

Compliance Assessment Report CAR_NRW0039200

Permit being assessed: BR9685IX.

For: Barry Silicone Plant, held by Dow Silicones UK Limited

At: Cardiff Road, Barry, Vale of Glamorgan, CF63 2YL.

Type of assessment carried out: Site Inspection, Reason: Routine.

On 16/11/2021 between 09:00 and 16:00.

Parts of permit assessed: Monitoring Returns

NRW Lead Officer: Geraint Harris, accompanied by Antony Leakey.

Report sent to: Jude Sartor, Environmental Specialist on 20/01/2022.

1. Summary of our findings (full details in section 4)

Part of permitted activity assessed (criteria)	Assessment result	Permit condition
E1 - Emissions - Air	Assessed (A)	
E2 - Emissions - Land and groundwater	Assessed (A)	
E3 - Emissions - Surface water	Assessed (A)	
E5 - Emissions - Waste	Assessed (A)	
F2 - Amenity - Noise	Assessed (A)	
G4 - Monitoring and Records, Maintenance and Reporting - Reporting and notification to Natural Resources Wales	Assessed (A)	
B5 - Infrastructure - Plant and equipment	Assessed (A)	

Result types are explained in more detail in the 'Important Information' section below.

Total number of non-compliances recorded	Total non-compliance score
0	0

How we use the non-compliance score to calculate your annual fee is explained in the 'Important Information' section below.

2. What action is required?

No action required.

3. What will happen next?

Any non-compliance we have identified and recorded on this form is an offence. It can result in criminal prosecution and/or suspension or revocation of your permit.

At this time, we do not intend to take any further action.

This statement does not stop us from taking additional enforcement action if further relevant information comes to light or offences continue.

4. Details of our assessment

Dow Silicones UK Ltd reporting and compliance assessment review – 20/01/2022

Site Visit

Since the previous CAR Form was issued, NRW and Dow have participated in an online MS Teams discussion (10th November 2021) followed by an onsite visit (16th November 2021). The purpose of this was to discuss the ongoing compliance of the Barry site and to allow Senior Officer Geraint Harris to become familiar with the site as part of the regulatory handover.

Permit variation

In July 2021 Dow received their newly varied permit. Dow applied to vary this permit to expand their Very Low Viscosity Fluids (VLVF) and packaging stretch project to make a wider range of VLVF materials and install a new self-contained drum and Intermediate Bulk Container (IBC) filling machines. This will increase the siloxane release rate from two existing vents (on the 5042 rework tank and the 5000 storage tank) to make them authorised release points on the permit. Volatile siloxanes are classified as VOCs in the upcoming European Waste Gas Best Available Techniques (BAT) Reference Document (BREF), and it is expected that releases above a set mass threshold will need to be abated. However, there is currently no standard or recognised abatement techniques available for mitigating volatile siloxane releases. As an interim protection measure (ahead of the EU Waste Gas BREF), the operator proposes that the 150,000kg VOC bubble limit remains but is expanded to also include volatile siloxanes. The vent changes involved in this variation will involve a total increase in siloxane air emissions of approximately 10%. In terms of total VOCs the increase is approximately 6%. As part of the variation a new permit limit for Total Organic Carbon (TOC) for the existing emission point W1 has been introduced.

Wastewater treatment failure

As mentioned in the previous CAR Form, high copper levels within the effluent discharge to river were attributed to several upsets within the wastewater treatment plant. Since the incident Dow have reviewed all aspects of the treatment plant to identify all the critical elements of the plant's operation. As a result of this they feel they have a better understanding of the system and have made some improvements and plans to make the system more robust. These upsets and improvements were discussed during an MS Teams meeting and subsequently observed during a site visit.

The primary causes and discussions were attributed to the build-up of solids and hence copper throughout the various stages of the treatment system. The accumulation of solids within the Brine Ponds coupled with reduced residence time, resulted in high solids carry over into the E-tanks. These 'DPR' like black solids were witnessed floating on the top of the E-Tank and Brine Pond during the site visit on the 16th November 2021. Such solids originate from the quench system and were further added to by a pump seal failure releasing spent bed material. These both discharge into the 400 Brine Pond and then onto the E-Tanks. The problem of solids 'carry over' along the treatment stages was further exacerbated by the reduction in the E-Tank levels to approximately 21% resulting in the effluent level reaching the part of the tank containing concentrated solids.

Dow have since been investigating a number of ways to reduce these solids throughout the treatment process. One such method is the 'slurrying up' of the effluent within the E-Tank and forcing it through a temporary filter press system. This method has shown to reduce the solids within the E-Tank as well as the 'carry over' to the remaining treatment process. During the site visit, floating solids similar to those observed in the E-Tank were not observed further downstream in the wastewater treatment process. This suggests the filter press system is effective in its ability to remove the DPR like solids. However, it is Dow's intention to try to reduce the solids further upstream. A successful 6-week trial involving the use of a second filter press located

at the Brine Ponds was completed. Due to its success in preventing solids carry over, Dow have been exploring the permeant installation of this equipment. This also has the added benefit of reducing the copper content of the effluent further up the treatment stream, since the effluent at this stage is alkali which enhances the precipitation of copper. It is understood that additional resources including newly appointed operators would be required to run this equipment. Therefore, the lead time is approximately 3 months. In addition to what has been mentioned already, Dow's longer-term goal for this and other sites around the world is to try to prevent or significantly reduce the solids at source, including looking into the quenching process.

Action: Dow to give an update on the control of solids at the next compliance meeting.

In September a few issues occurred with the rakes of the clarifiers within the Primary Wastewater Treatment area. There are three clarifiers and hence three rakes within this area. During this period two out of the three rakes failed and came offline. This resulted in the operation of one of the tanks without the use of the rake. This was observed during the site visit on the 16th November. Upon looking down into the tank a significant amount of settled sludge build-up could be seen at the centre and base of the clarifier. No solids carry over was seen during this time. However, Dow believe that 'solids' carryover from these clarifiers was a contributory factor to the elevated solids and copper levels further down the wastewater treatment process. During the MS Teams meeting, Dow believe that it will take 10-12 days to bring the first clarifier rake back online and then following its successful operation the second rake can be extracted and fixed. Dow were initially unaware of the rake failure since the system was designed to monitor each rakes torque. A healthy functioning rake and a stationary (broken down) rake will both read zero torque. Therefore, during this period there may have been an increase in solid material carry over to the secondary wastewater treatment.

Action: Dow to provide an update at the next compliance meeting, on the reinstatement of the rakes and the installation of a monitoring regime for the healthy operation of the clarifier rakes.

At the time of the elevated copper incident there was a build-up of scum on top of the bioreactor effluent. This coincided with the failure of the submerged pumps also located within the bioreactor. Upon analysis by Dow, the bioreactor scum had a high Silicon and dissolved copper component. The exact source of the silicon is not known but it is thought it may be from both DPR and silicone fluid sources. Functional Analysis identified highly crosslinked siloxane similar in structure to DPR gel. Since the primary treatment system was dealing with significant volumes of DPR like solids at the time it is thought that this scum is a result of the carryover of solids through the treatment process. Upon identifying the submerged mixers failure, Dow installed floating mixers in Bioreactor 200. These were observed during the site visit on November the 16th. Dow are currently considering using the floating mixers on a more permeant basis provided that they provide adequate mixing throughout the tanks.

Action: Provide update on the permanent use of the floating mixers and their ability to provide adequate mixing throughout the bioreactor tanks.

Following the treatment in the bioreactor, the resulting effluent is gravity fed into two clarifiers and then onto the final discharge point. These clarifiers utilise a series of valves which work in conjunction with a floating rake to remove floating solids to a holding tank. This system has always seen small quantities of scum floating on the top but following the incident mentioned previously these levels have increased. This situation was further exacerbated by the failure of the spring-loaded flat valves on both clarifiers. The sheering of one of the valves has left a hole in the tank causing the scum collection tank to quickly become overwhelmed with effluent. These valve failures coupled with the issues further upstream in the treatment process have contributed to the copper breach in the final discharge effluent. As a temporary measure, Dow have employed the use of a manually handled vacuum to extract these solids. This has helped to reduce the solids within the final effluent.

Action: Dow to provide an update on the installation of new valves on both the clarifiers and an update on the planned preventative maintenance of these valves in the next compliance meeting.

It is clear that there are numerous factors that contributed to the elevated copper levels. Another aspect that was investigated was the bioreactors pH and the Magmex system. For effective copper removal the pH of the effluent needs to lay within the alkali region, preferably between pH 8 and 9. During the episode of high copper effluent the pH was measured between pH 6 and 6.5. This coupled with the increase in copper, as a result of the excessive solids within primary treatment, resulted in poor copper removal within the bioreactor stage. In the past a Magmex system was employed to control the pH of the bioreactor. However, according to Dow "the Magmex operation has deteriorated over the last 3 years and replaced with regular manual addition of caustic. Magmex purchase in 2018 was 271Te, 2019 was 150Te, and Zero in 2020. The Magmex tank was found to be fouled on internal walls with a thick separated layer at the tank base". During the meeting on the 10th November Dow informed NRW that they had recommissioned the Magmex and it was back online. During this work they targeted a higher pH which resulted in a significant reduction in the levels of copper in the final effluent. In doing this Dow have effectively introduced a second hydroxide precipitation step within the wastewater treatment.

Action Dow to provide an update on the use of the Magmex and the associated planned preventative maintenance in the next compliance meeting.

As mentioned in CAR_NRW0038379 the loss of the treatment plant coupled with very heavy rainfall resulted in effluent storage capacity reaching critical levels in January 2021. At the time the submerged pumps, used to pump effluent from primary into secondary treatment, were offline for maintenance and were replaced with temporary diesel pumps. Unfortunately, Dow were not aware that one of the diesel pumps had failed, further reducing the treatment capacity and adding to the capacity problems. Since then, Dow have tried to improve the WWTP resilience and reliability to minimise risk of wastewater accumulation. During the MS Teams meeting Dow explained that a significant storm would typically add 100m³ an hour of water to the treatment facility on top of their normal 200m³ an hour processing. As it stands the WWTP is comfortably capable of treating approximately 250m³ an hour. Dow have set themselves a target of being able to handle 300m³ an hour in an instant. As a result of this they are aiming to keep the associated tanks as low as possible and have implemented this within the plant's KPI's

Action: Provide an update in the next compliance meeting.

W413 low pH storm water discharge

During the containment escalation event in January 2021, storm water was inadvertently discharged into the River Cadoxton via release point W2 below the permitted limit of pH 6. Zinc concentration was also elevated above the maximum permitted level. The root cause investigation identified the passing isolation penstock valves allowing acidic process effluent to leak from the abnormally flooded chemical sewer into W413 spill pond as the cause. An offline continuous sampling pump meant that a detection measure was not operational during the discharge, although procedures allowed for this eventuality and spot sampling was taking place to check on discharge water quality. This resulted in early detection of the issue. The valves were not subject to a planned maintenance schedule. This oversight was deemed critical given the importance of isolation of the acidic chemical sewer from the storm water during normal operating conditions as well as during upset conditions such as this. Dow was asked in the previous CAR form to inspect the failed valves and identify and review the inspection and maintenance of any other similar valves.

Following this request, Dow have tried on a few occasions to schedule maintenance on the passing W413 valves. W413 storm water sump is normally in continuous use with water collected transferred to the wastewater treatment plant. Therefore, it is proving difficult to safely enter this space. It has been very rare

that Dow have discharged this water to the river as it is normally contaminated. There is a project planned to understand causes of contamination of storm water into W413 storm sump and hopefully this can address issues at source so that water quality can meet permit W2 discharge requirements. Fixing the passing valves will be part of the Improvements with this project. Until the project is complete there will be no discharge of water from W413 to river and Dow are currently treating all site storm water within the waste treatment facility. Dow have a clearly defined project with copper and historical contamination from the landfill and also some storm sewers that need to be converted to chem sewers. This project is being developed and has funding. In the finishing area they are still defining which of the storm sewers are major contributors to siloxanes and suspended solids within the finishing area storm water. Dow aim to look at source to find what is causing this issue with the possible aim of turning some storm water sewers into chem sewers if needed. However, it is BAT to segregate clean surface water from effluent systems where possible, but containment and treatment of contamination is essential. Therefore, a change of designation may be justified if elimination at source is not practical or cost effective. Due to the extra capacity already mentioned, the WWTP is able to comfortably handle this extra capacity.

Action: Dow to provide an update on the above work at the next compliance meeting

Dow have significantly improved their knowledge and understanding of the wastewater treatment plant as a result of the various issues that occurred over the past 12 months. A business sponsored operational excellence program including senior Dow employees was implemented late last summer. This involved a review of the site's documentation including the EMS and KPI's with the aim of improving the all aspects of the wastewater treatment plant. Furthermore, Dow have also increased the number of operators working on the plant by two. To help with the plant's resilience an agreement with Cogmoors and Suez has been made to help reseed the Bioreactor. This should reduce downtime to a number of days rather than weeks.

A new limit for TOC for the effluent discharge to river was introduced into the newly varied permit. The location of the continuous TOC analyser was observed during the site visit. This will be reviewed in more detail upon undertaking the next water-based OMA audit. However, Dow state that the analyser is running well, and the results are well below the 100mg/l limit.

Coper Bioavailability

The River Cadoxton was sampled monthly from June 2020 to March 2021 to assess the bioavailable copper concentration and to try to understand the low dissolved Oxygen levels observed downriver of the effluent discharge point. The bioavailability tool employed by Dow to assess the bioavailability of copper and its subsequent results were discussed during the MS Teams meeting in November. The results showed that the 1 ppb bioavailable copper limit was never exceeded during this investigation. As for the dissolved oxygen concentrations over this period. High salinity and low DO were a concern, therefore, Copper, dissolved oxygen (DO), chloride, calcium and pH levels were recorded during the following scenarios:

- High flow high tide
- Low flow high tide
- Sampling 100 metres up & down river of the effluent discharge point

The DO was found to be slightly higher down river than upriver. This may be attributed to the turbulence created as effluent travels off site and into the Cadoxton. The TOC, chloride, calcium and copper levels were higher downstream which is in line with the effluent discharge composition. During periods of low chloride, the DO was higher. However, the flow was higher at this time (winter) and so the DO would be higher as a result of increased water turbulence. There appeared to be no significant correlation between DO and chloride levels. Samples were deliberately tested during hightide and showed no significant increase in chloride levels indicating that the tidal flaps were working. The assessment has since concluded, and DOW

have reverted back to sampling twice yearly as required by the permit. Furthermore, improvements to the wastewater treatment including the increase in pH in the bioreactor have already increased copper removal from the effluent.

Eel Regulation Compliance

Dow have some outline costs for some complaint submerged pumps with integral filters.

Action: Please provide an update in next compliance meeting

Chlorosilane Waste

Following an incident at the Currenta incinerator in Germany on the 27th July 2021, Dow have had to store surplus chlorosilane waste in road tankers at the Barry site. The main route for disposal of this waste is Veolia's incinerator in Ellesmere Port with the Currenta incinerator disposing of the surplus. Over the summer Veolia's capacity to incinerate Dow's waste was lower than what Dow was generating and so a surplus of waste in tankers occurred. At its peak the Dow site was storing around 14 tankers, but this has dropped to 10 due to reductions in production volumes. Dow have been investigating ways they can prevent such stockpiling from occurring in the future, as well as adding resilience to the waste disposal options, especially in the event that the incinerator at Veolia stops. During this work Dow were able to work with Veolia to increase the processing rate up to 43% higher for the two weeks preceding the MS teams meeting in November. Dow have also been investigating other potential disposal sources within the UK and Europe including cement kilns and other incinerators. During the site visit Dow enquired if there was any scope for the "R" code only policy to be relaxed to allow use of European incinerators with "D" code's only. Upon being asked by Dow to check with NRW's waste International Transfrontier Shipment of Waste (TFS) team, this waste can only be sent abroad if the recipient can offer an 'R' code. This therefore significantly reduces their disposal options. One option that was discussed was looking into reducing the amount of chlorosilane waste by putting it through the quenching process on the site. Dow believe this is a possible option, However, it would require significant buy in from senior management along with a capital investment.

Action: Dow to provide an update on chlorosilane quantities and disposal routes in the next compliance meeting.

Action: Dow to investigate if the COMAH report mentions transitory/temporary or slightly longer-term storage of waste chlorosilanes in road tankers.

Noise

Dow have completed several noise surveys conducted both within and outside of their permitted boundary. The two most recent include a survey by Hunter Acoustics, commissioned by Dow to carry out night-time noise surveys around the perimeter of the Barry Chemical/Industrial complex site on Cardiff Road, Barry on 30th June to the 01st July 2021. The second being a three-day internal audit using Sound Camera hardware (21st to 23rd October). The latter survey generated an Environmental Impact Noise Ranking Report by measuring the noise levels with a Cirrus 161D noise meter. Dow need to review all the previous reports to identify if the noise sources recorded by the sound camera relate to the external noise recordings, i.e do any of the acoustic camera tonal sources match the off site ones? Furthermore, Dow should produce a plan on how they can make improvements on site to those areas highlighted in the Ranking report. Of note is the small compressor / pump on the edge of the W822 plant next to the fence line. The noise is tonal with no obstructions between it and the fence. This particular noise was very noticeable during the site visit in November. Therefore, using this report coupled with past work, a plan for tackling the dominant offsite noise sources should be produced.

ACTION: Dow Silicones to review all noise surveys undertaken so far to investigate if the noise sources

identified within the site relate to those measured outside of the boundary. Dow should also develop a plan to tackle the noise sources identified within the Environmental Impact Noise Ranking Report. Please provide an update on both of these actions in the next compliance meeting.

Monitoring returns

Monitoring returns for Q2, Q3 and Q4 in 2021 were received as required by reporting condition 4.2.3 of permit BR9685IX. No non-compliance with permit conditions were identified.

The annual return for 2021 was received on Tuesday 18th January 2021. There were no non-compliances identified within the report. Primary energy usage and the corresponding CO₂ production were the lowest since 2008. Water usage was the lowest since 2016 and waste generation was similar to 2020 but significantly less than the preceding years. As per CAR_NRW0035136 the Performance Index report is no longer included as part of this submission. Therefore, a review into the performance index of these parameters will be conducted during a future site visit.

Groundwater monitoring data review

A spreadsheet containing landfill borehole sampling results and a report of copper and Trimethylsilanol trending for the period Q3 2021 was received. The trends show a decreasing concentration of copper especially from borehole A2D. This may be a result of the completed capping works on the closed landfill on the Barry site.

END.

If you have any queries about this report, or to discuss completion of any actions, please contact the NRW Officer named above.

Important information

Legal status of this report

Your permit is issued to you under the Environmental Permitting Regulations. You have a responsibility to comply with the conditions of your permit and prevent pollution/harm of the environment. You must also ensure that you comply with any other relevant legislation that may apply to your site's operations.

This report explains the findings of our assessment and any action you are required to take. We categorise non-compliance using our guidance for assessing non-compliance at regulated sites.

When we find potential non-compliance/s we will normally give you advice on how to maintain compliance.

To correct non-compliance, we may:

- require you to take specific actions
- issue a notice
- review the conditions of your permit.

Any advice and guidance we give will be without prejudice to any other enforcement response that we consider may be required.

Assessment results and non-compliance categories (used in section 1):

Assessment result	Description
Assessed (A)	Assessed or assessed in part, no evidence of non-compliance found
Action only (X)	Action only relating to the activity assessment
Ongoing (O)	Ongoing non-compliance, not scored

Non-compliance category	Description	Score
C1 Major	Potential to have a major, serious, persistent and/or extensive impact or effect on the environment, people and/or property	60
C2 Significant	Potential to have a significant impact or effect on the environment, people and/or property	31
C3 Minor	Potential to have a minor or minimal impact or effect on the environment, people and/or property	4
C4 No environmental impact	Non-compliance at a regulated site that cannot foreseeably have any impact on the environment, people and/or property	0.1

How we use assessment scores

The number and severity of non-compliances recorded in a year will affect your annual subsistence fee the following year. A non-compliance factor is added to your site's Operator

Performance Risk Appraisal (OPRA) score when we calculate your fee to reflect the additional resource we use to assess permit compliance.

What are suspended scores?

In line with our guidance, we may suspend scores for up to six months to allow time for remedial action to be taken. Suspended scores will be re-instated if the action is not completed.

Full list of Industry and Waste action criteria (used in section 1 and 2):

A: Permitted activities

- A1 Specified by permit

B: Infrastructure

- B1 Infrastructure – Engineering for prevention and control of emissions
- B2 Infrastructure – Closure and decommissioning
- B3 Infrastructure – Site drainage engineering (clean and foul)
- B4 Infrastructure – Containment of stored materials
- B5 Infrastructure – Plant and equipment

C: General management

- C1 General management – Staff competency/training
- C2 General management – Management system and operating procedures
- C3 General management – Materials acceptance
- C4 General management – Storage, handling, labelling and segregation

D: Incident management

- D1 Incident management – Site security
- D2 Incident management – Accidents, emergency and incident planning

E: Emissions

- E1 Emissions – Air
- E2 Emissions – Land and groundwater
- E3 Emissions – Surface water
- E4 Emissions – Sewer
- E5 Emissions – Waste

F: Amenity

- F1 Amenity – Odour
- F2 Amenity – Noise
- F3 Amenity – Dust/fibres/particulates and litter
- F4 Amenity – Pests/birds and scavengers
- F5 Amenity – Deposits on road

G: Monitoring and records, maintenance and reporting

- G1 Monitoring and records, maintenance and reporting – Monitoring of emissions and environment
- G2 Monitoring and records, maintenance and reporting – Records of activity, site diary/journal/events
- G3 Monitoring and records, maintenance and reporting – Maintenance records
- G4 Monitoring and records, maintenance and reporting – Reporting and notification to Natural Resources Wales

H: Resources efficiency

- H1 Resource efficiency – Efficient use of raw materials
- H2 Resource efficiency – Energy efficiency

Enforcement response

Any permit condition non-compliance is an offence and we may take legal action against you. Action we take can include prosecution, serving a notice on you and/or suspension or revocation of your permit. See our Enforcement and Sanctions Guidance for further information.

Data protection notice

You should make sure that anyone named in this report knows that the information it contains will be processed by Natural Resources Wales to fulfil its regulatory and monitoring functions and to maintain the relevant public register(s).

We may also use and/or disclose the report in connection with:

- offering or providing you with our literature or services relating to environmental matters
- consulting with the public, public bodies and other organisations (e.g. 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 our service
- Freedom of Information Act or Environmental Information Regulations requests.

We may also pass it on to our agents or representatives to do these things on our behalf.

Disclosure of information – this report will be available to view on-line

If you think this report contains commercially confidential information that should not be placed on our public register, you must contact your local Natural Resources Wales office within **fifteen working days** of receiving this report, using the contact details in the accompanying email or letter. You must give a full explanation of why it should not be added to our public register, including specifying which information is commercially confidential. We will assess your request and respond to you within 20 working days to let you know if we agree to your request.

What do I do if I disagree with the report or have a complaint?

If you disagree with this compliance assessment report, you should contact the lead officer without delay to discuss your concerns.

If you are unable to resolve the issue with the lead officer or their line manager you should contact our Customer Contact team on 0300 065 3000 (Monday to Friday 08:00 – 18:00), or email enquiries@naturalresourceswales.gov.uk for details of how to raise your dispute further through our Complaints and Commendations procedure.

If you are dissatisfied with our response, you can contact the Public Services Ombudsman for Wales by phone on 0300 7900203 or by email at ask@ombudsman.wales

Welsh Language Standards

We are committed to establishing Natural Resources Wales as a naturally bilingual organisation. We will provide compliance reports in your preferred language.