

Pettit, Andrew

From: Smith, Geoff C.
Sent: Wednesday, April 13, 2022 4:17 PM
Cc: Pollution Control
Subject: UPDATE: BELCO Progress Report and Ocean Lane Monitoring UPDATE

Good day all,

Further to the previous progress reports on the air quality, odour and soot emissions from the BELCO engines the Pollution Control Section of the Department of Environment & Natural Resources can provide the following:

- BELCO had largely satisfied most of the previous requirements that were laid out by the Environmental Authority in 2020 (*i.e.* monitoring of air quality and water tanks*) such that two new letters were sent by the Authority in July 2021 for BELCO to address additional requirements.

These requirements included:

- A. A monthly summary of air quality monitoring data relative to the Bermuda and UK/EU statutes in addition to the UK/EU air quality objectives.
 - B. A monthly summary of soot fall-out events and oil tank odours and associated complaints and mitigation measures.
 - C. Consideration of additional mitigation measures that BELCO could implement to address strong odours of exhaust fumes at Ocean Lane, Pembroke.
- BELCO have been providing monthly reports on the above items to the Environmental Authority and DENR and we can report the following:

Air Quality Monitoring

1. There have yet to be any exceedances of the 'Limit Values' of either the Bermuda or UK/EU statutes with respect to sulphur dioxide, nitrogen dioxide or other combustion products. This observation is from the measurements taken at three (3) air quality monitoring stations located at Cemetery Lane, Top of Langton Hill and Ocean Lane, Pembroke.
2. There were a total of 55 exceedances of the UK/EU Air Quality Objective 'Target Level' for 15-minute sulphur dioxide for 2021 (*i.e.* greater than 266µg/m³). These 'target values' are not yet statutes in the UK/EU and local authorities will generally work with the polluter to bring the number of exceedances down to below a threshold of 35 per year. The fact that 55 exceedances occurred in 2021 has necessitated the appropriate response by the Environmental Authority and DENR which has resulted in actions by BELCO that are reported below in points 11 to 14 below.
3. *As an aside we can report that the proposed Clean Air Act Amendment Bill for Bermuda has been approved to start the consultative process leading to drafting instructions to be approved and written into law. These amendments propose to align the air quality 'limit values' in the Bermuda Clean Air Regulations 1993 statute with both the 'limit values' and 'target values' of the UK/EU air quality statutes and objectives, respectively.*

Soot Fallout Events

4. Fallout of soot from the BELCO stack(s) has caused impacts to roofs, vehicles and property in the neighbourhood. The characteristic orange rust stains from these particles reflect the iron content that the soot is expected to pick up from the inside of the metal lined exhaust stacks.
5. Monitoring of water quality from tanks impacted by soot has shown compliance to the most stringent drinking water standards, including those of the World Health Organization (*See reference below for more details*). It is apparent from observations of some household water filters that the characteristic orange

staining is highlighting some carry over from the sediments in the water tank to some household plumbing systems.

6. The North Power Station (NPS) dual-fuel engines required further optimization to run on heavy fuel oil (HFO) and a refit to increase the combustion pressure in the cylinders (*i.e.* lengthened shims) and to change the cylinder crowns in each of the four, 14-cylinder NPS engines started in 2021 and completed at the end of January 2022.
7. Although this has reduced the amount and size of soot particles released from the stacks, the soot events still continue. DENR is assessing the situation with BELCO to identify the potential cause and to determine what further measures can be introduced to mitigate the soot.

Oil Tank Odours

8. Odours were shown to be emanating from the various small tanks and plant equipment located, adjacent to, and along St John's Road. These odours were not from any combustion process but instead from the passive vents to the liquid diesel and warmed heavy fuel oil odours (*i.e.* unburnt fuels).
9. In December 2021 BELCO installed activated carbon filters that had been designed to interface specifically to these tanks and equipment. Measurements have shown that these filters are functioning as planned.
10. However, since December there have been a couple of odour incidents from unburnt fuel in the St John's area. These events appear to have originated from the oily water separator that treats all of the waste oily water on the site and is located centrally in BELCO to the south of Cemetery Road. DENR understands that current practices at BELCO are being reviewed at the oily water separator and DENR will investigate further as this plant is also licenced under the Clean Air Act.

Additional Mitigation Measures by BELCO to Address Exhaust Emissions

11. BELCO considered what mitigation measures could be introduced to reduce the occasional exceedances of the UK/EU air quality objective for 15-minute sulphur dioxide at Ocean Lane, Pembroke. Since November 2021 BELCO has adopted a procedure of '*Partial Primary Abatement*' for some engines in order to reduce the net amount of sulphur emitted into the atmosphere (*i.e.* as sulphur dioxide).
12. When the wind is from SW/SSW direction and above 15 knots we understand that the Ocean Lane, Pembroke area is impacted by downdrafting of fumes from both the NPS and East Power Station engines (EPS). If the 15-minute sulphur dioxide air quality objective is exceeded, as realized from instant email notifications, then BELCO will start to switch some of the engines from HFO to road diesel, which has a much lower concentration of sulphur.
13. To date (Nov to Mar'22) there have been a total of five (5) discrete periods when 15-minute sulphur exceedances have occurred resulting in a total of twenty five (25) exceedances of the UK/EU air quality objective. A total of four (4) periods of partial primary abatement were introduced to address most of these periods from Nov-Mar'22. The total duration that either 2 or 3 engines were switched to, and operated on, road diesel over these four (4) periods equated to approximately 25 hours. This mitigation measure would have reduced the amount of further potential exceedances of the UK/EU air quality objective for 15-minute sulphur dioxide.
14. BELCO is currently in the process of formalising this procedure into a standard operating procedure to reduce the number of exceedances of the UK/EU air quality objective target level per year.

Apologies if some copied may find this information too technical in nature but this, we believe, is warranted based on the nature of the issues and the detailed remedial work necessary to address these issues. Furthermore, many residents being impacted by these issues have demonstrated that they are well versed in the technical issues and the remedial measures being considered.

Further updates to the public will be provided by DENR Pollution Control Section every 2 months going forward.

* Reference to previous studies are available at:

Kind regards

Geoff



Dr Geoffrey Smith

Environmental Engineer

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www.gov.bm

From: Smith, Geoff C.

Sent: Thursday, April 22, 2021 10:05 PM

Subject: RE: UPDATE: BELCO March Progress Report and Ocean Lane Monitoring UPDATE

Good day all,

Further to the February report provided last month we can report the following:

1. The monthly progress report by BELCO was received on the 16th April. Updates include:
 - a. The portable monitoring station located on Ocean Lane had reported a further three (3) exceedance of the UK Air Quality Objective of 15-minute sulphur dioxide (SO₂) bringing the total number of exceedances since January of thirty four (34) to the end of March.
 - b. Reference by BELCO to a separate reporting requirement to the Authority specific to the soot issues from the new NPS engines is made. FYI - The Authority, DENR and other parts of Government are reviewing the progress made by BELCO to date and the further changes that are proposed to be made to address the periodic soot emissions from the NPS engines. The cause of all of the soot issues have yet to be fully addressed but the mitigation measures are continuing to be made to address this issue.
2. Since the March BELCO progress report there have been a further six (6) exceedances of the UK air quality objective of 15-minute SO₂ up until 20th April, five (5) of which were on the 16th April when many complaints were received. Under the UK Air Quality Objectives the maximum number of permitted exceedances of the 15-minute SO₂ objective is 35 per year before an Air Quality Action Plan is required to mitigate the poor air quality. DENR is in consultation with UK DEFRA to comprehend how in the UK such exceedances of the UK air quality objectives are addressed including appropriate mitigation options.
3. Note that the air quality measured at stations located at the top of Langton Hill, Cemetery Lane and Ocean Lane have yet to show an exceedance of any of the 1-hour or 24-hour air quality standards of the UK and other jurisdictions for sulphur dioxide, nitrogen dioxide or particulate matter. However, the highest 24-hour SO₂ concentration of 123 µg/m³ was measured at Ocean Lane on 16th April, where the UK air quality standard is 125 µg/m³ with no more than 3 exceedances permitted per year. The current Bermuda standard for 24-hour SO₂ is 150 µg/m³.
4. The proposed amendments to the Bermuda Clean Air Regulations to align more closely with the UK air quality objectives are still underway and I will provide a further update when I have it.
5. As a follow up to the recommendations made in the water tank monitoring study DENR is in the process of procuring a turbidity/depth sensor to determine the extent of sediment being mixed into the water of tanks next to the foot valve. This will help to determine whether water quality standards could potentially be exceeded as a result of turbulence caused by heavy rain or water truck deliveries.

Kind regards,

Geoff



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Environmental Engineer

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pollutioncontrol@gov.bm; www.gov.bm

From: Smith, Geoff C.

Sent: Friday, March 26, 2021 11:34 AM

Cc: Pollution Control <pollutioncontrol@gov.bm>

Subject: RE: UPDATE: BELCO February Progress Report and Ocean Lane Monitoring UPDATE

Good day all,

Further to previous emails we have the following updates:

1. Monthly BELCO progress report for February 2021 against the requirements set by the Environmental Authority – See attached.
In this progress report you will notice that the tally for exceedances of the 15-minute sulphur dioxide limit (i.e. >266µg/m³) is up to 31 by the end of February. It is noted in the progress report that there have yet to be any exceedances of the 1-hour or 24-hour limits for sulphur dioxide or nitrogen oxides at the portable or fixed monitoring stations against either the Bermuda Regulations or from the UK Air Quality Objectives. It is further noted that we are now entering a period of more southerly winds predominating and we will update you with the results in due course.
2. I can add that there have also been a further 3 exceedances of the 15-minute Sulphur dioxide limit for March to date (i.e. 3rd and 4th March). This brings the total exceedances of the 15-minute sulphur dioxide limit to 34 for the calendar year. Under the UK Air Quality Objectives no more than 35 exceedances per year are permitted per year. In the UK places that exceed the UK Air Quality Objectives are referred to as ‘*Air Quality Management Areas*’ and either local authorities or the Environment Agency will be involved with the polluter to work towards and ‘*Air Quality Action Plan*’. DENR is in consultation with DEFRA in the UK to fully understand this proven process.
3. Government is currently in the process of amending the Clean Air Regulations to align with international standards. We will provide an update when we have it.
4. Further to the water sampling article in the Royal Gazette this week the full ‘EnviroTalk’ article can be found at: <https://environment.bm/s/851-Envirotalk-Spring-2021.pdf>.
5. With regards to the follow up work referred to in the Envirotalk article DENR is currently in the process of specifying and procuring a sensor to measure turbidity and pressure at the foot valve of a water tank. This is to determine the extent of sediments at the bottom of the tank becoming stirred up in the water during rain events and other periods that may cause sufficient turbulence in the water tank. These trials will be aimed to occur over different levels of water in the water tank.

Geoff



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From: Smith, Geoff C.

Sent: Tuesday, February 23, 2021 2:27 PM

Cc: Pollution Control <pollutioncontrol@gov.bm>

Subject: RE: UPDATE: BELCO January Progress Report and Ocean Lane Monitoring UPDATE

Good day all,

Further to the previous email I have the following updates:

1. Monthly Belco Progress Report for January 2020 against the requirements set by the Environmental Authority.
- See attached FYI.
2. Ocean Lane, Pembroke - Portable Air Quality Monitoring Station data for last week.
- Note that the emissions measured up to the previous update of the 15 February highlighted that there had been 16 exceedances of the UK Air Quality Objective Sulphur dioxide limit (i.e. 15-minute $\text{SO}_2 < 266\mu\text{g}/\text{m}^3$) with no exceedances of the 1-hour or 24-hour limit for sulphur dioxide and no exceedances for any other parameter based on the UK air quality standards.
- In the period since the 15th February to Sunday 22nd February there had been numerous complaints received from neighbours of the Ocean Lane area. However, analysis of the data revealed that there had not been any exceedances of the UK Air Quality Objectives for all gas and particulate pollutants. On the Saturday 20th February between 6am and 2pm the sulphur dioxide level was noticeably very high with a maximum of $251.7\mu\text{g}/\text{m}^3$ where the UK 15-minute limit is $266\mu\text{g}/\text{m}^3$. With the gusty conditions at the moment it is expected that the concentrations of these gases at Ocean Lane are quite variable. In the coming months more continual sustained winds may be expected to show a more representative concentration of these pollutants.

Kind regards

Geoff



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From: Smith, Geoff C.

Sent: Tuesday, February 9, 2021 2:07 PM

Cc: Pollution Control <pollutioncontrol@gov.bm>

Subject: UPDATE: BELCO Soot and Odour Complainants - Water Tank - Water Quality Report and Data UPDATE

Good day all,

Following on from the previous Government update from last October the final report from BIOS on the water tank; water quality and sediment quality has been received and has been reviewed by Government and BELCO.

The BIOS report is attached in addition to a cover letter by Government that further explains the significance of the results presented.

As provided to the public in October 2020 the water quality in water tanks close to BELCO were well within the safe limits defined by drinking water standards of UK, US, and the World Health Organisation (WHO) and, in most instances, were below the method detection limits for petroleum combustion-related contaminants.

The water tank sediment data revealed that the majority of combustion-related contaminants are derived from road-vehicle emissions, as was also apparent from the Island-wide study of water tank sediments by BIOS from 2005. The metals nickel and vanadium are associated with the fuel used at BELCO. These metals did show increased levels in the water tank sediments near to BELCO. But concentrations of nickel and vanadium in the overlying water were at safe levels and in many instances were below the detection limit of the methods used.

DENR will next focus on understanding what processes could lead to the sediment in the base of the water tanks becoming mixed with the overlying water thereby increasing the risk, of uptake via the foot valve and subsequent ingestion, of the contaminants that are known to be present in all water tanks in Bermuda.

If you have any questions on this information, which by its nature is very technical, then please contact me and I can assist.

Kind regards

Geoff



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(BCC to 75 recipient email addresses)

From: Smith, Geoff C.

Sent: Tuesday, October 27, 2020 2:36 PM

To: Smith, Geoff C. <gcsmith@gov.bm>

Subject: UPDATE: BELCO Soot and Odour Complainants - Water Tank - Water Quality Report and Data UPDATE

Good day all,

Further to the last update below please find attached the summary report and two data tables from the water tank sampling of 10 properties that was carried out recently by the Bermuda Institute of Ocean Sciences (BIOS). The text of the report should explain how to interpret the two tables of data but if you have any questions then please let me know.

Once you have read the report you can also refer to the attached information from the Department of Health that informs home owners how to maintain safe tank water with respect to bacteria.

There are also other updates on the BELCO issues that we can provide some more information:

1. The results of the pollutants present in the sediment of the above water tanks will be presented in November once all of the data has been received.
2. The leachability test of the sample of BELCO soot that was sent overseas for analysis revealed that the organic pollutants associated with soot (i.e. Poly-Aromatic Hydrocarbons (PAH's), dioxins, furans) could not be washed from the soot using water. The data did reveal that iron was present in the soot samples, as suggested by the orange rust staining that is visible on white roofs impacted by soot. This data will be fully presented with the tank sediment data later in November.
3. The portable air quality monitoring station has been deployed to Ocean Lane and has been collecting data from early October. The networking tasks to provide for automatic alerts to Government and BELCO and to allow retrospective analysis of the data is largely complete subject to some edits to the software.
4. The Environmental Authority, as part of their normal process, is currently reviewing the conditions of the operating licence for the BELCO controlled plants. BELCO's operating licence (OL-114) is issued annually with conditions and reviewed at the end of each licence period. The recent air quality issues will be taken into considerations during the deliberations of the Environmental Authority, DENR and other advisors.

If you become aware of soot fallout events or exhaust odours going forward then please continue to email DENR at pollutioncontrol@gov.bm as we have yet to identify an instrument that can detect these soot events.

You are on this email distribution group as a result of your complaints to BELCO or to Government. You have stated that you wished to receive updates from Government on how the soot and odour issues from BELCO are being addressed. Please reply if you wish to be removed from this email distribution going forward.

Kind regards

Geoff



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From: Smith, Geoff C.

Sent: Friday, October 2, 2020 10:02 AM

Subject: UPDATE: BELCO Soot and Odour Complainants UPDATE

Good day all,

I am writing to you today to provide an update on the monitoring and other requirements that the Department of Environment & Natural Resources (DENR) and the Environmental Authority have placed on BELCO. These requirements are necessary in order to understand the impacts and to address the soot fallout issues and exhaust odours in the vicinity of the BELCO site and other more remote areas that are being affected by downdrafting.

I was waiting for the article on these BELCO issues to be published in the DENR 'Envirotalk' newsletter but as this is taking longer than expected please find attached an advanced copy of the article that summarises the main issues that are being addressed.

As an update I can provide the following on the monitoring:

1. Ten water tanks were sampled from the neighbourhood by the third party, Bermuda Institute of Ocean Sciences (BIOS), for water quality analysis for comparison to the US and UK drinking water standards in addition to the World Health Organization (WHO) guidelines. The final results are due on the 4th October and these will be sent out by email to you (copied) by DENR and the Dept of Health shortly afterwards.
2. The sediments from most of the water tanks above were also sampled and sent away for analysis by BIOS and these results are due much later in October.
3. The soot collected from the inside the BELCO exhaust stack of the North Power Station engines has also sent away for analysis. This soot was collected after the major soot event in June, when BELCO had experienced some failed startups. These results will also be presented with item #1, above.
4. The portable trailer-mounted air quality monitoring station is due to be located to Ocean Lane, Pembroke, today Friday 2nd October, which is an area experiencing significant exhaust odours from the BELCO East Power Station stack as a result of the phenomenon known as downdrafting. The operation and maintenance of this monitoring station will be overseen by BIOS who will also complete data analysis with presentation to DENR. The monitoring station will be at this location for at least 6 months and additional locations will be considered at a later date.

DENR is aware that BELCO are in discussion with the NPS engine manufacturers, MAN, to understand the causes of the recent soot events and to work towards a technical solution to prevent this occurring again in the future. Some changes have already been implemented and others are due to follow and these are also about to be reviewed further by Government.

If you become aware of soot fallout events or exhaust odours going forward then please continue to email DENR at pollutioncontrol@gov.bm as we have yet to identify an instrument that can detect these soot events.

You are on this email distribution group as a result of your complaints to BELCO or to Government. You have stated that you wished to receive updates from Government on how the soot and odour issues from BELCO are being addressed. Please reply if you wish to be removed from this email distribution going forward.

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