Best Practice: Redeveloping Industrial Harbor for Public Swimming

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CITY: COPENHAGEN **POLICY AREAS: CITY PLANNING**

BEST PRACTICE

On July 15, 2002, Copenhagen opened the Harbor Bath ("Havnebadet") at Islands Brygge, just 200 metres from Copenhagen City Hall in order to provide Copenhageners with a clean environment for swimming, fishing and leisure activities.

The Harbor Bath is an innovative example of how an industrial harbor can be redesigned as a recreational swimming facility by using technology to mitigate combined sewer overflows (CSOs). Residents can also monitor swimming conditions on a designated website - www.kk.dk/Borger/ByOgTrafik/GroenneOmraader/badevand.aspx

ISSUE

The first swimming facility in the Copenhagen Harbor area opened in 1785 and throughout the 19th century several more were established. But in 1953 the pollution level had increased, and combined with an improved general knowledge of bacteriology and viruses, swimming was banned for persons 16 years old and younger. In 1954, all swimming in the harbor was banned.

GOALS AND OBJECTIVES

The Harbor Bath provides Copenhageners with a clean environment for swimming and leisure. The aim of the redevelopment of the industrial harbor area was to:

- Provide Copenhageners with a clean environment for leisure activities
- Improve water quality
- Reduce costs related to cleanup of flooding from sewage overflows

IMPLEMENTATION

The development of the Harbor Bath was made possible by Copenhagen's effort to mitigate combined sewer overflows (CSOs). A CSO is the discharge of wastewater and stormwater from a combined sewer system that flows directly into a river, stream, lake or ocean. Over the last 20 years, Copenhagen invested in treatment plants and sewer systems, leading to an immense improvement of the water quality. The city also invested in underground reservoirs to minimize the risk of CSOs. Structures were established, equipped with transmitters to indicate risk of flooding.

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Meanwhile, the harbor area itself evolved from an industrial harbor to a harbor surrounded by residences and office buildings. Today marine recreational options are more important and the transport of goods in the harbor is less prevalent. Public interest in establishing the Harbor Bath was intense and resulted in the establishment of plans to build the Harbor Bath as early as the mid-1990s.

Today every combined sewer overflow structure has at least one level transmitter that indicates when there is a risk of an overflow event. The transmitters continuously send information to a central computer in the Waste Management Department at Copenhagen Energy, and every fifteen minutes data of overflow volumes are transmitted to Copenhagen Environmental Protection Agency (CEPA) and Danish Hydraulic Institute (DHI). If an overflow is spotted, a text message is sent automatically to the officials at the CEPA, Copenhagen Energy and DHI.

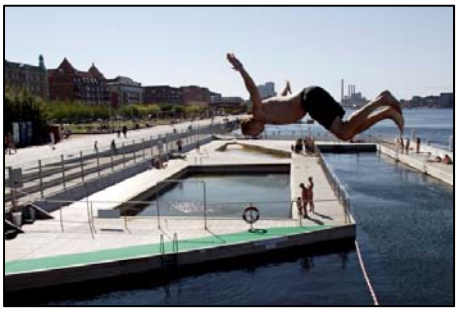
The CEPA decides whether a red flag should be hoisted at the swimming facilities. If the red flag is hoisted, DHI starts calculations in a model that uses online data. For safety reasons, if the E-coli count exceeds 500 per 100 ml of water, then the agency is notified and a public warning is issued.

Data on the actual situation of the swimming facilities can be monitored by the public at any time during the swimming season on the Internet. The Internet address is http://www.kk.dk/Borger/ByOgTrafik/GroenneOmraader/badevand.aspx

Cost

Investments in the sewage system do not solely relate to swimming water quality but also to rehabilitation and flooding. The annual investments in the sewage systems of Copenhagen are approximately 200 million DKK (approx. 38 million USD).

Results and Evaluation



Copenhagen's harbor was formerly used for industrial purposes such as goods transport and ferry services. As the industrial activities moved to new harbor areas, only ferries and cruisers remained, mostly in the northern part of Copenhagen. Today, the harbor areas at the centre of the city scarcely have sailing traffic, and along the harbor basins residence and office buildings are being built. Recreational activities such as kayak-polo, canoeing, kayaking, and yacht sailing are taking over the water areas. Citizens now have swimming facilities as well.

Timeline

1996:	Masterplan for sewage system of Copenhagen requires a 50% reduction in CSOs to the harbor
1996:	Real time control introduced in sewers
1998:	First two retention tanks established – several to follow
2000:	New masterplan for sewer system introduces water quality goals for 2010
2002:	First swimming facility in the inner harbor of Copenhagen
	EU's blue flag indicates good water quality in the beach of Amager, Copenhagen
2010:	Inner harbor now determined swimming water (one local exception)
2015:	Goal - all marine receiving waters of Copenhagen are determined of swimming quality

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2000-2015: Massive investments in sewer system, including rehabilitation, control systems and new treatment technologies will be implemented

LEGISLATION

The EU Swimming Water Directive is the driver behind the planning of CSO control measures. Since 2000, the Directive had been included in the Sewerage Plan of Copenhagen and continually revised.

LESSONS LEARNED

From 2000 to 2011 there was an increase in the frequency of extreme rainfalls, e.g. during the 2. July 2011 rain storm more than 150 mm fell in less than two hours. This is challenging to the systems, and a disconnection of stormwater from the combined sewer system is now strongly promoted.

Since it opened in 2002, twenty rain events caused the closure of the swimming facility for a total of 30 days. The closures were determined by the Danish Hydraulic Institute's (DHI) monitoring devices. Compulsory weekly swimming water control tests of the E-coli concentration showed a concentration far below the threshold for swimming water and also show that the actual E-coli concentration is considerably lower than previously calculated, an indicator that the alarm system works safely.

The best security against swimming in polluted water is to avoid combined sewer overflow at all. As this is technically and economically impossible, it is important that the alarm system performs flawlessly; especially until the sewer system is fully developed.

The main sources of error turned out to be that one or more level transmitters returned wrong values (typically due to wrong calibration or because the transmitter has been pushed out of its place) and that signals to DHI have an outfall. As there are more than 30 transmitters connected to the alarm system, the error of one transmitter is not crucial for the safety of the alarm system; however, a great effort is still required in order to secure the right information from the level transmitters. If the signals have an outfall, it is easy to detect and correct.

Apart from telling when there is CSO and risk of polluted swimming water, the alarm system also calculates when clean swimming water will be obtained again, based on the safest swimming conditions for residents. Later comparisons show that the modelling is safe regarding E-coli concentration. Even though the model is adjusted on this basis, the basic philosophy for the alarm system is to calculate conservatively to ensure that there is no risk connected to swimming in the harbor, even though this may cause the swimming facilities to close unnecessarily.

TRANSFERABILITY

For cities considering opening a safe area for swimming and marine recreational activities in a formerly industrial harbor, the Harbor Bath is a case study to consider given its innovative use of technology to monitor the CSOs.

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Facts and figures in this report were provided by the highlighted city agencies to New York City Global Partners.