

AERIUS Model assumptions and results

In order to determine potential N-emission impact on an environment caused by the installation, a simulation was conducted using the AERIUS Calculator Model. Simulation results are attached to this document, however to better understand the results and provide more background, we would like to present following assumptions and their justification:

The model includes 5 main emission points:

1. Trucks arrival

Trucks arrival represents a truck traffic from the motorway exit at Weteringweg. It is considered to be a heavy truck traffic operating both ways (nl. Zwaar vrachtverkeer) with a frequency of 22,7 trucks per day. The frequency is based on:

- Liquid supply material of estimated 114.000 tonnes per year, where truck loading is 30 tonnes, thus: $114.000 / 30 / 365 = 10,4$ trucks per day
- Solid supply material of estimated 6.000 tonnes per year, where truck loading is 25 tonnes, thus: $6.000 / 25 / 365 = 0,7$ trucks per day,
- Digestate disposal of estimated 23.600 tonnes per year, where truck loading is 25 tonnes, thus: $23.600 / 25 / 365 = 2,6$ trucks per day,
- Liquefied CO₂ offtake of estimated 8.800 tons per year, where truck loading is 25 tonnes, thus: $8.800 / 25 / 365 = 1$ trucks per day,
- Other types of trucks with consumables and other materials which were determined by experience are estimated as 2.920 trucks per year, thus 8 trucks per day,

As a result 22,7 trucks per day were obtained. Thus, in the new situation, a maximum of 8,256 trucks per year will also be received for the entire facility.

Given the section under consideration and the fact that it runs through a built-up section that is not heavily used, it was assumed that the vehicle would not be in traffic, so a value of 0% was assigned to this factor.

2. Company cars

These are the cars of the plant's employees that travel the access road to the plant. Therefore, the route they take is the same as the lorries in point one. An assumption based on experience was made of 12 cars per day.

3. Trucks unloading

The process of unloading the liquid feedstock from the truck into the biogas plant is much longer than the other steps and takes about 20 minutes. During this the engine is running. All trucks visiting the plant meet the EURO VI emission standard.

Therefore, assumptions used for this emission point are as follows:

- Only trucks supplying liquid materials are considered to be loading/unloading
- 114.000 tonnes per year, where truck loading is 30 tonnes, thus:
 $114.000 / 30 = 3.800$ trucks per year
- Nominal power truck engine: 339 kW; [Engine D11K460, EU6SCR]
- Partial load truck engine when running stationary: 20%
- Average unloading/loading time 20 minutes (0,33 hours)
- NO_x emission Euro VI: 0,4g NO_x /kWh

Thus, to obtain total NO_x emissions of considered source we use the following calculation:

$$3800 * 339kW * 20\% * 0,33 * 0,4gNO_x/kWh / 1000 = 34,0 \text{ kg NO}_x/\text{year}$$

4. Heating boilers

Plant uses 50.800 m³ of gas in own boilers to heat up digesters. These are 100 kW units with flue gas exhaust at 4 meter high at 100 mg/m³ of NO_x. Hence, that results in 5,1 kg per year emission of NO_x.

5. Shovels operation

On site, there is a mobile equipment used such as shovels. They are classified as Stage V, 75 – 560 kW diesel engine vehicles. They operate 2000 hours per year, with 12000 litres/year fuel usage and the AdBlue 770 litres/year AdBlue usage. These parameters results in 51,8 kg/year of NO_x emissions and 2,9 kg/year NK3 emissions.

6. Other remarks

No other sources of Nitrogen emissions were identified. All remaining heating will be electric (heat pumps).