The analyzed object is mechanical biological wastewater treatment plant with intensified nutrients removal and full sludge treatment, designed for 1,200,000 population equivalent. It has been the object of local community complaints due to odour nuisance. Taking into account results of olfactometric analyses and field inspections, sources as primary clarifiers and thermal drying plant have been selected for further WWTP odour impact assessment. It was assumed that every source emits one specified mixture of odorants, which is considered as an individual type of odour.

Table 1. Odour emissions from selected sources

<table>
<thead>
<tr>
<th>Emission source</th>
<th>Type of source</th>
<th>Odour concentration (μg m⁻³)</th>
<th>SOER (μg m⁻³ s⁻¹)</th>
<th>OER (μg l⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>primary clarifiers</td>
<td>area-passive</td>
<td>11130</td>
<td>835</td>
<td>7089918</td>
</tr>
<tr>
<td>thermal drying plant</td>
<td>area-active</td>
<td>19916</td>
<td>-</td>
<td>44636</td>
</tr>
</tbody>
</table>

The calculations using the CALPUFF model have been carried out for summer (July) and winter (November) seasons what allowed to assess odour impact range of analysed WWTP for different meteorological conditions and to determine the shape and spatial variability of odor plume. Calculations have been made for six day periods (144 hours). Input emission rates shown in table 1 were constant for both seasons. For modeling purposes two groups of meteorological data has been provided: data from ground stations (wind speed and direction, cloud height, cloud cover, air temperature, relative humidity, atmospheric pressure) and soundings data from aerological stations (atmospheric pressure altitude, air temperature, wind speed and direction with altitude at which they occurred). Model calculations were conducted for the grid size 3 x 5 km, which includes neighboring residential areas, which are exceptionally exposed to odours.

Fig. 1. Site of the study

Fig. 2. Vacuum sampler

Fig. 3. ECOMA windtunnel

Fig. 4. Dynamic olfactometer TO8

Fig. 5. Wind rose for analyzed site - May

Fig. 6. Wind rose for analyzed site - November

Fig. 7. Maximum odour concentration – primary clarifiers, winter season

Fig. 8. Maximum odour concentration – thermal drying plant, summer season

Fig. 9. Maximum odour concentration – thermal drying plant, winter season

REFERENCES


Work carried out under the project: ‘Development of a dynamic-statistical model of odour nuisance propagation in urban and industrial environments’, National Science Centre, Poland, 2015/18/P/ST8/034126.