

2020

Excel Spreadsheet to calculate Air Emissions

| <u>1. General Data Acetylene Production</u> | | | <u>Remarks</u> |
|--|--------------------------------------|----------|---|
| 1.1 Operating days/a | | 250 | notice: yellow coloured fields contain fixed data. For calculation, you just have to fill in all yellow coloured fields |
| 1.2 Operating hours/d | | 8 | |
| 1.3 Carbide consumption (t/a) | | 329 | |
| 1.4 Pressure (mm water column) | | 300 | |
| 1.5 Charging quantity (t/charge) | | 0,7 | |
| 1.6 Water quantity (m ³ /tCaC ₂) | | 8,7 | |
| 1.7 Water volume in circle of acetylene generation (m ³ /a) | | 2862,3 | <i>Italic</i> figures are calculated |
| <u>2. Impurities in raw acetylene</u> | | | |
| 2.1 Phosphine PH ₃ (ppm) | | 300 | |
| 2.2 Ammonia NH ₃ (ppm) | | 620 | |
| 2.3 Hydrogensulfide H ₂ S (ppm) | | 10 | |
| 2.4 Arsine AsH ₃ (ppm) | | ignoring | |
| <u>3. Carbide Dust Emission (Cyclone)</u> | | | Carbide dust emission is not relevant for closed generator |
| 3.1 Capacity (exhausting volume) (m ³ air/h) | | 3600 | |
| 3.2 Concentration of Carbide dust (mg/m ³ air) | | 45 | |
| Cyclone operation time (min) | | 1 | |
| <u>4. Acetylene production</u> | | | |
| Practical yield of acetylene Y | | 0,804 | |
| kg Acetylene per kg Carbide | | 0,327 | |
| 4.1 Acetylene (t/a) | | 107,5 | |
| 4.2 Lime 25% (t/a) | | 1223 | |
| <u>5. Emissions</u> | | | |
| <u>5.1 Charging the generator with Carbide</u> | | | |
| <u>Closed generator</u> | C ₂ H ₂ (kg/a) | 159,3 | |
| | PH ₃ (kg/a) | 0,067 | |
| | NH ₃ (kg/a) | 0,070 | |
| | H ₂ S (kg/a) | 0,002 | |
| <u>Open generator</u> | C ₂ H ₂ (kg/a) | 154,6 | replaced by carbide during charging process escaped due to the overpressure in the generator |
| | C ₂ H ₂ (kg/a) | 238,9 | |
| | PH ₃ (kg/a) | 0,16 | |
| | NH ₃ (kg/a) | 0,17 | |
| | H ₂ S (kg/a) | 0,01 | |
| | Carbide dust (cyclone) (kg/a) | 1,27 | |
| | | | |

| | | | | |
|--|--------|-------------------------|--|--------|
| 5.2 Lime pit | | | Differences in concentration (mg/l water) | |
| C ₂ H ₂ (kg/a) | | 200,361 | C ₂ H ₂ | 70 |
| PH ₃ (kg/a) | | 0,08 | PH ₃ | 0,029 |
| NH ₃ (kg/a) | | 0,09 | NH ₃ | 0,03 |
| H ₂ S (kg/a) | | 0,00 | H ₂ S | 0,001 |
| | | | | |
| 5.3 Gasholder | | | Estimation: 1% of the lime pit emissions | |
| C ₂ H ₂ (kg/a) | | 2,00361 | | |
| PH ₃ (mg/a) | | 830,067 | | |
| NH ₃ (mg/a) | | 858,69 | | |
| H ₂ S (mg/a) | | 28,623 | | |
| | | | | |
| 5.4 Overpressure relief system | | | Estimation: 1% of the lime pit emissions | |
| C ₂ H ₂ (kg/a) | | 2,00361 | | |
| PH ₃ (mg/a) | | 830,067 | | |
| NH ₃ (mg/a) | | 858,69 | | |
| H ₂ S (mg/a) | | 28,623 | | |
| | | | | |
| 5.5 Compressors/drying system/filling station | | | Estimation: 0.5% of acetylene production, ~1% in old or badly maintained compr. | |
| C ₂ H ₂ (kg/a) | | 537,3 | | |
| | | | | |
| 5.6 Cylinder testing | | | Estimation: 1% of acetylene production, which is a result from a complicated calculation | |
| C ₂ H ₂ (kg/a) | | | | |
| Acetone (kg/a) | | | | |
| | | | | |
| Acetone emission: If acetone is filled with a gas displacement device, these emissions can be neglected, if acetone vapour disperses into the atmosphere the amount of vapour can be calculated. | | | | |
| Acetone density liquid (kg/l) | A(dl) | 0,79 | Acetone emission is calculated: $A(em)=A(con) \times AcetylenexA(dv)/A(dl)$ | |
| Acetone density vapour (kg/l) | A(dv) | 0,0026 | | |
| Acetone consumption (kg/ton acetylene) | A(con) | 46 | | |
| | | | | |
| 6. Sum of emissions | | | | |
| | | closed generator | open generator | |
| C ₂ H ₂ (kg/a) | | 900,9 | | 1135,2 |
| PH ₃ (kg/a) | | 0,15 | | 0,25 |
| NH ₃ (kg/a) | | 0,16 | | 0,26 |
| H ₂ S (kg/a) | | 0,01 | | 0,01 |
| Carbide dust (kg/a) | | 0 | | 1,27 |

901,2

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