Nutrients from sewage effluent: past and future

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Estimating nutrient emissions

Population * Emission factor

Population per 5km grid square
- 0 - 9
- 10 - 99
- 100 - 999
- 1000 – 9999
- ≥10,000

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Past based on protein intake

Past based on constant for diet plus detergent P
Estimating nutrients in effluent

Emissions * connection to sewer * (1 - loss on treatment)

<table>
<thead>
<tr>
<th></th>
<th>Raw</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
<th>P stripping</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN</td>
<td>0.75</td>
<td>0.4</td>
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<tr>
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<td>0.67</td>
<td>0.42</td>
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<tr>
<td>Nitrate as prop^n DIN</td>
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<td>0.3</td>
<td>0.9</td>
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</tbody>
</table>
Historical sewage nitrogen flux for UK
Historical sewage phosphorus flux for UK

Assumed treatment

raw sewage  primary treatment  secondary treatment

P from septic tanks
organic P
dissolved inorganic P
non-detergent P emissions
phosphorus emissions
implementation of tertiary treatment and P stripping

phosphorus flux (kt/yr)

1800 1825 1850 1875 1900 1925 1950 1975 2000
Future scenarios

**P1**: population projections from Office of National Statistics to 2089; extended in proportion to UN projections to 2100; emission and treatment factors held constant

**P2**: population as above; P stripping applied everywhere
## Future scenario results

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (million)</th>
<th>Nitrogen emissions (kT/yr)</th>
<th>Nitrate* sewage flux (kT/yr)</th>
<th>P emissions (kT/yr)</th>
<th>P sewage flux (kT/yr)</th>
<th>P sewage flux with stripping (kT/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>63</td>
<td>263</td>
<td>91</td>
<td>44</td>
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<tr>
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<tr>
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<td>283</td>
<td>132</td>
<td>63</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

NB. Phosphate dosing not included in P calculations.

*ammonium flux 10kT/yr rising to 15 kT/yr

Influent to be treated at WWTWs

Effluent flux to river/sea