

# **USE OF AN OPERATING SCHEDULE IN THE PROCESS PLANNING AND IMPROVEMENT**

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## **SUMMARY**

A simple computer based operating schedule and information centre has been constructed to give support to the process operators at a WWTP. The information centre contains a large amount of information which can be used to improve and secure the process. The information centre and the operating schedule are developed for Bromma WWTP in Stockholm, but the methodology, to build an operating schedule, and the information can be used elsewhere where support is of interest.

The operating schedule is build upon a "Knowledge Bank" which gives explanations to the different strategies used in the schedule. The incorporated fault tree analysis is another useful tool in the operation of a WWTP. Also in this case the information centre is important to give backgrounds and explanations . The information centre and the operating schedule are build on the Adobe Acrobat Platform to give a simple and standardised tool. The software gives possibilities to link and systematise information in a user friendly way.

## **BACKGROUND**

One of the goals of the Stockholm STAMP-team was to construct an operating schedule for a WWTP. Bromma WWTP was the platform of the team in Stockholm. This treatment plant was also the base for the construction work with the schedule and information centre.

During the work different documents, articles and reports have been written with the goal of systematise the information. One important document is the "Knowledge Bank". This document describes the run of the wastewater through the treatment plant.

Another document is the operating schedule itself which contains a large amount of strategies. Furthermore has the fault tree analysis contributed with useful information of how to counteract disturbances and unexpected events. The different documents are collected in the information centre.

## OPERATING SCHEDULE FOR BROMMA WWTP

One of the goals of the Stockholm STAMP-team was to construct an operating schedule for a WWTP. The schedule refers to a collection of strategies described in the "Knowledge Bank and in the information centre. The "Knowledge Bank contains information and facts collected by experience and by literature reviews.

The overall work with the schedule has several goals:

- 1) Give guidelines for the operation of the WWTP
- 2) Give minimum, average and maximum curves to compare process parameters
- 3) Give guidelines for internal effluent standards during different months
- 4) Give guidelines for reduction efficiency during different seasons.
- 5) Give guidelines for dosage of coagulants or carbon sources.
- 6) Give instructions and guidelines for unexpected events as inhibition of activities.

### Bromma WWTP

Bromma wastewater treatment plant serves the north-western parts of Stockholm area. The plant is designed for a sewage flow of 160 000 m<sup>3</sup>/day and a load of BOD<sub>7</sub> of 30 000 kg/day. The plant is highly loaded. The largest industry, a brewery, produces a wastewater containing easily degradable organic material. There are also a lot of smaller industries in the catchment area, some with hazardous effluents causing problems in the biological stage 2-4 times every year.

The biological stage is operated as an pre-denitrification process with six lines in parallel. Each line is divided into five zones. The first zone is anoxic, the remaining four zones are always oxidic. The biological stage has a total volume of 23 400 m<sup>3</sup>. The aerated basins is 5 m deep. Each of the six lines is connected with two secondary sedimentation tanks. In this way the biological stage is divided into six separate lines. The treated water is led to two-media sandfilters before discharge to the Baltic Sea. A process schedule for Bromma WWTP is presented below.

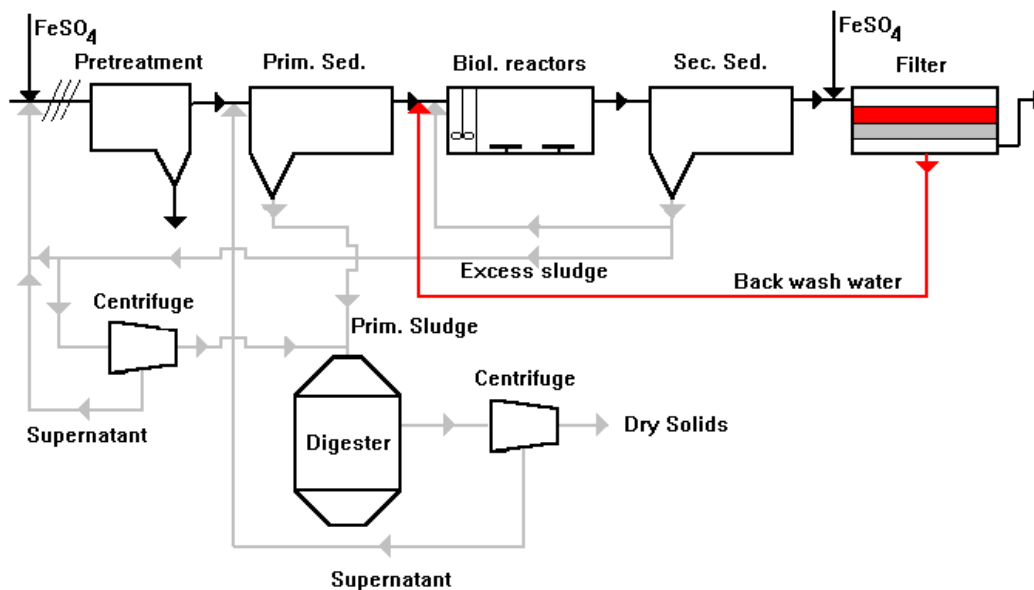


Figure 1 Process schedule for Bromma WWTP

Henriksdal and Bromma WWTPs have been extended to meet more stringent requirements. The effluent standards for BOD<sub>7</sub>, total phosphorus and total nitrogen are 10, 0.3 and 15 mg/l respectively. For BOD<sub>7</sub> and total phosphorus the effluent standards correspond to the average for every quarter of the year and for total nitrogen the average for one year.

## Operating Schedule

The operating schedule is a description of how the WWTP will be run under different situations to still treat the wastewater effectively instantly and in a longer run. Depending on the actual situation different strategies must be used. Strategies are constructed for the different treatment steps separately but also for the synergetic effects between different stages.

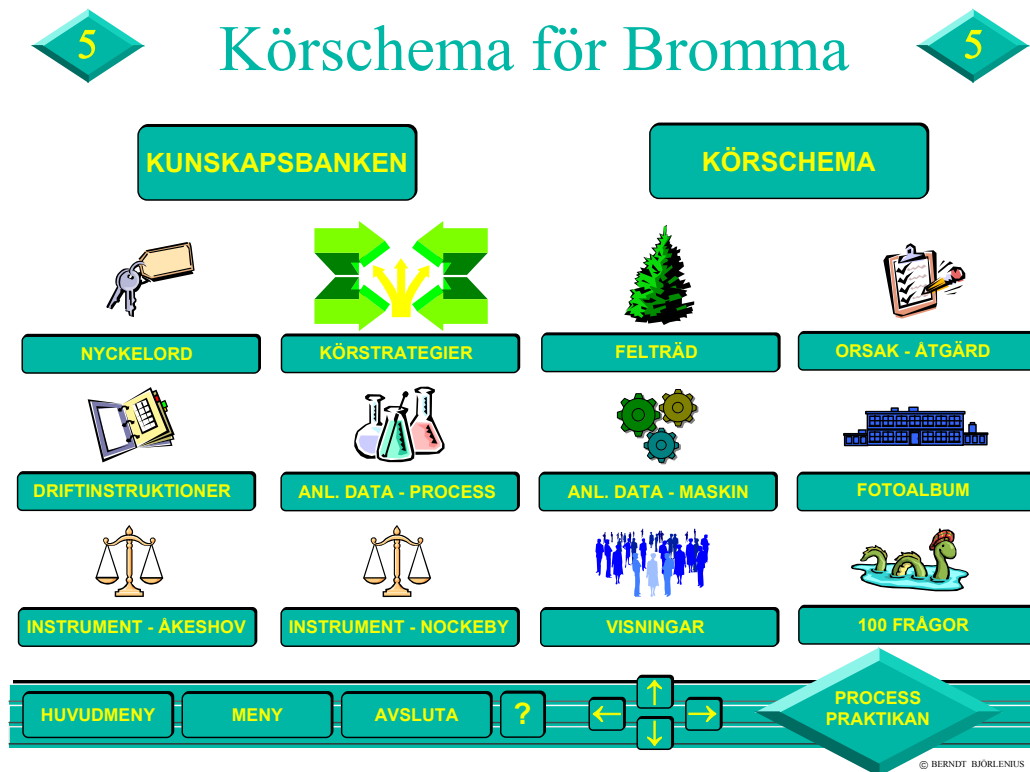


Figure 2. Menu in the operating schedule for Bromma WWTP

## The "Knowledge Bank"

The operating schedule is build upon a "Knowledge Bank" which gives explanations to the different strategies used in the schedule. The "Knowledge Bank contains information and facts collected by experience and by literature reviews. This document describes the run of the wastewater through the treatment plant.

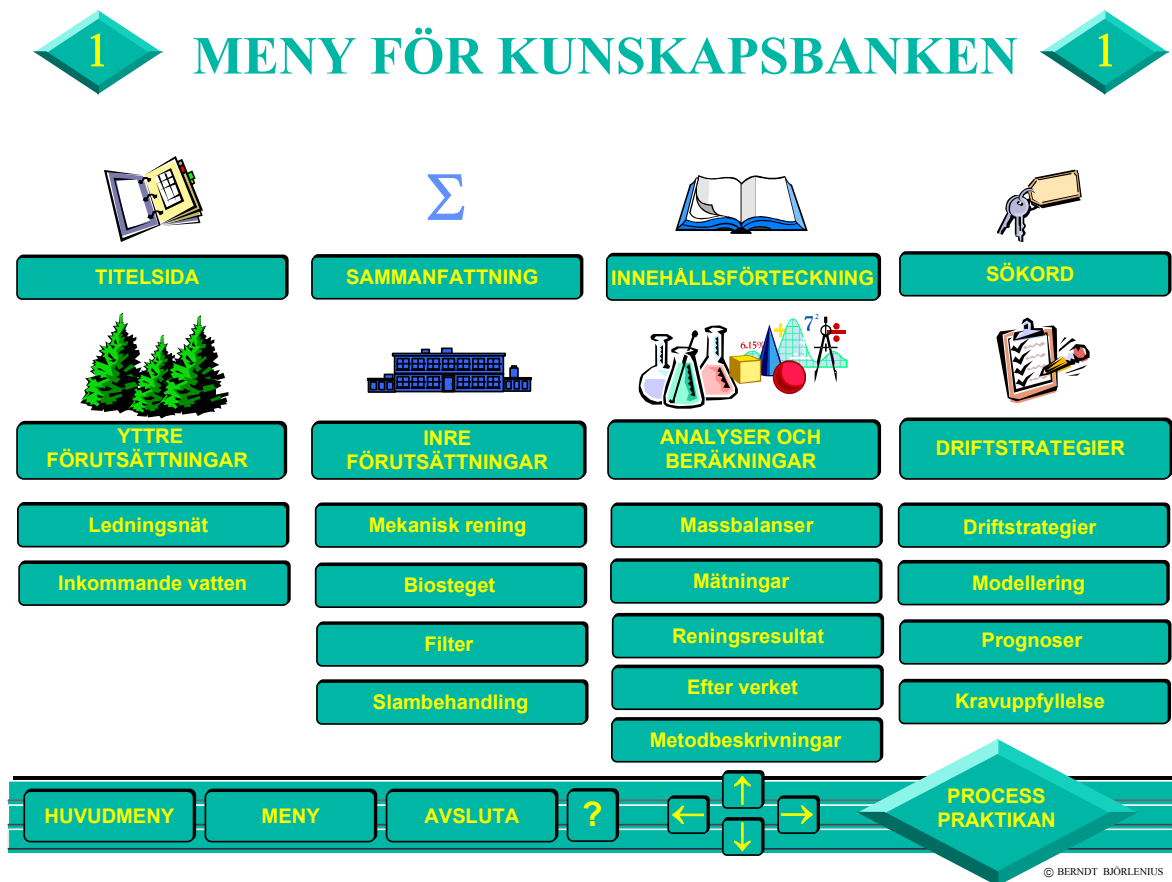


Figure 3. Menu for the "Knowledge Bank"

The "Knowledge Bank has a layout of a reference and an encyclopaedia. At 300 pages the treatment of wastewater from influent to effluent is discussed in a relatively easy language.

### FAULT TREE ANALYSIS

The use of fault tree analysis has improved and facilitated the systematic work with unexpected events and break downs. The analysis describes the different possible causes of the disturbance. Frequency or probability is given as an experienced figure.

**FELTRÄD FÖR HÄNDELSEN:  
BOD<sub>7</sub> ÖKAR I UTGÅENDE VATTEN**

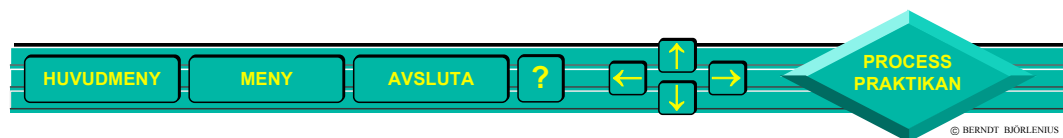
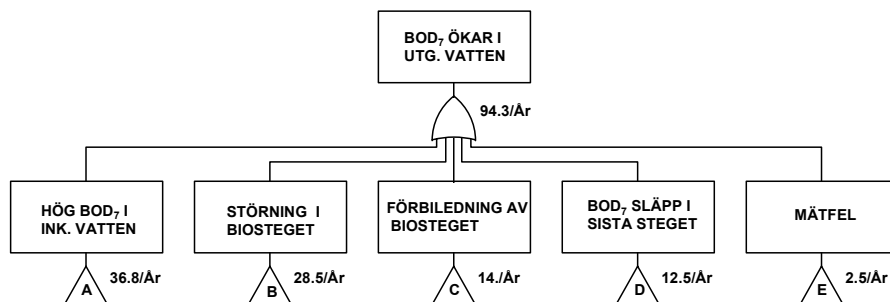


Figure 4. Example of a main branch in a fault tree for (suddenly) increased concentrations of organic matter in the effluent of a WWTP.

## THE INFORMATION CENTRE

The information centre contains a large amount of information which can be used to improve and secure the process. The information centre is developed for Bromma WWTP in Stockholm, but the methodology, to build an operating schedule, and the information can be used elsewhere where support is of interest.

The information centre is build on the Adobe Acrobat Platform to give a simple and standardised tool. The software gives possibilities to link and systematise information in a user friendly way.

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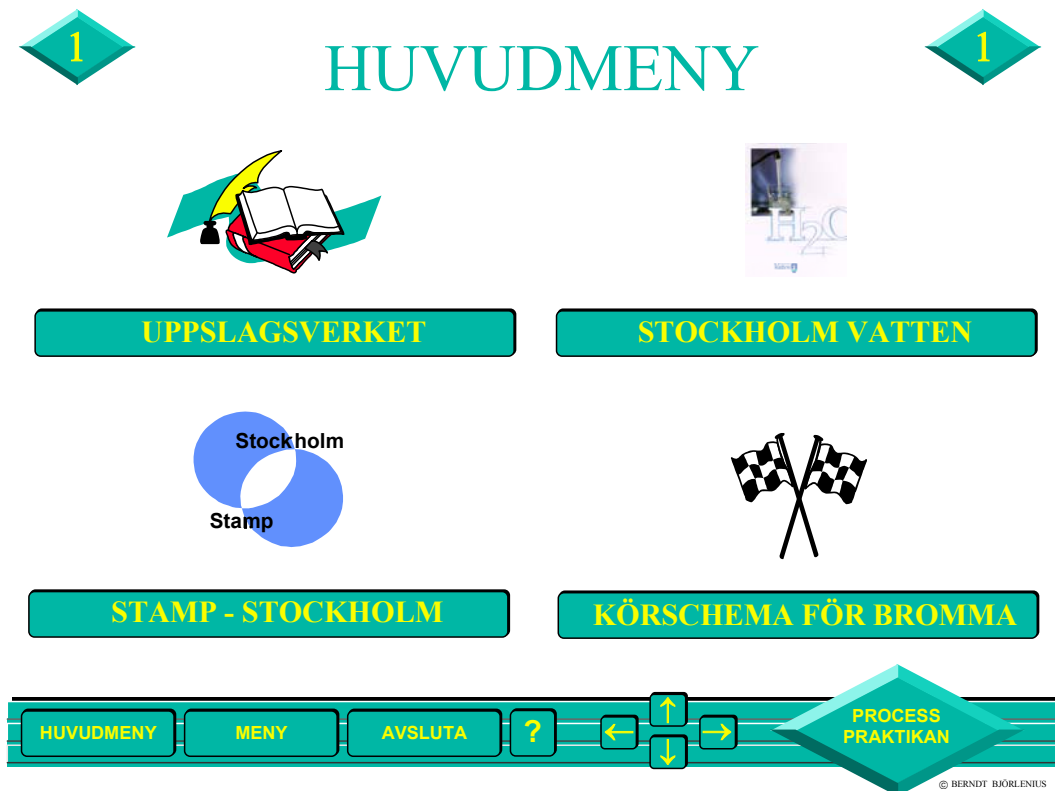


Figure 5. Main menu in the information centre

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