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Catskill-Delaware Water Treatment Ultraviolet Light Disinfection Facility, USA

Case Study 126

Catskill-Delaware Ultraviolet Light Disinfection Facility, which treats drinking water for 9 million people in New York, was constructed to high environmental standards and won a national best practice award in the environmental category.

Aspects of Sustainability

This project highlights the following:

Green Aspects

- Energy
- Carbon
- Materials
- Water
- Local Impacts

Social Aspects

- Human Resources
- Corporate Community Involvement
- Business Ethics
- Health and Safety



“The \$1.3 billion construction project was executed in a manner that instilled our confidence in the team itself and in the delivery approaches implemented, all resulting in some of the best delivery performance metrics earned on any major DEP capital construction project.”

Gerard Cox, Portfolio Manager,
 NYC Department of Environmental
 Protection, Bureau of Engineering Design
 and Construction

Project Sustainability Highlights

Economic

- Around 75 % financial savings compared to a water filtration plant of the same capacity
- Operational financial savings of over 30 percent

Green

- National “Best of the Best Project” award in the Water/Environment category
- Operational **energy** savings of over 30 percent
- 98 percent of construction **waste** diverted from landfill

Social

- Over 2.6 million hours worked on site without a lost time accident

Skanska Color Palette™

Energy



Carbon



Materials



Water



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Project Introduction

The Catskill-Delaware Water Ultraviolet Disinfection Facility is a 15,000 m² ultraviolet (UV) water disinfection plant that has been built in Valhalla, Westchester County, approximately 50 km north of Manhattan. The facility was constructed to disinfect water from New York City's Catskill and Delaware reservoir systems, which supply drinking water to more than 9 million New Yorkers or around 90 percent of New York's potable water. The UV disinfection facility was built to complement New York's existing chlorination and fluoridation facilities, and meet water treatment requirements from the United States Environmental Protection Agency following Cryptosporidium- and Giardia-related illness outbreaks in other parts of the country. At the time of construction, the facility was 10 times larger than any other UV disinfection plant in the world and was the world's largest unfiltered surface water system. UV treatment has no health impacts and does not affect water taste.

A Skanska USA Civil joint venture (50 percent owned by Skanska) constructed the US\$ 1.6 billion project for the New York City Department of Environmental Protection (DEP). The Catskill-Delaware facility applies Low-Pressure High-Output (LPHO) UV disinfection technology and is equipped with 56 UV disinfection units that neutralize waterborne pathogens in approximately 8.5 million m³ of water per day. Valves and roller gates are designed to control the flow of water with gravity, rather than pumps, and the facility

includes over 1.5 km of steel piping and over 3 km of concrete encased piping, ranging from 1.2 m to 3.7 m in diameter. The project included excavating over 450,000 m³ of material, pouring 92,500 m³ of concrete, and the installation of 1,200 tons of structural steel and 522 precast elements. The building consists of a structural steel frame with a precast façade and stainless-steel roof. Much of the facility is located below grade and is covered with green roofing. Above-grade structures include the offices, mechanical and electrical support facilities, and a generator building. The facility also includes laboratory space and is equipped with comprehensive monitoring, back up and safety systems.

The team maintained a 4D construction model of the plant throughout the project, which combined a 3D design model with scheduling information and construction sequences, which helped to identify potential construction issues and achieve on-time project delivery. The UV facility construction was completed on schedule and on budget, whilst meeting the multiple interim milestones established by regulators.

The Catskill-Delaware UV disinfection facility won the ACEC (American Council of Engineering Companies) National Grand Award for "Best of the Best Project" in the Water/Environment category in 2013. The award recognized the significantly reduced environmental impacts achieved by the project, both during construction and operation.



Contributing Toward Sustainable Development

The Catskill-Delaware UV disinfection facility has ensured the supply of safe and high quality water to New York City, whilst reducing financial costs and environmental impacts through smart design during construction and operation. The facility cost around 75 percent less to construct than a filtration plant of the same capacity. The disinfection facility is equipped with efficient LPHO UV disinfection units that are designed to use 30 percent less power than conventional medium-pressure units, and the facility uses gravity rather than pumps. The facility has been estimated to reduce operational energy and financial costs, as well as make annual greenhouse gas emission savings of 13,700 tCO₂e. The facility is also partially covered by green roofing and includes office spaces that promote high quality working environments for staff. During construction, an innovative Joint Venture approach was employed to promote cooperation and communication throughout the project team. This cooperation allowed the team to excel in environmental performance and helped to reduce environmental impacts during construction. 98 percent of the construction waste was diverted from landfill, and the team worked to reuse materials and source local materials where possible. Close cooperation throughout the team also promoted a working environment that was free of site accidents, and over 2.6 million hours were worked on site with no lost time accidents. The project contributed toward local economic benefit and invested in the local community.

Green Aspects

Energy

Energy efficiency

The facility was equipped with efficient LPHO UV disinfection units that use 30 percent less power than conventional medium-pressure units. In addition, the facility was designed to avoid the need for large and energy intensive pumps to distribute the water to New York City by maintaining a gravity flow.

Carbon

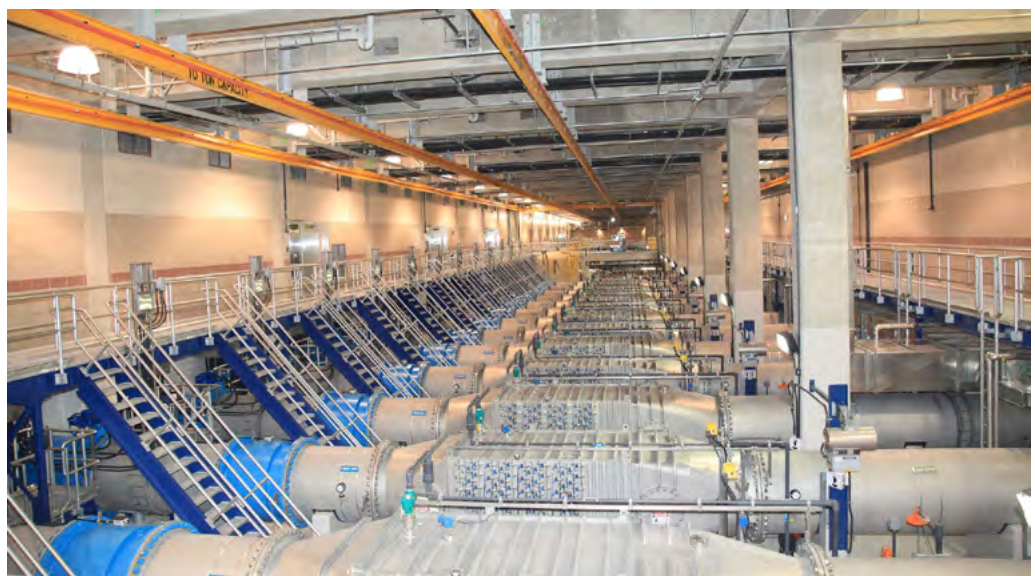
Reduced operational carbon

A study by the equipment manufacturer and University of Western Ontario calculated that the LPHO UV disinfection technology used at the Catskill-Delaware facility leads to greenhouse gas emission savings of 13,700 tCO₂e per year compared with if a medium pressure solution had been used.

Materials

Waste management during construction

Between 2012 and 2013, 98 percent of the construction waste was diverted from landfill, which exceeded Skanska's targets of 92 percent in 2012 and 94 percent in 2013. The team strived to carefully sort and segregate waste on site throughout the project. One simple waste management measure that had significant benefit involved using clear waste bags instead of standard black bags. Clear plastic bags ensured that waste handlers could easily see the type of waste, which avoided sending recyclable waste to landfill by mistake. All asphalt removed from the site was recycled.





Environmentally responsible materials

Recycled concrete was sourced locally and used for all road sub base used on the site. Excavated soils were reused on the site as fill material, which avoided the need to dispose of and source fill material.

Other Green Aspects

Reducing local environmental impacts during construction

The team worked to reduce air pollution and greenhouse gas emissions during construction by using low-emission construction equipment and low-sulfur fuels. Site noise was carefully monitored to ensure it did not exceed agreed limits. The 4D model promoted material efficiency by accurately calculating the quantities of materials required to minimize waste, and by reducing the need for rework.

Green roofing

Much of the processing facility is located below grade and is partly covered with turf roofs. The turf roofs provide additional thermal insulation, contribute toward a lower urban heat island effect, reduce stormwater runoff, and provide habitats for birds and insects.

Social Aspects

Project team cooperation

The project team consisted of a Joint Venture that was led by Skanska. Rather than organizing the cooperation as a typical Joint Venture whereby

each project partner is assigned specific duties, the partners of the Joint Venture were fully integrated. This integrated approach involved dividing individuals within the team into specific disciplines (Civil Structural, Civil Site Work, Mechanical, Document Control and Project Controls including cost, scheduling and commercial issues), regardless of which partner the individual worked for. This approach built a strong and dedicated project team based on the experience and expertise of the individuals, and facilitated communication and cooperation throughout the entire team. The project management believe this innovative Joint Venture approach was key to the project's success.

Community investment

The team organized several Red Cross Blood Drives on site and encouraged workers to donate blood. Skanska also allowed the local fire department to use the site to practice emergency rescue drills. The team donated approximately US\$ 5,000 of materials to the local Boy Scouts to help them build a handicap ramp, and operated a 100-foot boom lift for them during repair work on a steeple.

Occupational health and safety

Over 2.6 million hours were worked on site with no lost time accidents. Skanska's safety culture and the team's innovative Joint Venture approach promoted a working environment that was free of site accidents. Injury Free Environment training was provided to instill a strong safety culture by encouraging everyone to look out for their fellow workers. Safety initiatives included daily morning coordination and Job Briefing meetings that always included safety, various safety training programs,



a Safety Super League where crews competed for prizes and monthly safety committee meetings that included a site walk through.

Promoting high quality working environments

The offices are open planned and are lit with natural light. Low partitions between workstations ensure that natural light penetrates the offices, while fostering a working environment that promotes communication and collaboration.

Supplying high quality water to New York

The facility ensures the continued provision of safe and high quality water to consumers. The UV treatment avoids outbreaks of Cryptosporidium- and Giardia-related illnesses in New York City.

Economic Aspects

Local economic benefits

Approximately 800 workers worked on site and all were from local unions. The workers were encouraged to use local amenities, such as restaurants and stores, with the aim of benefiting the local economy during construction. The team used local restaurants to feed 100 management staff every Friday, and the entire workforce when each of the project's ten milestones was reached.

Financial savings

The client estimated that the UV treatment facility cost around 75 percent less to construct than a conventional filtration plant of the same capacity. In addition, the facility is equipped with UV lamps that use 30 percent less energy than conventional

medium-pressure lamps, and the need for large and energy intensive distribution pumps were avoided through smart design that uses gravity. Consequently, the facility will realize significant financial savings throughout its lifespan. During construction, financial savings were realized by the 4D model, which reduced waste, the need for rework, replacement materials and lost time.

Learning From Good Practice

The innovative Joint Venture approach was key to the success of this large civil project. The approach facilitated communication and cooperation between all project partners. It also contributed toward the project's good environmental performance and the winning of a national best practice award in the environmental category.

