practice
- A reference to photos taken

### Actions from previous Car Form issued on 8th January 2018

The 2016 annual returns included the fugitive emissions report that reported a total of 51.8kg of R407C refrigerant had to be added to the chiller system in Oct and December. This equates to 91893.2kg CO<sub>2</sub> based on the GWP of 1774 for R407C.

EC Regulation No 517/2014, which came into force in the UK on 1 January 2015, is designed to reduce emissions of fluorinated greenhouse gases (F Gases), used predominantly in the refrigeration and air conditioning sectors and which make a significant contribution to climate change.

The EC regulation is directly applicable in the UK so no domestic legislation is needed to implement its main provisions.

The CAR form issued on 8th January 2018 resulted in the following permit breach.

*Considered a category three breach of permit condition 2.1.2 where, 'All plant, equipment and technical means used in operating the Permitted Installation shall be maintained in good operating condition.'*

The GWP of the leaked gas could foreseeably result in a pollution that would impact on the environment potential erosion because of the sea water in the air. This should have been a consideration on installation of the equipment and factored into the maintenance regime.

Any losses should be reported to NRW using the Schedule 1 Notification form.

The submitted Fugitive Emissions report for 2017 noted a fugitive release following a circuit failure on the chiller system in June. This resulted in a release of 23kg of R407C, equating to 40,802kg CO<sub>2</sub> based on the GWP of 1774 for R407C.

The action from the previous CAR Form is carried forward with a further breach of permit condition 2.1.2.

**ACTION:** Site to provide details of the updated maintenance checks as well as ensuring the accident management plan, planned preventative maintenance, fugitive emissions plan and the EMS are updated. The requirements of the Regulation (EU) No.517/2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 should be taken into consideration, specifically Chapter II Containment.

**Considered a category three breach of permit condition 2.1.2** where, 'All plant, equipment and technical means used in operating the Permitted Installation shall be maintained in good operating condition.'

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### IQE Silicon Site visit on 26th January 2018

A meeting was arranged with IQE Silicon to discuss the ongoing R&D development which is part of the Compound Semiconductor Centre (CSC) based in South Wales. The work being undertaken on site involves

the construction of a new separate facility within the IQE Silicon Building. This is being undertaken owing to the shortage of space that Cardiff University has for installing reactors. All work performed on this reactor will be for R&D purposes only.

IQE Silicon submitted a document outlining the provisional planned procedures to operate this reactor from an Environmental standpoint and is summarised below.

The site proposes to install an Aixtron 3X2 CCS R&D reactor in a class 10,000 reactor room. The loading of the reactor will take place through a class 1,000 area that will be accessed by an interlocked changing room that is also a class 10,000 area. The class 1000 area will contain a Wetbench for cleaning wafers prior to processing them in the reactor. There will be a room containing a CS resin bed through which all the exhaust gas from the reactor will pass. The whole R&D facility will be stand alone with separate access points to the existing clean room, it will share essentials such as the main acid drain that discharges to sewer via S1 with the discharge consent and within the existing limits.

### **Proposed Materials for Processing**

The following gases / chemicals will be supplied to the reactor:

| <b>Material</b>        | <b>Chemical Reference Name</b> |
|------------------------|--------------------------------|
| Tertiarybutylarsine    | TBAs                           |
| Tertiarybutylphosphene | TBP                            |
| Triethylstibine        | TeSb                           |
| Trimethylindium        | TMIIn                          |
| Trimethylgallium       | TMGa                           |
| Trimethylaluminium     | TMAI                           |
| Tetraethyltin          | TeSn                           |
| Diethylzinc            | DeZn                           |
| Disilane -200pm        | Disilane                       |
| Forming Gas            | Forming Gas                    |

The following acids will be used in the Wetbench:

| <b>Acid</b>       | <b>Chemical Reference Name</b> |
|-------------------|--------------------------------|
| Hydrofluoric Acid | HF                             |

The following substrates will be used for processing:

| <b>Substrate</b> | <b>Chemical Reference Name</b> |
|------------------|--------------------------------|
| Silicon          | Si                             |

|                  |      |
|------------------|------|
| Indium Phosphide | InP  |
| Gallium Arsenide | GaAs |

## **Control & Containment**

### *Hydrofluoric Acid (HF)*

HF is not a new chemical to IQE Silicon with 200 litre drums and 5 litre bottles already being used and disposed of using good environmental practices. HF will be controlled and contained in the same way as is currently the case at IQE Silicon. The acid will be transported to the new wet station in five litre bottles and one bottle only will be kept in a bunded storage area. For any en-route spillage the current procedures for dealing with spills will apply.

The used acid will be disposed of in the Wetbench which will be connected to the existing acid drain and treated with the current water treatment plant. It is expected that the amount of acid used will not exceed 500ml per day.

### *Bottled Gases*

Gases will be stored in the existing gas bunkers prior to use. The existing controls of storage and handling gas bottles to and from the gas bunkers will be applied. Gases will be transferred to the clean-rooms using existing procedures and controls.

The gases, when being used by the reactor, will be stored in gas cabinets within the clean room, once again the existing procedure of shutting off the gas supply at source should any leak be detected will apply.

### *Source Chemicals*

Source chemicals will be kept in an extracted fire proof cabinet within the existing gas bunkers. They will be kept in labelled delivery containers in an extracted fireproof cabinet within the gas bunker and monitored with smoke / fire detectors. Within the reactors the source chemicals will also be monitored in the same way.

### *Substrates*

Substrates will be stored in appropriate labelled boxes within storage racks within the stores area or within the cleanroom.

### *Reacted Material*

Gases and source chemicals used in the reactor will either be collected in the CS Gas Scrubbing System or deposited on reactor parts. The CS system is fitted with a hydride gas break through detector that will identify when hydride components in the gases and bubblers have nearly exhausted all the resin. Enough resin is provided to complete the run prior to a resin change. The MO elements are undetected but the system is designed such that the hydride resin will be exhausted well before the MO removal resins. Under normal operating conditions the CS system will ensure the following output:

TBAs, TBP, TESB, TMGa, TMAL, TESn, TMIn, DEZn,  
Si<sub>2</sub>H<sub>6</sub>

TBAs (Tertiarybutylarsine) < 0.01 mg/m<sup>3</sup> (as As)  
TBP (Tertiarybutylphosphine) < 0.1 ppm (as PH<sub>3</sub>)  
TESB (Triethylantimony) < 0.5 mg/m<sup>3</sup> (as Sb)  
TMGa (Trimethylgallium) < 3 mg/m<sup>3</sup> (as Ga<sub>2</sub>O<sub>3</sub>)  
TMAL (Trimethylaluminum) < 2 mg/m<sup>3</sup> (as Al)  
TESn (Tetraethyltin) < 0.1 mg/m<sup>3</sup>  
TMIn (Trimethylindium) < 0.1 mg/m<sup>3</sup> (as In)  
DEZn (Diethylzinc) < 2 mg/m<sup>3</sup> (as Zn)  
Si<sub>2</sub>H<sub>6</sub> < 5 ppm

### **Waste Disposal**

- i. HF will be disposed of using the existing acid treatment plant or in the case of out of date material it will be returned to the supplier.
- ii. Substrates will be collected in a sharps bin and disposed of using existing Hazardous waste rules.
- iii. Equipment residues deposited on components will be sent for cleaning at approved vendors currently used by IQE Europe.
- iv. Used CS resin beds will be sent to CS for refurbishment where the waste disposal will be monitored in accordance with the latest appropriate environmental BKM.
- v. Used bubblers will be returned to the appropriate bubbler vendor in supplied packaging.

### **Material Usage & Volume Storage**

#### *Substrates*

It is expected that the maximum number of substrates required will be no more than 75 of any type – these being restocked in boxes of 25 when the store level drops below 50. It is expected that no more than 400 substrates of all types be used in any year.

#### *HF*

The maximum usage should not exceed 2 litres a week but in reality, the usage will probably be significantly lower than this.

#### *Bottled Gases*

One bottle of disilane will be kept in stores and one on the reactor – one bottle will probably last at least two years. IQE Silicon plan to use the minimum amount that can be economically purchased with a shelf life of two years (hopefully less than a standard bottle size of 7500 litres).

Three forming gas bottles will be kept in stores and one on the reactor – One bottle will be used per month (Each bottle is about 3500 litres).

#### *Bubblers*

The table below identifies approximate usages of material per annum and the maximum bubbler size allowable on the reactor. It is expected that the only times bubblers will be stored in the gas bunker is when it arrives awaiting to go on a reactor, having been ordered as the previous bubbler is due to expire – thus minimising stored material on site.

| Material | Approx Use Per Annum | Maximum Bubbler Size |
|----------|----------------------|----------------------|
|----------|----------------------|----------------------|

|      |      |       |
|------|------|-------|
| TBAs | 1kg  | 1.5kg |
| TBP  | 700g | 1kg   |
| TESb | 100g | 200g  |
| TMIn | 100g | 200g  |
| TMGa | 100g | 200g  |
| TMAI | 100g | 200g  |
| TeSn | 10g  | 100g  |
| DeZn | 10g  | 100g  |

As a result of the new R&D facility at IQE Silicon there will be two new emission points to air. The two emission points will serve the R&D facility only and are not a continuous process.

The first new emission point serves the CS resin bed which takes out all significant residues from the reactor.

The second new emission point serves the oven for baking clean filters before inserting them in the reactor.

The emissions from these new emission points do not emit pollutants at which emission limits would be appropriate or necessary. When the site next applied for a permit variation then these emission points can be added to the permit as emission points only with no associated limits or monitoring.

There will be no new emissions to water with existing permitted storage locations and procedures adopted.

IQE Silicon will ensure that the technician from Cardiff University is fully trained to IQEs procedures ensuring compliance with the permit EPR/BJ6968IY.

### **Returns for 2017**

The following returns below have been received by NRW:

- Six monthly as required by Form A1 - No comments;
- Six monthly as required by Form S1 – No comments;
- Annual as required by Form A2 – No comments;
- Annual as required by Form E1 – No comments.

In line with the requirements of permit condition 4.1.3 there is a requirement for annual improvement targets that have been reported including:

- 17.1 for the successful transition to ISO 14001:2015;
- 17.2 for a 5% reduction in raw materials that was not achieved;
- 17.3 for efficient energy usage where LED lightning will be completed in 2018;
- 17.4 for climate change levy agreement reporting 21.71MWh per m2 against a target of 5.55MWh per m2.

**END**

## EPR Compliance Assessment Report

**Report ID:  
CAR\_NRW0032875**

**This form will report compliance with your permit as determined by an NRW officer**

|                        |                           |            |            |
|------------------------|---------------------------|------------|------------|
| Site                   | St Mellons EPR/BJ6968IY   | Permit Ref | BJ6968IY   |
| Operator/Permit holder | IQE Silicon Compounds Ltd | Date       | 26/01/2018 |

### Section 3 – Enforcement Response

You must take immediate action to rectify any non-compliance and prevent repetition. Non-compliance with your permit conditions constitutes an offence and can result in criminal prosecutions and/or suspension or revocation of a permit. Please read the detailed assessment in Section 2 and the steps you need to take in Section 4 below.

Other than the provision of advice and guidance, at present we do not intend to take further enforcement action in respect of the non-compliance identified above. This does not preclude us from taking enforcement action if further relevant information comes to light or advice isn't followed.

### Section 4 – Action(s)

This section summarises the actions identified during the assessment along with the timescales for when they will need to be completed.

| Criteria Ref.       | CCS Category | Action required/advised                                                                                                                                                                                                                                                                                                                                                                               | Due Date   |
|---------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| See Section 1 above |              |                                                                                                                                                                                                                                                                                                                                                                                                       |            |
| B5                  | C3           | Site to provide details of the updated maintenance checks as well as ensuring the accident management plan, planned preventative maintenance, fugitive emissions plan and the EMS are updated. The requirements of the Regulation (EU) No.517/2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 should be taken into consideration, specifically Chapter II Containment. | 29/03/2018 |

## Section 5 – Compliance notes for the Operator

To ensure you correct actual or potential non-compliance we may

- Advise on corrective actions verbally or in writing
- Require you to take specific actions verbally or in writing
- Issue a notice
- Require you to review your procedures or management system
- Change some of the conditions of your permit
- Decide to undertake a full review of your permit

Any breach of a permit condition is an offence and we may take legal action against you

- We will normally provide advice and guidance to assist you to come back into compliance either after an offence is committed or where we consider that an offence is likely to be committed. This is without prejudice to any other enforcement response that we consider may be required.
- Enforcement action can include the issue of a formal caution, prosecution, the service of a notice and/or suspension or revocation of the permit.

**See our Enforcement and Civil Sanctions guidance for further information**

This report does not relieve the site operator of the responsibility to

- Ensure you comply with the conditions of the permit at all times and prevent pollution of the environment
- Ensure you comply with other legislative provisions which may apply

### Non-compliance scores and categories

| CCS category | Description                                                          | Score |
|--------------|----------------------------------------------------------------------|-------|
| C1           | A non-compliance that could have a major environmental effect        | 60    |
| C2           | A non-compliance which could have a significant environmental effect | 31    |
| C3           | A non-compliance which could have a minor environmental effect       | 4     |
| C4           | A non-compliance which has no potential environmental effect         | 0.1   |

**Operational Risk Appraisal (Opra)** - Compliance assessment findings may affect your Opra score and/or your charges. This score influences the resource we use to assess permit compliance.

## Section 6 – General information

### Data protection notice

The information on this form will be processed by the Natural Resources Wales (NRW) to fulfil its regulatory and monitoring functions and to maintain the relevant public register(s). The NRW may also use and/or disclose it in connection with:

- Offering/providing you with its literature/services relating to environmental matters
- Consulting with the public, public bodies and other organisations (eg. Health and Safety Executive, local authorities) on environmental issues
- Carrying out statistical analysis, research and development on environmental issues
- Providing public register information to enquirers
- Investigating possible breaches of environmental law
- Assessing customer service satisfaction and improving its service
- Freedom of Information Act/Environmental Regulations request

The NRW may pass it on to its agents/representatives to do these things on its behalf. You should ensure that any persons named on this form are informed of the contents of this data protection notice.

### Disclosure of information

The NRW will provide a copy of this report to the public register(s). However, if you consider that any information contained in this report should not be released to the public register(s) on the grounds of commercial confidentiality, you must write to your local area office within fifteen working days of receipt of this form indicating which information it concerns and why it should not be released, giving your reasons in full.

### Customer charter

#### What can I do if I disagree with this compliance assessment report?

If you are unable to resolve the issue with your site officer, you should firstly discuss the matter with officer's line managers using the informal appeals procedure. If you wish to raise your dispute further through our official Complaints and Commendations procedure, phone our general enquiry number 0300 065 3000 (Mon to Fri 08.00 – 18.00) and ask for the Customer Contact team or send an email to [enquiries@naturalresourceswales.gov.uk](mailto:enquiries@naturalresourceswales.gov.uk). If you are still dissatisfied you can make a complaint to the Public Services Ombudsman for Wales. For advice on how to complain to the Ombudsman phone their helpline on 0845 607 0987.

#### Welsh Language

If you would like this form in Welsh please contact your Regulatory Officer.