

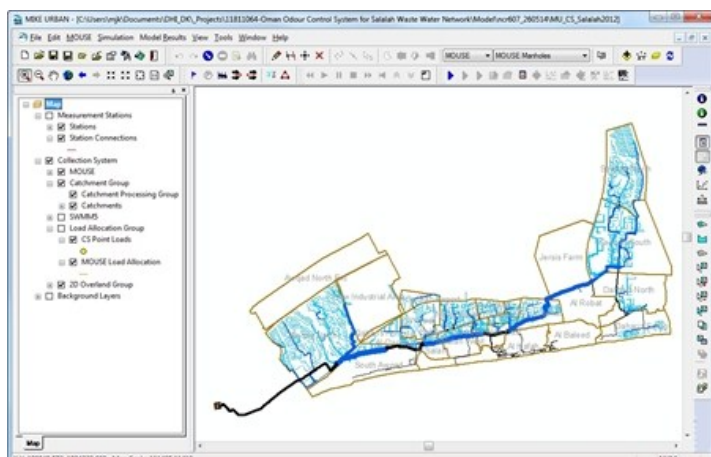
ASSESS HYDROGEN SULPHIDE FORMATION IN SEWERS

Using our integrated model concept

Hydrogen sulphide corrosion is a serious problem that affects large areas of a typical sanitary sewer collection system. In many cases, it is the main reason behind facilities restoration – the corrosion can require premature repair or replacement of concrete pipes, manholes, wet wells, pumping stations, wastewater treatment plant (WWTP) facilities, and ductile iron force mains. Globally, costs related to the mitigation of corrosion damages exceed approximately 50% of the overall sewer restoration costs. In addition, hydrogen sulphide frequently causes serious odour nuisances. Exposure to low levels of hydrogen sulphide can cause eye and respiratory tract irritation. At high levels it can cause immediate loss of consciousness and even death.

DYNAMIC MODELLING TO ASSESS HYDROGEN SULPHIDE FORMATION AND POLLUTION

To facilitate simulation of the hydrogen sulphide formation process in sewers and study its release into the atmosphere, we integrated the MIKE URBAN CS model with the Wastewater Aerobic/anaerobic Transformations in Sewers (WATS) model – originally developed by Aalborg University – to simulate flows and pollution in sewerage collection networks. MIKE URBAN CS WATS model complex provides a powerful platform for studying hydrogen sulphide in sewerage networks. It complements traditional field investigations and improves overall efficiency and reliability of mitigation measures.



Using MIKE URBAN CS WATS model complex to study hydrogen sulphide © DHI

CLIENT

- Municipalities
- Water and sanitation utilities
- Local and national authorities
- Universities and research institutions

CHALLENGE

Managing and controlling hydrogen sulphide formation in complex sewerage networks

SOLUTION

Our MIKE URBAN model with Collection System module (CS) integrated with Aalborg University's Wastewater Aerobic/anaerobic Transformations in Sewers (WATS) model

VALUE

Enables you to:

- identify areas with increased risk of hydrogen sulphide odour and corrosion
- assess mitigation options
- conduct diagnostic simulations, simulate development scenarios and mitigation strategies, and generate visualisations of critical areas
- perform efficient, reliable, accurate, highly detailed, and cost-effective desktop analysis and diagnosis of the actual hydrogen sulphide-related risks
- establish clear cause and consequence of corrosion and odour risks
- develop improved hydrogen sulphide prevention and mitigation strategies

We extended a calibrated MIKE URBAN CS hydrodynamic sewer network model to include:

- the simulation of advective-dispersive pollutant transport
- dissolved oxygen depletion and reaeration
- hydrogen sulphide formation
- hydrogen sulphide release into the air
- water age calculation

MIKE URBAN WATS model simulates the hydrogen sulphide-related biochemical processes in wastewater throughout the modelled network. The relevant hydraulic parameters and actual sewage properties used by the WATS model are provided by the hydrodynamic and transport models. This results in realistic and accurate modelling of process dynamics due to time-varying sewage flows and key properties such as pH, temperature and organic matter contents, pumping schedules, prolonged detention times in wet wells and rising mains during low flow periods being taken into account.

External control of the WATS model parameters allows the hydrogen sulphide formation process to be controlled beyond the default model operation, making it possible to calibrate the model based on sewage temperature, pH, COD and hydrogen sulphide measurements. All this creates an unprecedented level of detail and accuracy when studying hydrogen sulphide in large and complex sewerage networks. We further extended the MIKE URBAN WATS model to include the simulation of selected chemicals dosing for hydrogen sulphide removal and formation control. Simulations of nitrate and iron salt based chemicals dosing are included.

IDENTIFYING AN OPTIMAL STRATEGY WITH MIKE URBAN CS WATS

Our MIKE URBAN WATS model allows you to consider potential advanced dosing strategies to both prevent hydrogen sulphide formation and facilitate its removal – before you decide which option to implement.

This facilitates a reliable means for identifying an optimal strategy (for example, locations of dosing facilities, dosing dynamics, and chemicals amount) in terms of problem mitigation, dosing facility installation costs, and chemical costs.

Applying MIKE URBAN CS WATS assists you with increasing your understanding of hydrogen sulphide and identifies how its implications are likely to evolve with anticipated changes in future operational conditions. As a result, it can help you come up with potential mitigation measures.

The model output contains both numerical and graphical elements, including user-defined tables with extreme values of relevant variables, time series graphs and detailed maps of the sewer network.

The detailed maps illustrate the existing level of hydrogen sulphide, the amount of hydrogen sulphide released to the air, dissolved oxygen concentrations, and retention times. You can also animate the maps to fully understand the process dynamics throughout the simulation period.

THE BENEFITS OF MIKE URBAN CS WATS MODEL

Our MIKE URBAN CS WATS model provides accurate, highly detailed and cost-effective diagnosis of actual hydrogen sulphide-related risks. As such, it can help you establish clear causes and consequences of corrosion and odour risks due to changes in water and pollution loads, operation strategy, and future system developments. This can assist you with improving your hydrogen sulphide prevention and mitigation strategy.

In addition, the model's versatile and attractive visualisation options can assist you with reporting as well as help you improve your understanding of the problem. Our MIKE URBAN CS WATS model complex is available:

- as part of our MIKE Powered by DHI Software – MIKE URBAN pollution transport module
- as a consultancy service

REFERENCE

The Salalah Sanitary Drainage Services in the City of Salalah (Sultanate of Oman) faced serious odour problems and physical damage due to progressive corrosion of the sewer structures and equipment. This was caused by excessive hydrogen sulphide formation in the sewerage, which is associated with long rising mains adjacent to numerous pumping stations. High temperatures and organic matter concentration in wastewater further magnify the issue. Our MIKE URBAN WATS model simulations helped to:

- improve understanding of the mechanisms causing the problems by providing qualitative and quantitative spatial assessments of the hydrogen sulphide formation and release to atmosphere
- create a platform for the development and testing of mitigation measures, including dosing of chemicals for hydrogen sulphide inhibition and precipitation as well as changing pumping strategies



The City of Salalah (Sultanate of Oman) wastewater collection system's inlet for main pumping station #2 – air extraction and chemical dosing. © DHI

Contact: info@dhigroup.com

For more information, visit: www.dhigroup.com