Innovative local treatment of combined sewer overflows improving bathing water quality - DK

1. Policy Objective & Theme

- SUSTAINABLE USE OF RESOURCES: Preserving coastal environment (its functioning and integrity) to share space

2. Key Approaches

- Technical

3. Experiences that can be exchanged

Treatment of overflow sewage waters in catchments of big cities located near bathing waters can lead to improved water quality of the surface waters in question. The techniques are cost-effective and the method is applicable in other Member States.

4. Overview of the case

Three demonstration treatment techniques for combined sewer overflows were shown to improve discharges to receiving waters. One, in Copenhagen, substantially improved the bathing water quality of the receiving coastal waters.

5. Context and Objectives

a) Context

Traditional design of combined sewer overflows is known to have detrimental effects sometimes preventing surface waters from having a good status. Implementation of the Water Framework Directive (WFD) has highlighted the need to bridge the gap between discharge permits and water quality in surface waters resulting from combined sewer discharges.

Combined sewer overflows to surface waters are frequent in urban areas and therefore they constitute an important factor when it comes to ensuring the implementation of the WFD at the river basin level. Discharges from combined sewer overflows in many situations constitute a problem in relation to reaching "good status" in the quality of the surface waters of member countries, which is one of the requirements of the WFD. Surveys in the County of Aarhus, Denmark, demonstrated that 17% of the overflows led to unacceptable conditions in the receiving waters. Appropriate and cost-efficient technical methods for local treatment of the discharges were not available and standards for issuing permits for these discharges were also lacking.

b) Objectives

The objective was to demonstrate a full-scale treatment technique for combined sewer overflows using a lamella separator. The aim was to provide a cost-efficient tool for achieving the objectives of improving the quality of surface waters, as laid down in the WFD. More specifically, it was hoped to quantify and verify the efficiency of the concept for local treatment of combined sewage at three facilities, of which one represented discharges to marine coastal waters, including verifying the positive impact on the receiving waters.

6. Implementation of the ICZM Approach (i.e. management, tools, resources)

a) Management

Koebenhavns Energi is a municipal water and energy supply company, and is the public authority responsible for the supply of services and the treatment of wastewater inside the Copenhagen City area. The work was co-ordinated by Koebenhavns Energi, in partnership with other Danish municipalities and regional authorities and the Danish Environmental Protection Agency.

b) ICZM tools

Three facilities were designed and constructed and a detailed measurement programme was also designed and implemented. One of the facilities was in Copenhagen which discharges into coastal waters. It enabled the assessment of the treatment efficiencies of the facilities themselves and the corresponding effect on the surface waters receiving the discharged water. This part of the initiative was supervised by an independent auditor who was an internationally recognised expert in the field. The work established the knowledge needed for the implementation of the WFD, including identification of cost-efficient means to achieve sufficient environmental quality in surface waters. The calculations of cost-efficiency indicated that the Copenhagen demonstration facility was cost-effective compared to traditional methods and led to improved water quality at the surface waters in question. The cost-efficiency calculations showed that many of the simple storage devices for combined sewer overflows used throughout Europe can be improved. Some of the technologies tested were still not cost-effective for standard use. However, when space is scarce or the discharges occur near bathing waters, the very advanced technologies tested can be recommended for large catchments.

The Copenhagen demonstration facility was the most advanced. Here, the objective was to treat 1800 m3/h of combined sewage with an emission to the marine water that complies with the requirements of the Bathing Water Directive, i.e. <500 Escherichia coli (E. coli) /100 ml. The demonstration facility consisted of a mechanical treatment step and a microbiological treatment step. The mechanical treatment step is needed to ensure the efficiency of the microbiological treatment step. The mechanical treatment consists of a 2 mm screen, followed by two filters with a 100 µm and 20 µm mesh, respectively. The microbiological treatment step consists of a UV-disinfection unit. Filters have a quick start and operation is stable. In fact, the filters removed more suspended solids than a traditional basin using the same space; the UV disinfection unit worked well after being warmed up; some samples contained less than 1 E. coli /100 ml. Therefore, it is possible to design a plant with emissions that comply with the Bathing Water Directive. This plant is one of the reasons why the bathing water quality in the Svanemøllebugten has improved.

The general improvement of European water quality, e.g. through the implementation of national legislation and the WFD, has mainly been brought about via treatment of continuous discharges of wastewater. However, storm water outflows from the combined sewer systems continue to have an adverse effect on fresh water and marine waters. In order to meet the objective of the WFD that at least ‘good ecological status’ should be obtained in the majority of the community waters, discharges of combined sewer outflows must be further minimised. The only recommended solution to reduce discharges is the construction of large retention basins for storm waters. This solution unfortunately is quite expensive and deteriorates the performance of biological wastewater treatment plants. The solution provided by this initiative is more sustainable. In Denmark alone, the annual investment needed over the subsequent 15 years, in order to minimise the effects of combined sewers, was estimated to be approximately €100 million. However, the method employed would be, on average, 20% cheaper than traditional treatment methods. Furthermore, as the method is applicable in several other Member States as well, potential savings at Community level are substantial.

7. Cost and resources

The total budget was €5,109,020 with a Life contribution of €1,859,622.

8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)

It was shown that the treatment of overflow sewage waters could be achieved using several technical interventions depending on the expected overflow volumes, catchments and recipient water bodies. Additionally, treatment efficiencies were quantified regarding the most common polluting factors such as chemical oxygen demand (COD), suspended solids and E.coli. The Copenhagen plant was the first of its kind and the method was highly relevant in relation to large catchments in big cities located near bathing waters.

9. Success and Fail factors

Installation of lamella separators at the outlet was cost-efficient relative to construction of extra volume. Filters were cost-efficient with respect to removal of suspended solids when compared to large detention volumes. Construction of UV-disinfection was cost-efficient at large catchments compared to traditional volumes.

10. Unforeseen outcomes

Local conditions were of paramount importance. The actual calculation of cost-efficiency relied heavily on local characteristics such as size of the catchment and availability of space.

11. Prepared by

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12. Verified by

It has not been possible to verify this case.

13. Sources

- Innovative technologies for local treatment of combined sewage (undated) COWI
- www.ke.dk

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