

Compliance Assessment Report CAR_NRW0041190

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: Other.

On 13/12/2022 between 11:00 and 13:00.

Parts of permit assessed: Effluent Treatment Plant

NRW Lead Officer: Geraint Harris.

Report sent to: Jude Sartor, Environmental Specialist on 16/02/2023.

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

Part of permitted activity assessed (criteria)	Assessment result	Permit condition
C2 - General Management - Management system and operating procedures	Action only (X)	
G1 - Monitoring and Records, Maintenance and Reporting - Monitoring of emissions and environment	Action only (X)	
G1 - Monitoring and Records, Maintenance and Reporting - Monitoring of emissions and environment	Action only (X)	
G1 - Monitoring and Records, Maintenance and Reporting - Monitoring of emissions and environment	Action only (X)	
G1 - Monitoring and Records, Maintenance and Reporting - Monitoring of emissions and environment	Action only (X)	
E3 - Emissions - Surface water	C3 Minor	Permit condition 3.1.2
C2 - General Management - Management system and operating procedures	C3 Minor	Permit condition 1.1.1
G4 - Monitoring and Records, Maintenance and Reporting - Reporting and notification to Natural Resources Wales	Action only (X)	
E4 - Emissions - Sewer	Action only (X)	
E1 - Emissions - Air	Action only (X)	

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

Total number of non-compliances recorded	Total non-compliance score
2	8

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?

Criteria	Action needed	Complete by
C2	please respond to action 1 below by 30/03/2023	30/03/2023
G1	Action 2: Dow shall undertake a review of the current ETP analysis and compare it with previous analysis. If any variations are found, please provide details of these along with justifications for achieving suitable environmental control. Please update NRW by 30/03/23.	30/03/2023
G1	Action 3: Dow shall undertake a review of all the ETP related monitoring to identify if any additional monitoring and controls can be added to their Pi System to help provide more real time analysis of the ETP's health. Please update NRW by 30/03/23.	30/03/2023
G1	Please respond to action 4 by 30/03/2023	30/03/2023
G1	Please respond to NRW by 30/03/23.	30/03/2023
E3	Please respond to actions 1-5 by 30/03/2023	30/03/2023
C2	Please respond to actions 1-5 by 30/03/2023	30/03/2023
G4	Please amend your Q4 report so that the parenthesis related to W1 BOD emissions is removed.	30/03/2023
E4	Action 7: Is this high BOD related to the recent plant updates? If not, please investigate why the BOD is so high. Due by 30/03/2023.	30/03/2023
E1	Action 8: Please provide an explanation why monitoring points A123 and A124 have not been monitored. Due by 30/03/2023.	30/03/2023

Action criteria codes are listed in the 'Important information' section below.

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

EPR/BR9685IX

I received a phone call on the 7th of December 2022, from the Environmental Specialist at Dow, informing me of issues with the biological activity within Dow's secondary wastewater treatment plant (SWWT). At the time of this call Dow hadn't exceeded any permit ELV's relating to the effluent treatment plant (ETP), however, they had to make some essential evasive actions to prevent such a scenario from occurring. The main issue was the loss of biological activity within SWWT which significantly impacted Dow's ability to treat their effluent. Consequently, Dow were urgently looking into partially or fully reseeded the bioreactor. Dow asked if it was acceptable to use biomass from another industrial process and/or municipal process and if there were

any further controls NRW would stipulate Dow have, on their effluent, given the origin of the alternative biomass. The following response was given “You can reseed with whatever you like as long as it can cope with your effluent, which may be a problem with sewage works biomass - not acclimatised to the methanol”. Over the following days Dow identified several potential sources for reseeded their bioreactor. Finally, it was identified that the biology from a local papermill had the most desirable properties.

On the 12th of December Dow was informed, by their neighbours, that a significant amount of foam was exiting their ETP outfall (W1) on the Cadoxton River. Pictures taken by the neighbour during a weekly pipeline inspection, were subsequently shared with NRW. A fallen tree had caused the foam to build up approximately 60 metres downstream of emission point W1. NRW received a Schedule 5 Notice for this release into the Cadoxton. The foam was described as floating activated sludge from the biological wastewater treatment process. Dow approximate between 200-500kg was released over the course of 5-6 days. Dow state that this incident would not have been identified by daily composite sampling as the quantity of activated sludge released would have been within permitted suspended solids parameters. After identifying this release, Dow stopped the release of effluent from outfall W1.

Three officers from NRW, including myself, attended the incident the next day and walked the stretch of the Cadoxton from Wimborne Road to Dow’s W1 outfall. The only area where foam was witnessed was approximately 60-100 metres downstream of W1. Upon standing over emission point W1, treated effluent was seen entering the Cadoxton, however this contained very little foam. A build-up of foam could be seen downstream where a tree had fallen into the river. At the time of this observation the Cadoxton was flowing towards the sea and there were no obvious signs of any impact to the environment.

I then Drove over to Dow’s reception and met their Environmental Specialist for a discussion and tour of the treatment plant. At this point Dow were still trying to ascertain why they had lost a significant amount of biological material into the river. It was explained that during this event they had witnessed a substantial amount of floating material within their SWWT clarifiers. This was thought to be attributed to the formation of filamentous bacteria within the bioreactor. Filamentous bacteria play a critical role in floc formation within ETPs. Activated sludge settles most efficiently when it contains a moderate number of filaments which provide structure for the floc and aid in the stripping of the water column. The floc cannot form properly if there are too few filaments, and the floc cannot settle properly if there are too many. Filamentous bacteria are able to predominate under low dissolved oxygen, low F/M (food to microorganism ratio), low nutrient conditions or high sulfide levels. However, it is thought that low F/M is the predominant cause of bulking in most wastewater treatment plants. The optimum pH in the aeration tank should be between 7.0-7.5. pH. Values below pH 6.0 may favour the growth of fungi and cause filamentous bulking. Temperature changes are also thought to influence the growth of filamentous bacteria. When water temperature reaches lower ranges (below 15°C), the metabolism and growth of helpful microorganisms can slow down extremely, which in turn slows the contaminant breakdown process. In addition to this, filamentous microorganisms can experience more growth during the winter, causing other potential problems such as a decrease in DO or an upset in pH and F/M.

During this incident a wash out of solid material from the ETP system did occur. The buoyant biological material (filamentous bacteria) were able to pass through the weirs of the clarifiers and onto the final effluent chamber. During my visit it was this chamber which exhibited the most foam, however it is also a very turbulent chamber. Located within this final effluent chamber is a turbidity sensor and a suspended solids (SS) sensor. Both in-situ probes operate in a continuous mode to analyse the effluent and redirect any out of spec treated water into the emergency storage tank. At the time of observing, the effluent’s suspended solids approached the ELV limit and was redirected to the emergency tank, however, within a few minutes the effluent fell back within spec and was redirected back to river again. Upon viewing the final discharge point

(W1) at the river only small amounts of foam associated with turbulent water could be seen entering the watercourse. A daily composite is also taken and analysed and used for compliance purposes. Dow haven't reported any breaches of their SS limits within the composite samples during this incident.

Notwithstanding the suspended solids levels within the final effluent, condition 3.2.1 of Dow's permit states "Emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution. The operator shall not be taken to have breached this condition if appropriate measures, including, but not limited to, those specified in any approved emissions management plan, have been taken to prevent or where that is not practicable, to minimise, those emissions".

It has been considered that the release of this biological material has caused a visual amenity pollution as a minimum. The effects of biological material on a watercourse, especially during slack periods, can include lowering the dissolved oxygen in the water making oxygen less available for fish, their eggs as well as the macroinvertebrate fauna. At this point it is unclear what impact the release of this material may have had on the dissolved oxygen concentration of the impacted watercourse. No obvious signs of impact were witnessed on the 13th of December, however, no detailed investigation including an invertebrate survey was conducted.

Extended plant maintenance activities are known to result in poor wastewater treatment plant (WWTP) performance upon restart. This is especially the case when the normal plant activities are shut-down, depriving the WWTP of normal wastes. In particular, secondary or biological treatment systems often suffer frequent shock loadings during maintenance activities, resulting in poor biological health and performance issues. Problems include excessive foaming, settleability problems, TSS carryover and ultimately ammonia and/or COD removal and associated discharge issues. This appears to be the case with DOW's WWTP. During normal operations the influent is typically saline in nature due to the treatment of the waste acidic influent with quick lime. During shutdown periods, this flow of acidic wastewater was significantly reduced causing the influent into the SWWT to become more akin to fresh water than saline. This period of reduced salinity was longer than usual due to a planned extended maintenance shutdown period. Upon start up the increased flows coupled with the reintroduction of saline conditions is potentially part of the reason for the treatment plant upset. In conjunction with the changing wastewater properties the ambient air temperature also reduced significantly, with temperatures dropping below zero degrees Celsius over an extended period. During normal operations Dow will waste a portion of the activated sludge to maintain a healthy microbe age and help with copper discharge levels. During this extended shutdown period the wasting of sludge was ceased to try to maintain an optimal MLSS concentration. This would have caused the microbe age to increase significantly. The combination of temperature changes, changeable influent loadings and sludge age are most likely the reason for the plant upset in December.

It's important that operators of a WWTP manage the fluctuations of the influent to cope with the seasonal variations (summer/winter), start-up and shutdown procedures, Cleaning-In-Place (CIP), continuous and/or batch operations, seasonal campaign productions (e.g. fine chemicals) and other conditions that can affect the composition of the influent. Effective wastewater management on a large chemical site requires knowledge of the relevant parameters in the local situation, e.g. mass flows, concentrations of specific single substances or sum parameters, temperature, pH, as well as flexibility in handling different circumstances and relations between different wastewater streams coming from the production plants/units.

Since extended plant maintenance activities frequently result in poor WWTP performance upon restart, NRW would expect an operator to have put in place additional measures to avoid or reduce plant upset upon restart. Such measures would include

Utilisation of a stream inventory/register to identify any parameters that may have an influence on the performance of the WWTP

- An incremental approach to increasing influent flow
- An increase in microscopic observation to “head off” any bulking episodes
- Enhanced or additional monitoring to give advance warning of step changes within the ETP.
- Increased visual inspections of various aspects of the WWTP and outfall.

Action 1: Dow shall undertake a review of the above measures against current operating procedures used when restarting the treatment plant, implement additional appropriate measures and update NRW by 30/03/23.

An Analytical review and data evaluation report of Barry WWTP dated 8th- 9th of February 2017 stated the following ETP analysis was taking place. “MLSS/pH/Temperature in the reactor are measured by means of in-situ probes. On a daily base, the probe readings are recorded by the operator and a lab sample is taken and analysed on pH and MLSS at the WWTP. On a weekly base a spot sample is taken and analysed by an external lab on MLSS/MLVSS (organic fraction of suspended solids), Total Copper and Dissolved Copper. Sludge blanket is measured by means of an on-line sludge level detector”.

Action 2: Dow shall undertake a review of the current ETP analysis and compare it with previous analysis. If any variations are found, please provide details of these along with justifications for achieving suitable environmental control. Please update NRW by 30/03/23.

Action 3: Dow shall undertake a review of all the ETP related monitoring to identify if any additional monitoring and controls can be added to their Pi System to help provide more real time analysis of the ETP’s health. Please update NRW by 30/03/23.

As well as the above statement, the report states “The organic load to the biological plant is measured by means of a STIP BOD-analyser. On a daily base one ‘spot’ value is captured. With this value and the influent flow (m3/day) a daily BOD load is calculated (kg BOD/day). The Methanol addition is adjusted based on the BOD-probe reading. Frequency of checking/adjustment is not known at this moment.”

Action4: is this still the method for adjusting the methanol addition? If this is not the case how was methanol adjusted during the shutdown period? Please update NRW by 30/03/23.

NRW expect operators to have an upset recovery program or plan in place that accounts for scenarios where the biological activity has been affected. This could include keeping a small volume of bacterial products on hand for upset conditions. The bacteria products usually have a relatively long shelf life- 6 months to a year, so having a small amount on hand can be a good idea if your plant has the potential for upset conditions or wide swings in influent loading such as site wide shutdowns.

Action 5: Dow shall undertake a review to see if the above approach or an alternative can be implemented going forward. Please update NRW by 30/03/23.

With regards to the second section of condition 3.2.1. the operator shall not be taken to have breached this condition if appropriate measures have been taken. Such measures should include regularly monitoring the occurrence and abundance of filaments in their sludge, since the microbial population in activated sludge changes slowly in most cases, generally requiring 2-3 sludge ages to radically change, this microscopic observation needs to be performed only at weekly intervals. However, during a period of bulking onset or changes to the plant’s operations, including changes to the influent properties, a daily observation of the activated sludge is warranted. NRW would expect operators to increase their monitoring and observations of the treatment plant and outfalls during critical periods such as post shutdown start-ups. Unfortunately, this wasn’t the case, it was only when a neighbour discovered the foam that Dow were aware of the loss of microbes to the river. Therefore, due to low impact of the pollution the incident is considered to be a **minor**

category 3 breach of permit condition 3.1.2. Dow's management system should identify and minimise the risk of pollution from all operations on site, in this instance Dow failed to operate the ETP in a way that prevents or reduces the chance of pollution. Due to low impact of the pollution the incident is considered to be a **minor category 3 breach of permit condition 1.1.1.**

NRW are pleased to see that throughout this incident Dow have employed a considerable amount of resources and effort to identify the root cause and add resilience to the WWTP going forward.

Annual Returns

NRW received the Q4 and annual returns on the 26th of January 2023.

Because of the WWTP upset mentioned above a number of water intensive operations were shutdown in Q4. Therefore, there were no emissions and hence no monitoring for the emissions points listed below. This is not considered a noncompliance since there were no emissions being emitted.

- A41 (monthly Hydrogen Chloride and Chlorine) –
- A85 (quarterly Siloxanes)
- A43 (quarterly Hydrogen Chloride)

The results for A41 Particulates, Carbon Monoxide, and oxides of Nitrogen are required to be reported as one hourly average monitored annually. Within this report Dow have reported them as time weighted averages of all the monitoring throughout the year. During a Microsoft Teams meeting on the 8th of February 2023, Dow shared the individual monitoring results for each of the parameters. Both the carbon monoxide and oxides of nitrogen were all found to be within compliance. The results for A41 particulates have exceeded the limit on a number of occasions but these have already been accounted for in previous CAR forms. NRW are pleased to see that the most recent particulate monitoring returns for A41 are well within the compliance limits.

The result for outfall W1 (Discharge from effluent treatment plant) has a high BOD result (21mg/l vs a permit limit of 20mg/l). Dow appeared to have incorrectly applied the following condition 'No spot sample shall exceed the limit value by more than 50%. Limit is 20 mg/l so allowable spot sample result is 30 mg/l'. Unfortunately, this condition only applies to the BOD monitoring of the W2 outfall. The reason why the footnote for BOD in the recent version of Dow's permit, is no longer applicable to the W1 BOD emission point, is due to the application of the higher TOC limit of 100mg/l. This annual average is justified due to Conditions A and B of footnote 4 of Table 4.1: BAT-AELs for direct emissions of TOC, COD and TSS to a receiving water body, being met. When asked, Dow provided the BOD method statement developed by ALS. This statement includes a segment on BOD measurement uncertainty and states "The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2, which gives a level of confidence of approximately 95%. Uncertainty of Measurement is 23.60%". Having checked this level of uncertainty against other reports submitted to NRW this appears to be within an acceptable range. Therefore, taking into account this 23.60% uncertainty, the BOD measurement of 21mg/l is not considered a breach of the permit.

Action 6: Please amend the report to reflect the permit requirement. Due by 30/03/2023.

Action 7: Is this high BOD related to the recent plant updates? If not, please investigate why the BOD is so high. Due by 30/03/2023.

Dow received a varied permit on the 28th of July 2021. This permit variation has allowed for an increase in 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. These are included as emission point references A123 and A124

in the updated permit. This is due to making lower viscosity products which have a lower boiling point. The permit requires quarterly monitoring with a method to be agreed with NRW. No monitoring returns for these emission points have been provided since the varied permit was submitted.

Action 8: Please provide an explanation why these monitoring points have not been monitored. Due by 30/03/2023.

Energy, Waste and Water

The amount of energy and waste used in 2022 and hence the amount of CO2 produced was the lowest since 2008. This is mostly due to the reduction in production for the year. However, these figures are not reported against a specific unit out and so it is not known if they represent an improvement in efficiency at all.

Total water use has reduced year on year since 2017. As the amount of water extracted from the Cadoxton has decreased the amount of towns water used on site has increased. The reason for this is related to compliance with the EEL regulations where Dow need to update their extraction pumps to comply with such regulations.

Groundwater monitoring data review

Dow has been undertaking groundwater level monitoring at up to nine locations on a six monthly basis across the landfill site since 2015. A spreadsheet containing landfill borehole sampling results and a report of copper and Trimethylsilanol trending for the periods Q1 and Q3 of 2022 was received. The results for both substances fall within the usual trends. These reports have been accepted.

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.