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EXPERIENCES WITH PREVENTIVE PROCEDURES APPLICATION IN THE PROCESS OF BEER PRODUCTION IN CZECH REPUBLIC

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Abstract

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Food-processing industry is an intriguing field regarding prevention procedures application. All food-processing operations have common fundamental spheres of problems – wastewater polluted by organic substances, solid waste of biological origin and losses during source material processing. Beer production process is a representative of food-processing sphere. The brewing industry has an ancient tradition and is still a dynamic sector open to new developments in technology and scientific progress. A case study of beer production in Czech Republic has been performed. During the work on the project, there were utilized methodical procedures of Cleaner Production, best available technologies (BAT) utilization and hazard analysis critical control points (HACCP), optimization of final technology operation.

breweries, Cleaner Production, best available technology, critical points

1 INTRODUCTION

Virtually all pollution prevention (PP)/Cleaner Production (CP) programmes in Central and Eastern Europe (CEE) have been developed and implemented with support from donors and international organisations. Several countries, particularly the US, Norway, Denmark, the Netherlands, Austria and Sweden, have funded activities in this field on bilateral and/or multilateral basis (Staniskis and Arbaciauskas, 2004). The most comprehensive PP/CP programmes implemented in CEE are the World Environment Centre's (WEC) pollution prevention centres (PPCs); the Norwegian Society of Chemical Engineers' World Cleaner Production Society and the UNIDO/UNEP National Cleaner Production Centres. All programmes pursued similar goals but with different approaches (Staniskis and Arbaciauskas, 2004). Cleaner Production (CP) has been practised for more than 18 years in many countries all over the world. Oestfold Research Foundation's Institute for Environmental Protection in Norway has been involved in this work from the very beginning and has participated in some capacity or other in CP projects in Poland, the Czech Republic, Slovakia, Russia, China, Indonesia, and Uganda. The financing for these projects has come from the Norwegian Government (Kjaerheim, 2005). Many participating companies can show impressive results with respect to improved material utilisation, lowered energy consumption and reduced emissions to air, water and soil (Kjaerheim, 2005).

The Czech Republic, like other countries in Central and East European region, is facing enormous challenges ahead in the course of transition. Czech companies are under competitive pressure of free marked economy, while faced with increasingly tougher environmental regulations. Cleaner Production is a win-win strategy to overcome those two seemingly conflicted challenges.

This article presents the case study of chemical processes taken from the process of beer production in the Czech Republic, where significant reduction of waste materials has been achieved through the application of the Cleaner Production approach and best available technologies resulting in substantial cost savings and subsequently in environmental and health risk minimisation.

2 MATERIAL AND METHODS

The food production industry requires large inputs of resources and causes several negative environmental effects. The food production system are oriented and optimised to satisfy economic demands and the nutritional needs of rapidly growing world population. Environmental issues, however, have not been given much attention (Koroneos *et al*., 2005). Food – processing industry is an intriguing field regarding prevention procedures application. All food – processing operations have common fundamental spheres of problems – wastewater polluted by organic substances, solid waste of biological origin and losses during source material processing. Food –processing industry produces a wide scale of wastes, which present many specific properties. It is given by raw materials processed here, consisting of expensively produced and quickly deteriorating organic substances. Regarding the very processing, it concerns operations and technologies' seasonal and atypical character, wide range of products and their frequent variation. In addition, a certain amount of raw materials becomes waste even before the processing, due to incompliance with hygienic requirements. At the same time, a large part of materials would be better characterized by label "by-product" or "secondary raw material", rather than waste. Subsequently, means of these materials' handling could be subject to a different mode than other types of waste. For these reasons, food – processing enterprises more often turn to prevention procedures, which mean, in most cases, considerable economical benefits in terms of raw materials, energy, charges and penalties' savings. In all these operations, hygienic requirements preclude technological water recycling in a way that is usual at non – food – processing operations – therefore all projects were also aimed at water consumption decrease and decrease of wastewater pollution rate to values determined by regulations for sewers. In order to complete these objectives, a series of precautions have been proposed, namely in the field of installation of various types of automated installation devices. However, without adequate engagement of devices' operators and all staff, as well, none of these precautions would solve sufficiently the problems identified.

Beer production process is a representative of food – processing sphere. Beer is the fifth most consumed beverage in the world behind tea, carbonates, milk and coffee and it continues to be a popular drink with an average consumption of 23 liters/person per year. The brewing industry has an ancient tradition and is still a dynamic sector open to new developments in technology and scientific progress (Fillaudeau *et al.*, 2006). During the work on the project, there were utilized methodical procedures of Cleaner Production, best available technologies (BAT) utilization and hazard analysis critical control points (HACCP), optimization of final technology operation.

2.1 Prevention strategy

The adoption of Cleaner Production practices helps conserve raw materials and energy, can help to ensure the reduction or elimination of toxic materials, and can reduce the quantity and toxicity of emissions and wastes during the production process. The UNEP defined the objectives of its Cleaner Production programs as designed to promote worldwide awareness of preventive environmental protection strategies and to encourage their adoption by industries, with the help from the government.

The Cleaner Production approaches that can be applied in production processes include recycling, process modification, plant operation improvements, and input substitution. Cleaner Products, on the other hand, can be obtained by ways such as redesigning the products, modifying the production processes, and changing the chemicals used to less hazardous ones (Ghazinoory, 2005). The principal actors of Cleaner Production are the companies, which control the production processes. They are influenced strongly by their customers (private, public or other companies) and politics (by laws, regulations, taxes).The main focus is always to create awareness for the prevention of pollution, to find the source of wastes and emissions, to define a program to reduce emissions and increase resource efficiency by implementing and documenting Cleaner Production options.

2.2 Calculations of precaution's economical effect

Calculation of (Cash Flow) business effect

Business effect Tab. I is calculated by means of deducting cash outflow (CO) from cash inflow (CI), denoted in € per year.

$$CF = CI - CO \qquad [€/year]. \qquad (1)$$

Calculation of PP (Playback Period) investment return

$$PP = \frac{IN}{CF_{(t)}} \qquad [year]. \qquad (2)$$

Investment return is determined by dividing investment (IN) by the amount of business effect in the first year after loan reimbursement (CF (t)). Investment return is denoted by number of years; at Cleaner Production precautions according UNIDO methodology, favourable return period is up to 7 years.

I: *Calculation of business effect in year*

Item	€ /year
Income	X
Machinery depreciations	Deducted from X
Construction depreciations	Deducted from X
Loan interests	Deducted from X
Profit before taxation	Balance of X
Gains tax	Calculated from income before taxation
Profit after taxation	Tax deducted from income before taxation
Machinery depreciations	Added to profit after taxation
Construction depreciations	Added to profit after taxation
Loan payment	Deducted from profit increased by depreciations
Business effect	Result

Present net value of cash flow PVCF (t)

$$PVCF_{(t)} = \sum_{t=1}^{n} \frac{CF(t)}{\left(1+K_i\right)^t} \quad [€]. \tag{3}$$

Calculation is accrued present value of cash flow in *t* year at K_i internal discount rate, *CF (t)* means cash flow from given investment in *t* year.

2.3 Process characteristics

Brewery case study (Centrum Čistší Produkce Brno, 2004) concerns, besides malt production, the whole production cycle of beer production. Brewery assortment consists of lagers and special beers, followed by non – alcoholic products and beers with higher content of original extract. Annual output makes ca. 200 thousand hectoliters of beer. Technological process consists of the following stages: raw material processing, brew – house, fermentation, standing, filtration, bottle filling room, barrel filling room, storage, transport and distribution.

2.4 Process analysis

Essentially, brewery's very operation is divided into following parts: warm operation, cold operation, filling room and stores. Warm operation serves for wort preparation and it consists of brew – house machinery. Cold operation secures the very fermenting and maturing of beer. Brew – house is equipped entirely with stainless vessels and stirrers; vessel size is determined by brewery production capacity. Four – vessel brew – house consists of mashing tubs with malt supply line, mashing pans, straining tubs and wort coppers. Malt wort preparation's intensification element is represented by malt wort filters. Wort produced is deprived of undesirable hot sludge in rotational tubs. Wort chilling on yeast starter temperature proceeds by means of backflow. Chilled wort is aerated by sterile air by porous plug. Stainless vertical cylinder – conic tanks are used for maturing and fermentation; their capacity is connected to brew-house production volume. Devices are equipped by sensors and remotely controlled fixtures enabling control of their operation and check screening by computer system. Visual appearance of beer – sparkling beverage – is ensured by beer filtration. This proceeds in two stages. At the first stage, appropriate filtration material (e.g. bergmeal) creating filtration layer is washed on filtration barrier. The second filtration stage is performed by means of special filtration barriers. Trend in technology focus is reaching such degree of filtration that would separate all micro – organisms from beer. Subsequently, beer pasteurisation (heat treatment) would be dropped – besides energy saving, this would result in improvement in beer's taste. Before filling in packages (barrels, bottles), the product is pasteurised in through – flow heater. Filling room's operation is fully automated and the control device sorts out incorrect crates and bottles. Bottle washers work on the principle of dipping in disinfection baths with subsequent washing spraying, washing by hot and cold water, another control device checks cleanliness of washed bottles and sorts out bottles with possible remains of impurities or washing solutions. Furthermore, there is device for filling, sealing and labeling of bottles with following adjustment check.

3 RESULTS AND DISCUSSION – FOCUS OF CLEANER PRODUCTION PROJECT

3.1 KEG Barrels Labelling Device – Device Description

This concerns installation of INK – JET labeling device for KEG barrels labeling. KEG barrels are of cylindrical shape, made of stainless steel. Precaution is related to operation of washing and filling device connected to manufacture of barrels produced in accordance with DIN standard. Aside from the saving of labels, device also enables realization of barrel control system according to their numbers, their storage in memory, prevents occurrences o critical points in production and reclamations.

3.1.1 Effects achieved

Economical evaluation

Purchase of labeling device represents investment in the amount of € 7.825 Applying machinery depreciations and profit tax, following economical effects can be reached:

Profit Creation and Division (rounded):

- income 7.825 [€ /year]
- machinery depreciation 1.680 [€ /year]
- profit before taxation 6.140 [€ /year]
- tax 1.920 [€ /year]
- profit after taxation 4.225 [€ /year]
- business effect 5.900 [€ /year].

CF business effect according to equation 1 resulting from Tab. I, makes € 5,9010.

PP (Payback Period) investment return can be calculated according equation 2

PP = 1.72 year.

PVCF calculation was performed according equation 3, where $PVCF_{(t)}$ is accrued present value of cash flow in *t* year at discount rate K_i, *CF (t)* means cash flow given investment in *t* year and *IN* represents the amount of investment.

PV CF = € 23.240.

Internal income *IRR* percentage makes 13.70 %.

Environmental evaluation

Current labeling system – especially usage of glue – degrades content of washing bath, which has to be changed more frequently. By means of implementing overpressure tank and labeling device rationalization, it presumed that anticipated production of washing water discharged to sewage treatment plant will decrease by ca. 300 m^3 per year.

Project Evaluation:

- main *(most limited)* waste flow waste washing water
- amount of main waste flow decreased by ca. 300 m^3/year
- annual profit from the precaution realized overpressure tanks – € 90.960
- labelling device € 7.825

Total amount of financial resources necessary for precaution realization:

- overpressure tanks € 367.760
- labelling device € 2.350
- investment return overpressure tanks – 4.08 years
- labelling device 1.72 year.

3.2 Preventive project focus

Bottle scanner – BAT technology for HACCP Requirements fulfilment

Device description

Project proposes usage of best available technology, PAST INSPEKTOR control scanner – two independent checks: UV check – especially sensitive to small residues of lye and liquids, IR check – responses reliably to large amounts of liquids.

It is followed by bottle bottom check by CCD camera system with automatic evaluation and special lighting of bottle bottom with compensation of dark and light bottles.

Control device sorts off improper and inappropriate bottles, further control device checks cleanliness of bottles washed and sorts off bottles with possible impurities' or cleaning solutions' residues. The device fully complies with requirements of hygiene and sanitation. It guarantees efficient, economically and ecologically thorough check of bottles' cleanliness. Scanner utilization precludes possibility of internal microbial contamination and surface contamination of bottles, including occurrence of washing and disinfection agents' residues.

3.2.1 Effects achieved

Economical evaluation

Costs related to production process provision (in €), Tab. II. Costs related to created waste (in €),

II: *Costs related to production process provision (in €)*

Type of costs	Current amount	Anticipated amount after precaution implementation	Difference
Raw material costs	-	-	-
Secondary and auxiliary material costs	9,780	1,960	7,820
Energy and fuel costs	-	-	-
Process costs	21,520	0	21,520
Raw material transport costs	-	-	-
Costs for wages	-	-	-
Maintenance costs	-	-	
Saving per product	-	-	-
Total (1)	31,300	1,960	29,340

III: *Costs related to created waste (in €)*

Type of costs	Current amount	Anticipated amount after precaution implementation	Difference
Costs for waste gathering, collection, assortment and storage	-	-	-
Waste transport costs	-	-	-
Waste disposal costs	-	-	-
Costs for ending technologies operation	7 825	0	7 825
Other costs	-	-	-
Total (2)	7 825	0	7 825

IV: *Pollution fees (in €)*

Factor charged	Current amount	Anticipated amount after implementation	Current fees	Anticipated after implementation	Difference
Wastes	-	-	-	-	-
Communal	-	-	-	-	-
Other	-	-	-	-	-
Hazardous	-	-	-	-	-
Waters	-	-	-	-	-
Air	-	-	-	-	-
Energy	-	-	-	-	-
Total	-	-	-	-	-

V: *Summary of anticipated savings*

Type of savings	Total amount of savings
Total amount of investment (in €)	109,550
Process savings (in €)	29,340
Waste savings (in €)	7,825
Total annual savings (in €)	37,165
Total annual savings divided by total amount of investment	0.34
Annual savings on pollution fees	-
Annual savings on pollution fees divided by total amount of investment	N/A

Tab. III. Pollution fees (in €), Tab. IV. Summary sheet of anticipated savings created by precaution implementation and calculation of net contribution to the environment and precaution's economic benefits, Tab. V. Return period (in years) – 3.49 years.

Environmental evaluation

In case of HACCP procedures' application, removal of so-called critical points becomes priority; i.e. points, in which raw materials and products' lines cross. Installation of bottle scanner means preclusion of internal and surface contamination of bottles, including occurrence of washing and disinfection agents, i.e. fulfillment of HACCP requirements. Furthermore, it is presumed that annual production of waste washing waters will be decreased by 720 m^3.

Project evaluation

- main *(most limited)* waste flow drinking water
- amount of main waste flow decreased by 720 m^3/year
- annual profit from the precaution realized € 37.170
- total amount of financial resources necessary for precaution realization € 109.550
- investment return 3.49 years.

By gradual implementation of particular precautions, waste washing waters production concerning sanitation, washing and labelling will be decreased by 1 020 m^3 per year.

Comparison of waste washing waters production rate at sanitation, washing and labelling per year:

Waste washing waters production m^3:

- before precaution implementation 1.500
- after precaution implementation – sanitation, labeling 1.200
- after precaution implementation – bottle washing 480.

4 RESULTS AND DISCUSSION – HACCP PROJECT FOCUS

4.1 Technological equipment rationalization by overpressure tanks in beer and syrup stores

Device description

Precaution subject is to build rational technological equipment with overpressure tanks with target capacity of 120–150 m³. Current capacity of usable equipment is 42 m³.

Tank equipment: sanitation fixture, sanitation head, safety and vacuum valve, remote thermometer with 4–20 mA output, pressure probes – 2 pieces, manometer, sampling valve, stop valves.

Tank release will provided by gas medium pressure through anti-foam lamps. Tank sanitation will be performed in counter-pressure. The overall sanitation with lye at increased temperature will be performed according to analysis results during spare solution change.

4.1.1 Effects achieved

Economical evaluation

Savings consist mostly from decrease of sanitary agents' consumption, costs for human labour, product quality increase, operational costs, partially from water management savings. Costs related to production process provision (in €), Tab. VI. Costs related to created waste (in €), Tab. VII. Pollution fees (in €), Tab.VIII. Summary sheet of anticipated

VI: *Costs related to production process provision (in €)*

Type of costs	Current amount	Anticipated amount after precaution implementation	Difference
Raw material costs	0	0	0
Secondary and auxiliary material costs	80,205	39,125	41,080
Energy and fuel costs	0	0	0
Process costs	57,510	31,300	26,210
Raw material transport costs	0	0	0
Costs for wages	60,370	39,120	21,250
Maintenance costs	33,140	31,300	1,840
Saving per product	0	0	0
Total (1)	231,225	140,845	90,380

VII: *Costs related to created waste (in €)*

Type of costs	Current amount	Anticipated amount after precaution implementation	Difference
Costs for waste gathering, collection, assortment and storage	0	0	0
Waste transport costs	0	0	0
Waste disposal costs	0	0	0
Costs for ending technologies operation	4,500	3,910	590
Other costs	0	0	0
Total (2)	4,500	3,910	590

VIII: *Pollution fees (in €)*

Factor charged	Current amount	Anticipated amount after implementation	Current fees	Anticipated after implementation	Difference
Wastes	0	0	0	0	0
Communal	0	0	0	0	0
Other	0	0	0	0	0
Hazardous	0	0	0	0	0
Waters (m³, €)	300	0	235	0	235
Air	0	0	0	0	0
Energy	0	0	0	0	0
Total	300	0	235	0	235

IX: *Summary of anticipated savings*

Type of savings	Total amount of savings (in €)
Total amount of investment (in €)	367,760
Process savings	90,375
Waste savings	590
Total annual savings (in €)	90,960
Total annual savings (€) divided by total amount of investment	0.247
Annual savings on pollution fees	235
Annual savings on pollution fees divided by total amount of investment	6.36^{-04}

savings created by precaution implementation and calculation of net contribution to the environment and precaution's economic benefits, Tab. IX. Return period (in years) – 4.08.

Environmental evaluation

In case of HACCP procedures' application, removal of so – called critical points becomes priority; i.e. points, in which raw materials and products' lines cross. Rationalization of technological equipment of beer and syrup product lines sanitation lines connection without products' physical crossing. Furthermore, it is presumed that, along with new labelling device application, annual production of waste washing waters will be decreased by 300 m^3 per year.

4.2.1 Water and waste management in brewerys

Water management and waste disposal have become a significant cost factor and an important aspect in the running of a brewery operation and. Every brewery tries to keep waste disposal costs low whereas the legislation imposed for waste disposal by the authorities becomes more stringent. Water consumption in a brewery is not only an economic parameter but also a tool to determine its process performance in comparison with other breweries. Furthermore, the position of beer as a natural product leads the brewers to pay attention to their marketing image and to take waste treatment (wastewater, spent grains, Kieselguhr sludge, yeast surplus).

4.2.2 Water in the brewing process

The food and beverage processes including brewing are water consuming. Breweries have a specific consumption of water ranging from 4 to 11 hl water/hl beer. In brewing, the average water consumption of around 5–6 hl/hl beer is correlated to beer production for industrial breweries. Water consumption is divided into 2/3 used in the process and 1/3 in the cleaning operations. In the same way, effluent to beer ratio is correlated to beer production. It has been shown that the effluent load is very similar to the water load since none of this water is used to brew beer and most of it ends up as effluent (Fillaudeau, 2006).

4.3 Preventive project focus – ending technology operation optimization

Precaution description

Brewery sewage water was treated at biological sewage treatment plant, which had been in operation since 1984. This sewage treatment plant consisted of three metal reactors, out of which one served as activation phase with four inbuilt settlement tanks. The third one served as sludge storage reservoir. Biological treatment plant was used to gross pre-treatment, consisting of skimming screen and sand catcher. Machinery was already considerably worn and sewage treatment plant technology did not meet requirements for perfect biological treatment. Tank aeration was unsatisfactory, which had negative impact on oxygen conditions. These conditions resulted in sludge overload with organic pollution and treatment effects decrease. Gross pre-treatment manually skimmed screens were replaced for machine-skimmed with 1 mm porosity width. Equalization basin was modified in a way that instead of the whole flow volume, only water exceeding pump standard output flew into it once the modification was done; it is further pumped to biological phase at decreased inflow. Due to the precaution mentioned, more balanced flow volume through the treatment plant was achieved and energy consumption necessary for water pumping from equalization basin was decreased. In biological phase, two settlement tanks were removed, which enlarged aerated space up to 1.242 m^3, while preserving enough space for activated sludge settlement. Furthermore, biological phase reconstruction was performed by means of replacement of aeration elements, which can be removed from the operation. These provide fine-bubble aeration. Activated sludge excess is taken off from regeneration tank through thickener to centrifuge of 1–3 m^3 output per hour. Drained sludge is continually transferred to farming business for composting.

4.2.1 Effects achieved

Economical evaluation

If investment costs connected with purchase of sewage treatment plant machinery are estimated to

€ 40.000, following economic effects can be reached with machinery depreciation application.

Profit Creation an Division per year:

- income 40.000 €
- machinery depreciation 46.400 €
- profit before taxation – 6.400 €
- tax 0
- profit after taxation 40.000 €
- business effect 86.400 €.

Resulting from business effect according to CF equation 1 makes € 86.400. PP (Payback Period) investment return can be calculated according equation 2

$$PP = 3.24 \text{ year.}$$

PVCF calculation was performed according equation 3, where $PVCF_{(t)}$ is accrued present value of cash flow in *t* year at discount rate K_i, *CF(t)* means cash flow given investment in *t* year and *IN* represents the amount of investment.

$$PV\,CF = € \; 206.300.$$

Internal income *IRR* percentage makes 4.45 %.

Environmental evaluation

Precaution realization enabled decrease of organic pollution by ammoniac nitrogen and suspended substances in nearby stream. There were 255.7 Mg COD, 152.36 Mg BOD 5 and 62.29 Mg suspended solids (SS) per year. Sewage treatment plant sludge is transferred to nearby farmers' cooperation for composting.

Project Evaluation:

- main *(most limited)* waste flow
  organic pollution of wastewater
- amount of main waste flow decreased by
  255.7 Mg COD/year
  152.36 Mg BOD/year
  62.29 Mg SS/year
- annual profit from the precaution realized
  € 40.000
- total amount of financial resources necessary for precaution realization € 278.000
- investment return 3.24 year.

5 CONCLUSION

The example of brewery proved unambiguously the usability of prevention procedures, especially Cleaner Production methodology, in food-processing industry. On the basis of input-output analysis, production's weak points were identified and preventive measures were designed and prioritized. Measure realization resulted in significant environmental benefits, which consist in the fact that existing labelling system was removed; whereas mainly the usage of glues afflicts contents of washing bath, which must be changed more frequently. By means of pressure tanks and labelling device's rationalization, expected decrease in washing wastewater, discharged to sewage treatment plant, makes ca. 300 m^3 per year. In the next step, the project proposes usage of BAT (Best Available Technology/Technique), PAST INSPEKTOR checking viewer, which uses procedures of two independent checks: UV check – especially sensitive to small residua of lye and liquids, IR check – reacts reliably to large quantities of liquids. Anticipated payoff period for this measure is calculated to 3.49 years. With respect to environmental aspect of bottle viewer installation, the environmental evaluation means exclusion of inner and surface bottle contamination, including occurrence of washing and disinfection agents' residua, i.e. compliance to HACCP requirements. Furthermore, washing wastewater production decrease by 720 m^3 per year is expected.

Gradual implementation of particular measures will decrease washing wastewater production at sanitation, washing and labelling by 1020 m^3 per year. Further measure proposed consists in construction of rational technological equipment with pressure tanks with target capacity of 1,200–1,500 hl. Economic evaluation determined the measure payoff to 4.08 years. Final technology operation optimization made part of the prevention project, consisting in upgrade of sewage treatment plant machinery. Measure realization enabled decrease of ammoniac nitrogen and suspended substances organic pollution of nearby stream. Waste treatment sludge is transported to nearby agricultural cooperation for composting. The main objective of this work was to verify possibility of Cleaner Production methodology application, utilization of BAT (Best Available Technology/Technique), critical points (HACCP) and also final technology optimization at beer production process. Both environmental and economical benefits of preventive procedures used were proved unambiguously during the work on project.

6 SUMMARY

Food – processing industry is an intriguing field regarding prevention procedures application. All food – processing operations have common fundamental spheres of problems – wastewater polluted by organic substances, solid waste of biological origin and losses during source material processing. Food – processing industry produces a wide scale of wastes, which present many specific properties. It is given by raw materials processed here, consisting of expensively produced and quickly deteriorating organic substances. Regarding the very processing, it concerns operations and

technologies seasonal and atypical character, wide range of products and their frequent variation. In addition, a certain amount of raw materials becomes waste even before the processing, due to incompliance with hygienic requirements. At the same time, a large part of materials would be better characterized by label "by – product" or "secondary raw material", rather than waste. Beer production process is a representative of food – processing sphere. The brewing industry has an ancient tradition and is still a dynamic sector open to new developments in technology and scientific progress. A case study of beer production in Czech Republic has been performed. During the work on the project, there were utilized methodical procedures of Cleaner Production (CP), best available technologies (BAT) utilization and hazard analysis critical control points (HACCP), optimization of final technology operation. The example proved unambiguously the usability of prevention procedures, especially Cleaner Production methodology. On the basis of input-output analysis, productions weak points were identified and preventive measures were designed and prioritized. Measure realization resulted in significant environmental benefits, which consist in the fact that existing labelling system was removed. In the next step the project proposes usage of BAT (Best Available Technology/Technique). Final technology operation optimization made part of the prevention project, consisting in upgrade of sewage treatment plant machinery. Measure realization enabled decrease of ammoniac nitrogen and suspended substances organic pollution of nearby stream.
The main objective of this work was to verify possibility of Cleaner Production (CP) methodology application, utilization of BAT (Best Available Technology/Technique), critical points (HACCP) and also final technology optimization at beer production process. Both environmental and economical benefits of preventive procedures used were proved unambiguously during the work on project.

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