

BAT assessment – Breweries

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Environmental Inspection Planning

- Purpose of inspection
- Available information
- Understanding of production
- Environmental impact
- Focus on the key areas
- BAT assessment
- BREF notes

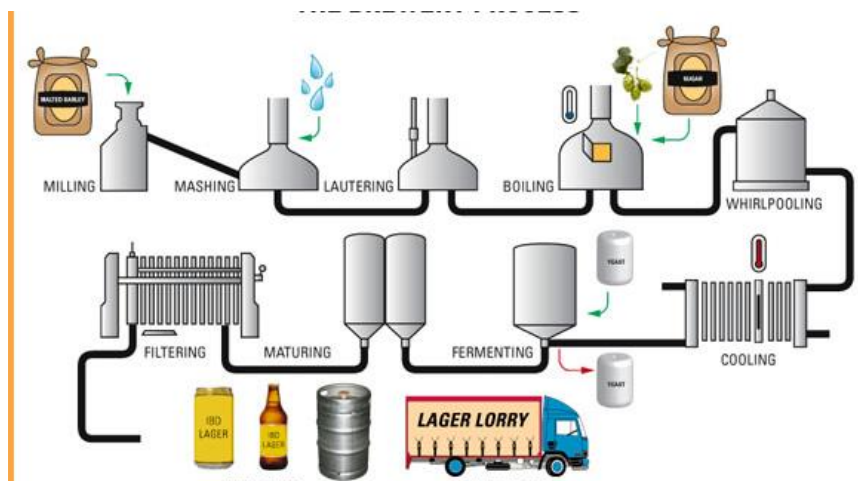


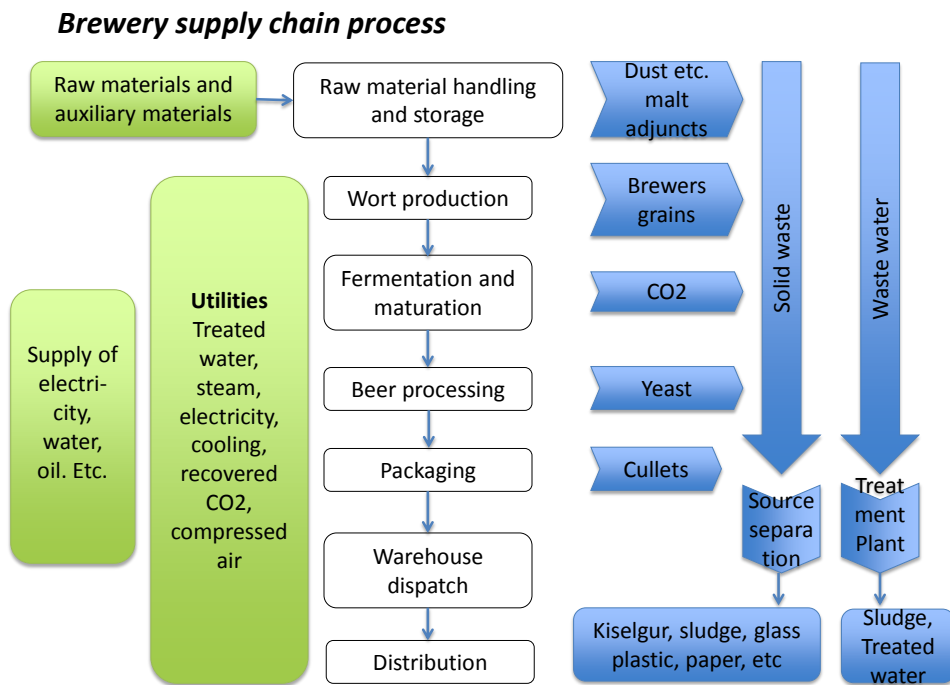
BAT Assessment - Breweries

- Industrial Emissions (IE) - DIRECTIVE 2010/75/EU – (103 pages)
- BREF – note FDM Food, Drink and Milk Industries, August 2006 (682 pages !!!!) – 3.3.1 Breweries
- Additional documents i.e.
 - BAT guidance note for Brewing, Milking and Distilling Sector – Cross reference document
EPA Ireland – 2008
 - Guidance note for establishing BAT in brewery industries
CMCB 2002

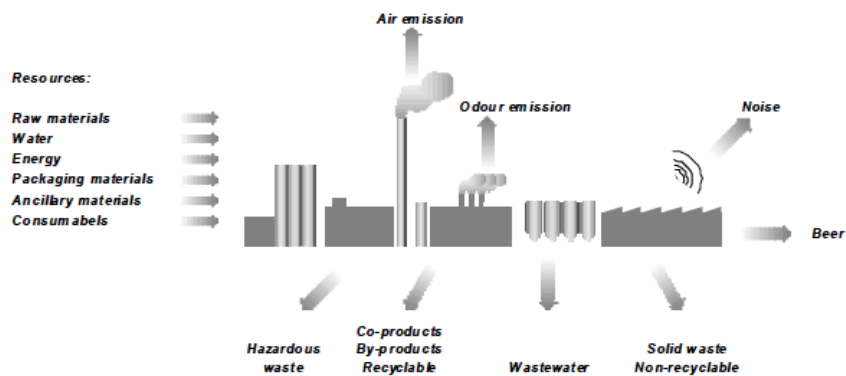


The brewing process

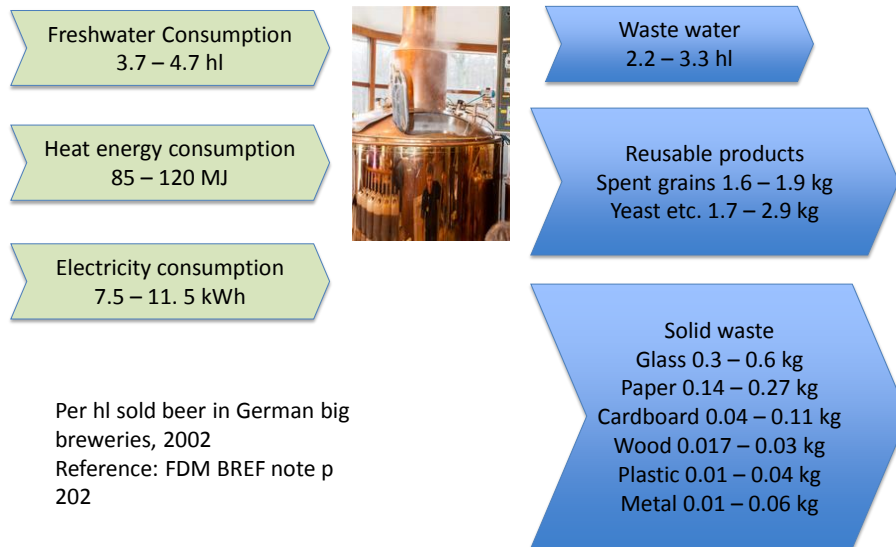




Environmental impact



Input and output figures



Environmental risk assessment

- Water consumption
- Energy consumption
- Emissions to air (Dust, SO_x, NO_x, CO₂, CO)
 - Odour?
- Solid waste (i.g. spent grains, surplus yeast, packaging waste, spent filter aids and sludge from wastewater, others)
 - Noise?
 - Risk?

BAT Emission Levels air

Table 6.1: BAT Associated Emission Levels for Emission to Air

Constituent Group or Parameter	Emission Level (mg/m ³)	Mass Threshold (g/hr) ^{Note 1}
Total Particulate Matter (including emissions from material handling)	5 - 50 150	>200 At mass flow up to 200
Total Organic Carbon ^{Note 2}	50	500
Other	--	Note 3

Reference: BAT guidance note for Brewing, Milking and Distilling Sector – Cross reference document ,EPA Ireland – 2008

BAT Emission Level - Water

Table 6.2: BAT-Associated Emission Levels for Discharges to Water*

Constituent Group or Parameter	Emission Level	Notes
pH	6 - 9	
Number of Toxicity Units (TU)	5	1
BOD ₅	>90% removal ³ , or 20 - 40mg/l	
COD	>75% removal ³ , or 125 - 250mg/l	
Suspended Solids	50mg/l	
Total Ammonia (as N)	10 - 15mg/l	
Total Nitrogen (as N)	>80% removal ³ , or 5 - 25mg/l	2,4
Total Phosphorus (as P)	>80% removal ³ , or 2 - 5mg/l	4
Oils, Fat and Grease	10 - 15mg/l	
Mineral Oil (from interceptor)	20mg/l	
Mineral Oil (from biological treatment)	1.0mg/l	
Other	--	5

Reference: BAT guidance note for Brewing, Milking and Distilling Sector – Cross reference document ,EPA Ireland – 2008

Input and output figures

Freshwater Consumption
3.7 – 4.7 hl

Waste water
2.2 – 3.3 hl

Heat energy consumption
85 – 120 MJ

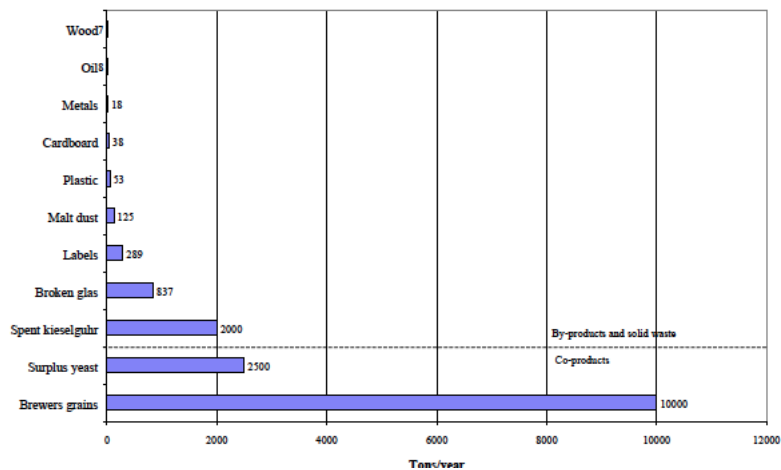
Reusable products
Spent grains 1.6 – 1.9 kg
Yeast etc. 1.7 – 2.9 kg

Electricity consumption
7.5 – 11.5 kWh

Solid waste
Glass 0.3 – 0.6 kg
Paper 0.14 – 0.27 kg
Cardboard 0.04 – 0.11 kg
Wood 0.017 – 0.03 kg
Plastic 0.01 – 0.04 kg
Metal 0.01 – 0.06 kg

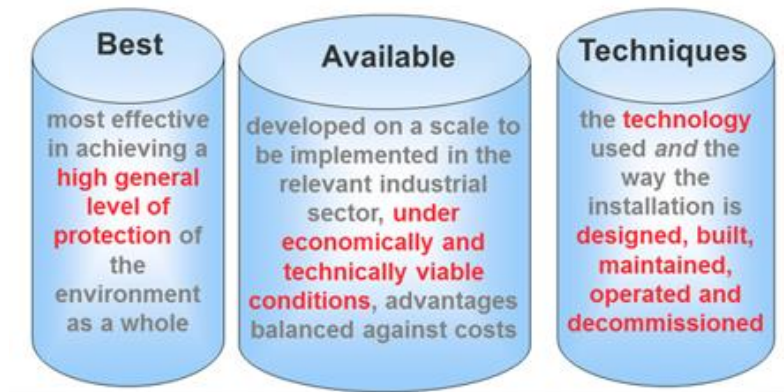
Per hl sold beer in German big
breweries, 2002
Reference: FDM BREF note p
202

Example waste production



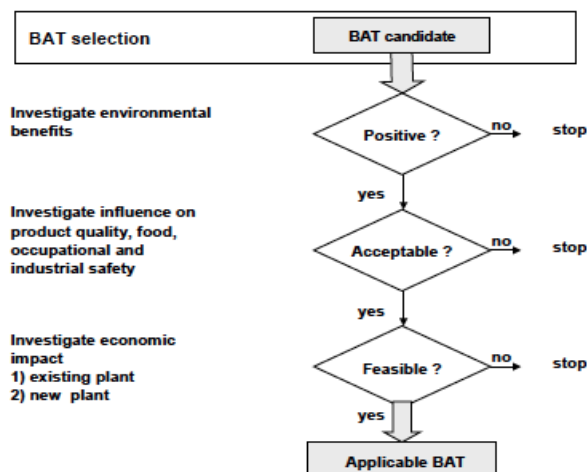
What is BAT?

Best Available Techniques (BAT)



Process or result?

BAT seen from the industry



Appendix

BAT measures for all brewing, malting and distilling plants is to do:

Reference: BAT guidance note for Brewing, Milking and Distilling Sector – Cross reference document ,EPA Ireland – 2008

BAT – GENERAL PREVENTATIVE MEASURES

- Operate an environmental management system
- Substitution or reduction of the use of some auxiliary materials, e.g. chemicals to minimize environmental impacts
- Employ good housekeeping practices

Minimization of Water Consumption

- Apply a methodology for reducing water consumption
- Provide water in a sufficient amount and suitable quality
- Optimise the use of water where possible
- Employ good housekeeping measures
Recycling/reuse water where possible)
- Reduce water use in bottling/kegging
- Optimise water consumption of rinsing zone in the bottle/keg

Minimization of Energy Consumption

- Apply a methodology for improving energy efficiency
- Implement an energy management system
- Employ good housekeeping and process optimisation; optimise process utilities such as compressed air, steam, refrigeration and electricity supply Employ energy efficiency techniques
- Employ heat recovery
- Use combined heat and power generation for electricity and thermal requirements
- The biogas from anaerobic digestion may also be utilised for energy recovery
- Install frequency converters on motors
- Insulation of pipework to minimise heat/energy losses
- Use an energy monitoring system
- Additionally

Minimization of Emissions to Air I

- Apply a control strategy to identify, quantify and select appropriate abatement options for emissions to air
- Audit odour to identify and characterise sources and determine any action required
- Use appropriate storage and handling techniques to contain emissions, e.g. dust
- Collect waste gases at source wherever this is possible at reasonable cost
- Select process techniques with maximum possible product yield and minimum emissions to the
- Optimise start up and shut down procedures and other special operating situations
- Reduce the quantity of the waste gas, e.g. use air recirculation but still maintaining special regard to hygiene requirements. Recover CO² by cleaning, compressing, drying, purifying and liquefying it from beer fermentation gas where applicable

Minimization of Emissions to Air II

- Use substitutes for hazardous raw materials where possible
- Prevent or minimise emissions of substances that deplete the ozone layer, e.g. substituting such substances, collecting them during waste treatment
- Procedures that involve switching off or bypassing the waste gas treatment systems must be designed and operated so as to ensure low emissions and must be subject to special monitoring by the recording of the relevant process parameters
- Put in place emergency plans and measures in the event of a failure of the emission reduction systems, to immediately reduce such emissions Aerate and cover wastewater treatment plants to prevent odour where necessary or use anaerobic digestion for wastewater treatment.

Minimization of Emissions to Water

- Ensure the regular maintenance of utility systems
- Optimise the use of water
- Selection of materials/chemicals used in cleaning
- Optimise cleaning procedures and provide training, e.g. base CIP sequences on conductivity rather than time
- Apply appropriate storage and handling techniques to control emissions such as dust during loading/unloading, conveying and storage, e.g. provide bunding for liquids, use cold storage and transfer systems for dusty materials
- Avoid overfilling process vessels, as contents can have very high COD levels
- Minimise leaching from spent grain during storage and transport
- Recycling/reuse water where possible to reduce emissions
- Return strong liquors to the process or recover them for animal feed or other reuse where practicable

Minimization of Emissions to Water II

- Avoid disposing of yeast to drain because it has a very high COD level and its propensity to form organic acids
- Use fine mesh baskets over floor drains to keep grain out of the drainage system
Apply multi stage bottle washing system which can lead to less chemical use
- In brewing, use a capacitance level switch for the separation of beer from dead yeast cells
- In distilling, use multi effect vacuum evaporators to concentrate slops from the mash column and then process to obtain pot ale which can be sold for agricultural use
- Meter the volume of product into containers rather than filling to capacity to avoid overfilling

Waste Minimization

- Implement a waste minimisation programme
- Apply good housekeeping practices
- Improve operating practices. Optimise the process control to minimise spoilage, off specification product, water usage and other losses through measurement of parameters such as temperature, pressure and flow
- Recycle or reuse solid by-products or sludge produced (see Section 4.4.3 of this document)
- For storage and handling, reduce overfill levels to 0.03% - 0.1% by using in line check weighers or knowledgeable filler operator
- Apply appropriate storage and handling techniques to control emissions such as dust during loading/unloading, conveying and storage, e.g. provide bunding, use cold storage and transfer systems for dusty materials
- Optimise packaging line efficiency

Reuse of waste - ideas

- Malt dust. Animal fodder, mixing into brewers grains, utilization in the production.
- Brewers grains. Animal fodder, including trub from the whirlpool.
- Surplus yeast. Animal fodder, yeast pills, cosmetics, pharmaceutical industry, spreads.
- Recyclable waste examples from breweries are:
- Spent kieselguhr from the beer filtration that could be used in the cement industry.
- Broken glass from the packaging lines that can be re-used for glass manufacturing.
- Label pulp from the washing of returnable bottles that can be re-used in paper manufacturing.
- Plastic from supply of ancillary materials, wrapping of products, etc. that can be recycled.
- Cardboard and paper from the supply of ancillary materials that can be reused by paper factories pending upon the pulp quality.
- Metal from hop cans, replacement of equipment, etc. that can be melted and used in the metal industry.

Prevention of Noise Emissions

- Use silencers in ventilation systems
- Use elastic linkages in between fans and ducts
- Install pipes with better sound insulation properties
- Increase wall thickness of pipes
- Insulate pipes in jackets
- Insulate mechanical/thermal vapour compressors
- Install machines on a basement with rubber
- Keep doors and windows closed.

Group work – 5 main questions

- 1) Water consumption
- 2) Energy consumption
- 3) Emissions to air (Dust, SO_x, NO_x, CO₂, CO)
- 4) Solid waste (i.g. spent grains, surplus yeast, packaging waste, spent filter aids and sludge from wastewater)
- 5) Waste water-

Thank you

Spørgsmål?