

Compliance Assessment Report CAR_NRW0042477

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: Site Inspection,

Reason: Routine.

On: 23/08/2023 between 09:00 and 16:00.

Parts of permit assessed: Effluent Treatment Plant.

NRW Lead Officer: Geraint Harris.

Report sent to: Jude Sartor, Environmental Specialist , on 20/09/2023.

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

Part of permitted activity assessed (compliance criteria)	Assessment result	Permit condition
IR3A - Emissions and monitoring - Emissions to water, air or land	C3 Minor	Permit Condition 3.1.2

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

Total non-compliances recorded	Total non-compliance score
1	4

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
IR3A	Dow should also undertake an internal audit of their sampling regime to review the sampling location suitability and sample system hygiene arrangements	01/12/2023

Compliance 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 Silicones

EPR/BR9685IX

NRW attended the Dow Silicones site on the 23rd of August 2023 to discuss ongoing compliance and the progress being made with regards to previous incidents.

Effluent Treatment Plant

After several plant upsets in December 2022 and January 2023 two compliance assessment reports (CAR_NRW0041511 and CAR_NRW0041190) were issued containing several actions for Dow to respond to. Responses to these actions were discussed during the onsite visit on the 23rd of August 2023 with the answers summarised in the text below.

Primary Wastewater Treatment Plant (PWWT)

Removal of solids and particulates is a critical aspect of Dow's treatment plant. Stopping solids from entering the treatment plant will be very beneficial, since it will reduce solids carry over through the plant and increase the storage capacity, however, this will require a lot of resource, time and expense. Dow have spent a considerable amount of time and money removing the excessive amounts of solids from within E-Tank 4401. The incident relating to these solids and Dow's storage capacity are detailed in car form CAR_NRW0038379. Solids entering the PWWT are primarily from the quenching of DPR with lime. Dow are investigating ways the solids carryover from the quench process can be reduced or stopped altogether.

During the meeting on the 23rd of August NRW were shown pictures of a now empty E-tank (E4401). After removing all the solids Dow then removed the liner for inspection. Once the repairs to the base have been completed the liner will be put back in place and the tank brought back online. This will allow 6600m³ of effluent storage capacity to come back online. The base of the tank contains pipework designed to perform an online clean and keep the effluent moving to prevent the build-up of solids. This is also being inspected and will be utilised to try to prevent solids from settling at the base.

The purpose of the rubber lined E-tanks (4401 & 4400) is to provide surge capacity and to smooth out changes in flowrate and pH through the primary treatment process for better control of final discharge quality. While E-Tank E4401 was being cleaned the E-Tank 4400 was being used as the sole receptor for the effluent from the site. E-Tank 4400 hasn't been cleaned to date but will require a periodic clean out and inspection soon. As it stands the de-watering filtration bags used to clean these tanks are not being operated on site. Dow are currently looking into ways they can reduce the build-up of solids within both tanks going forward.

Dow have stated in the past that "the set-up for proper equalization is not fully utilized – with two 6600 m³ tanks available, one should be used for equalization, the other for diversion. Equalization should primarily be based on organic loading to the WWTP, so requires incoming load measurement (TOC or BOD) and a flexible level control (driving a fixed load to the plant causes varying levels in the EQ tank) – in case of too high organic or toxic load the incoming wastewater should be diverted to the second tank". Dow are currently considering how best to utilise these tanks to ensure a consistent effluent is fed through the ETP. This will also be enhanced with the setup of a new a TOC smart alarm mentioned later.

During future turnaround periods Dow have stated that they intend to dose the PWWT stage with acid to keep a much more "standard" feedstock through the ETP processes. This should have the benefit of

maintaining salinity and conductivity within the effluent, which should assist in creating a stable environment for the microbes and potentially avoid any upset downstream in the secondary wastewater treatment plant (SWWT).

Dow have been looking at alternative ways of neutralising the acid effluent entering the primary treatment tanks. They have looked at methods such as liquid lime and caustic soda to investigate if the retention time and excessive solids generation can be reduced. However, the current lime slaker method appears to be the most financially beneficial.

Dow have set up torque meters associated with their rakes in the primary clarifiers. These meters are linked to their PI system so that high torque values related high solids build up in the clarifiers can be observed remotely and acted upon promptly.

Secondary Wastewater Treatment Plant (SWWT)

Dow now have a way of recording real-time MLSS data with an associated key performance target (KPT) on their digital control screen (DCS), allowing them to observe real-time fluctuations in their microbial population. This is also being coupled with weekly microscopic analysis to enable Dow to understand and hence control the various microbial populations within their bioreactor. Dow are also progressing with a TOC smart alarm linked to their DCS and Pi systems which looks at influent TOC, effluent TOC and the number of oxygen peaks in the bioreactor to establish if there is a need for adjusting methanol, further sampling and/or diverting the effluent. Dow's Tech centre are also investigating feed to mass ratios. MLSS should be the measurement to trigger the need to change to methanol feed, not flowrate. Dow also have a suspended solids meter within the Final Settlement Tanks (FST's) to alert the operators when there is solids carryover from the reactor. The suspended solids meter is linked to the DCS and have an associated KPT, DCS alarm and trip.

During the recent ETP upsets the Magmex system was highlighted as a vital process in the removal of metals from the effluent. Dow are in the process of installing a new transmitter to the Magmex Tank so they can remotely observe the tank level and look at trends on DCS and in Pi. Dow's response regarding the Magmex system is as follows: "All pipework surrounding the Magmex dosing system has been completely replaced with new pipes. System currently has 2 pumps - usually duty and standby, the system is currently operational with 1 pump available, 2nd pump in workshop (taken out a few days ago, to be returned to the plant as soon as fixed). 2 spare Magmex pumps on order. The key thing with this system is to keep the Magmex moving and flowing. Pump issues have prevented this in the past. Having duty and standby pumps plus spares on site should significantly reduce the potential for blockages to become an issue. Also being able to monitor the level in Magmex Tank (when the new level instrument is installed) will enable the ops to detect a change in rate of delivery and identify flow issues more easily".

Dow also intend to clean and overhaul the 'standby' bioreactor so that the current operational one can be drained and overhauled. To do this Dow will require improvements to their oxygen delivery system to ensure oxygen is able to be pumped to either bioreactor.

With regards to the reseedling program NRW are pleased to see that Dow have added some resilience to the SWWT. However, NRW recommend Dow continue to explore other options like the drying and storing approach mentioned in the appendices below, since this will add further resilience to the SWWT. SWWT process flows have been reconfigured, so it is now able to be put on full recycle whilst maintaining methanol feeds if required. This is useful during times of low levels and also when there are operational issues".

Since the recent plant upsets are associated with the extended turnaround period, Dow's restart process and optimum operating parameters during a site turnaround are under development with their Tech Centre. Dow have a better understanding of how this turnaround period affects their treatment plant and have a method for testing the salinity, conductivity and MLSS. Dow intend to dose the effluent within the primary wastewater

treatment plant with acid to ensure a constant or "standard" feedstock is delivered to the neutralisation pits and onto SWWT. During the meeting Dow discussed how they intend to bring the effluent treatment plant into the forefront of any future turnaround plans to ensure that the start-up process is controlled in such a way to minimise the risk of overloading the microbe's ability to treat.

Rotary Disc Filter

The rotary disc filter has now been removed from the site. The plant has operated compliantly since its removal and so there is no plan to install it permanently. Should Dow need to reinstall it then the relevant management of change procedures and connections are ready for use therefore allowing for a quick implementation.

High pH to River

The bespoke manhole covers have arrived at Dow ready for installation.

Noise

Dow have completed several noise surveys conducted within and outside of their permitted boundary. Please see CAR Form CAR_NRW0039941. Dow was asked to produce a plan to make improvements to the highest ranked Noise area. During the compliance meeting on the 11th of August 2022 Dow had not only created a plan but had actively targeted some of the highest scoring areas. During the meeting on the 23rd of August Dow explained that the remaining high score areas would involve significant investments to reduce the noise levels. Since there hasn't been noise complaints received by either Dow or NRW for a significant amount of time, Dow aren't planning on addressing these areas. However, Dow will continue to operate their fixed fence line noise monitoring with sound recording triggered by levels above 60dB.

W413 Passing valves

During a containment escalation event in January 2021, non-compliant storm water was inadvertently discharged into the river Cadoxton via release point W2(CAR Form CAR_NRW0038379). The root cause investigation identified the passing of 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. 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 to inspect the failed valves and identify and review the inspection and maintenance of any other similar valves. W413 storm water sump is normally in continuous use with water collected transferred to the wastewater treatment plant. Therefore, it proved difficult to safely enter this space. Dow have since replaced the analyser pump and are intending to replace the trip valve and analyser in the future. In the past it was very rare that Dow discharged this water to the river as it was typically contaminated. Dow have been working to understand the causes of contamination of storm water into W413 storm sump. Dow have identified the two most contaminated sewers and subsequently identified the upstream sources of this contamination. All of the associated sewers will be cleaned and sampled as part of the planned preventive maintenance. As a result of this work some storm sewers may be permanently turned into chem sewers.

Energy Recovery Unit (ERU)

The incident involving the ERU is detailed in CAR Form CAR_NRW0040390. There were several actions Dow

planned on undertaking following their root cause analysis of the incident. During the meeting on the 23rd of August 2023, it was clear that Dow have been working to try to improve their understanding of the chemistry of the CRU and how that relates to high particulate matter emissions from the ERU. Dow are currently in the process of installing a new more accurate FBR final vent analyser within the CRU. Additionally, Dow are planning on installing a new sampling system on the CRU so that they can sample and then analyse the CRU's inlet and outlet gases. Dow have then got the option of using this information to undertake an R&D project to explore the CRU reaction chemistry at the lab scale in Midland, USA, with the help of Dow's global tech centre. Since the incident Dow have increased their HCl feed rate to the CRU, to try to improve the conversion of hydrosilanes into chlorosilanes along with other control measures. Consequently, there have been no further exceedances of the ERU's particulate matter ELV'S. Dow are also planning on investigating the CRU reactor bed change out frequency/maintenance following the completion of the CRU studies mentioned above.

During the ERU particulate exceedances Dow also experienced a high differential pressure (DP) alarm (via the DCS high DP alarm) on the 12th of December 2021 (CAR Form CAR_NRW0040776). They determined that this was most likely an issue with the demister pad. When they carried out maintenance, they found the demister pad dislodged & displaced at an angle in the column due to a screw being loose which in conjunction with excessive silica build up in the scrubbers resulted in a high DP. Dow was asked to respond to a series of questions related to the DP in CAR Form CAR_NRW0040776, the responses can be seen in annex 1. With the storage of spare demister pads on site, Dow should be able to respond to a DP incident much quicker. Dow also have a troubleshooting standard operating procedure for the scrubbers which requires flushing with demineralised water. Dow also have set up planned preventive maintenance for ERU equipment cleaning, especially the vent stack which hasn't been opened since commissioning. The non-compliances related to this incident are described in CAR Form CAR_NRW0040390, no additional non-compliances are being considered at this point.

Suspended Solids Breach

Dow reported that a sample taken on the 12th of February 2023, resulted in the suspended solids 95th percentile >30mg/l limit being exceeded. A previous incident involving an exceedance in suspended solids levels had been identified as potentially spurious due to an inadequate cleaning regime associated with the composite effluent sampler (CAR Form CAR_NRW0036927). However, on this occasion Dow reported that the composite sampler was clean and that for the full 24 hours the two independent online turbidity/SS analysers were reading < 11mg/l. For this most recent exceedance Dow reported that "as soon as the analysis results came back a grab sample was taken (11:30 the following day) and both SS and Copper were very low, as was the final effluent composite the day before and after". Dow have stated that they have not been able to ascertain where the contamination occurred. Dow reported that "It happens very occasionally, the lab tech noticed that the sample looked very orange and contaminated. The sample was run as normal, but unsurprisingly was high in SS and Copper. Both suspended solids probes on the plant read extremely low for the entire day". During the meeting on the 23rd of August Dow were still unsure of the origins of the contaminated sample. The analytical results of the sample do not show any evidence of methanol and so it is unlikely that this sample was mixed up with the samples taken from upstream in the ETP. Dow have not been able to ascertain the root cause of this contamination. Since all the other treatment plant process parameters were operating as required and the continuous turbidity/SS analysers were measuring low the S.S. result is considered a **minor category 3 non-compliance against permit condition 3.1.2**. The fact that the sample representing the final effluent was orange and contaminated is concerning. If contaminated samples have happened before, then to avoid any similar situations from occurring in the future, Dow should review their sampling procedures. Dow should ensure that the system of controls for handling, submitting and storing samples from the point of collection through the laboratory is as robust as possible. Dow may want to think

about addition additional checks when sampling, including recording observations of the samples being taken and recording that the sample containers are suitably clean prior to use.

Action 1: Dow should also undertake an internal audit of their sampling regime to review the sampling location suitability and sample system hygiene arrangements. **Due 1st December 2023.**

Annual Returns

The annual returns were received on the 30th of March 2023 as agreed with NRW. The returns have been reviewed and are as expected. The report has been accepted.

A report or reports on the performance of the activities over the previous year was received, as required by permit condition 4.2.2, on the 21st of March 2023. The report read as expected with some of the more pertinent points listed below:

- Production was lower in 2022 than the last few previous years, this can be seen also with lower waste and lower operation of the CHP Cogen plant.
- A slight shift from Energy recovery to Incineration as we are no longer able to send waste to Germany for Energy recovery as it has to be incinerated.
- WWT operational improvements have been very successful in reducing the Copper and Zinc in the effluent to river over the last couple of years

Q1 and Q2 Returns

The Q1 returns were received on the 27th of April 2023. The only two exceedances were related to copper (CAR_NRW0041511) and suspended solids (see above, suspended solids breach). All other parameters within compliance.

The Q2 returns were received on the 28th of July 2023. All results accepted; no non-compliances found.

Q1-2023 Landfill Groundwater Sampling Results

The impact of bulk storage of materials on the landfill and its performance was monitored in quarter 1 of 2023. The quarterly sampling plan satisfies both SPMP (Site Protection and Monitoring Programme) and Landfill licence requirements. The results show most sampling this quarter fell within the normal range of the previous sampling data. No boreholes showed significant TMS concentrations this quarter. The only 2 boreholes displaying a significant value for copper was CP1S and CP1M. It has not been possible for Dow to sample either of these boreholes since Q3-2020 and this time only a small volume of liquid could be obtained which may not be fully representative.

Annex 1

Action 1: Are the readings prior to the DP rise true? If so, have you done an investigation into what may have caused the sudden sharp rise? **Due January 16th 2023.**

Dow Response: Yes - when we identified the high dP (via the DCS high dP alarm) we determined that this was most likely an issue with the demister pad. When we actually carried out the maintenance, we found the demister pad dislodged & displaced at an angle in the column due to one of the holding down screws coming loose - thus resulting in a high dP. During installation of the new demister pad/element we verified that this was secured adequately to prevent the holding screws from becoming loose/allowing the demister pad to move from position.

Action2: having established that there was a problem with DP, did you arrange to have a look inside the column to investigate the cause and consequence? **Due January 16th 2023.**

Dow Response: As above, the high dP indicated that the demister pad had either blocked (due to silica build up) or damaged. As we did not have a spare we determined the best approach was to wait for the new demister element to arrive before completing inspection & replacement.

Action 3: Since the demister pad is part of the abatement infrastructure. Did Dow not anticipate that a failed demister would cause emissions problems? **Due January 16th 2023.**

Dow Response: The 2 columns in the ERU are there to remove HCL and Chlorine gases. The demister pad at the top of the Chlorine column is there to A) Primarily, minimise liquid droplet carry over to the induced draft fan and B) to a much lesser extent, try to remove some larger particle size silica. There is no designated equipment present in the ERU to remove the bulk of the fine silica formed in the combustion chamber. We would require an Ionising wet scrubber (IWS) to achieve this.

Action 4: Given the importance of the demister pad and the 8-9 months long lead time for a replacement, what measures were put in place to try and limit the impact this may cause on ERU emissions? **Due January 16th 2023.**

Dow Response: From a process perspective we carried out backflush/wash downs of the demister pad multiple times using demin water to remove excessive silica build up. We maintained online cleans to manage ERU combustion chamber fouling and carried out offline ID fan cleans as required. The carbon block interchanger (5317) was also cleaned insitu and the wastewater flows were increased to introduce higher fresh cooling water make up, whilst most of these actions are focused on the upstream scrubbing system this minimised the quantity of Silica within the system and therefore reduced the rate of build-up within the demister element. We have followed up with the supplier of the demister pad and have been told that the lead time is actually only 6 weeks. Based on the lack of understanding as to how quickly the demister could block once a dP increase is seen, the decision has been taken to hold a spare. We are now in the process of setting this up as a stock item in our system and then the PO will be placed to order it.

Action 5: Please provide all the operating procedures related to the demister pad and differential pressure system that were used around December 2021. I would like to know what the triggers for the dp alarm were and what the actions were following a spike? **Due January 16th 2023.**

Dow Response: Attached is SOP Section 10 (Troubleshooting Procedure for ERU) – Page 47 shows the alarm and operator response to high dP, as mentioned in Action 4 – we carried out a washdown of the demister pad multiple times to try and reduce the dP across the demister pad however due to the failure being the demister pad dislodged this didn't reduce the high dP. This confirmed that there was a larger issue which initiated the replacement of the demister pad.

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.

If your assessment result in Section 1 is suspended, what does this mean?

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 compliance criteria (used in section 1 and 2):

1. Management

- IR1A – General management
- IR1B – Finance (only applicable to Landfill)
- IR1C – Energy efficiency
- IR1D - Efficient use of raw materials
- IR1E - Avoidance, recovery and disposal of wastes produced by the activities
- IR1F - Multiple operator installations

2. Operations

- IR2A – Permitted activities
- IR2B – The site
- IR2C – Operating techniques
- IR2D – Technical requirements
- IR2E – Improvement programme
- IR2F – Pre-operational conditions
- IR2G – Landfill engineering (only applicable to Landfill)
- IR2H – Waste acceptance (only applicable to Landfill)
- IR2I – Leachate levels (only applicable to Landfill)
- IR2J – Closure and aftercare (only applicable to Landfill)
- IR2K – Landfill gas management (only applicable to Landfill)

3. Emission and Monitoring

- IR3A – Emissions to water, air or land
- IR3B – Emissions of substances not controlled by emission limits
- IR3C – Odour
- IR3D – Noise and vibration
- IR3E – Monitoring
- IR3F – Pests
- IR3G – Air quality management plans
- IR3H – Monitoring for the purposes of the Industrial Emissions Directive (this heading includes Large Combustion Plants)
- IR3I – Fire

4. Information

- IR4A – Records
- IR4B – Reporting
- IR4C – Notification

Enforcement response

Any non-compliance with a permit condition 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 twenty 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 to 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.