Nord Stream
The new gas supply route for Europe

FACTS

NEWSLETTER ABOUT THE NATURAL GAS PIPELINE THROUGH THE BALTIC SEA ISSUE 23 / SEPTEMBER 2012

The survey vessel, Skandi Olympia is deploying a remotely operated vehicle that is used for visual inspection of the pipeline.

Underwater Robot Now Scanning Line 1 from Russia to Germany

Key data regarding the positioning and condition of the pipeline will be collected by October

The Nord Stream Pipelines will be subjected to regular inspections during their at least 50-year operational lifetimes in order to continually confirm their integrity. These periodic external and internal inspections will help to eliminate the risks caused by highly-unlikely deformation or damage.

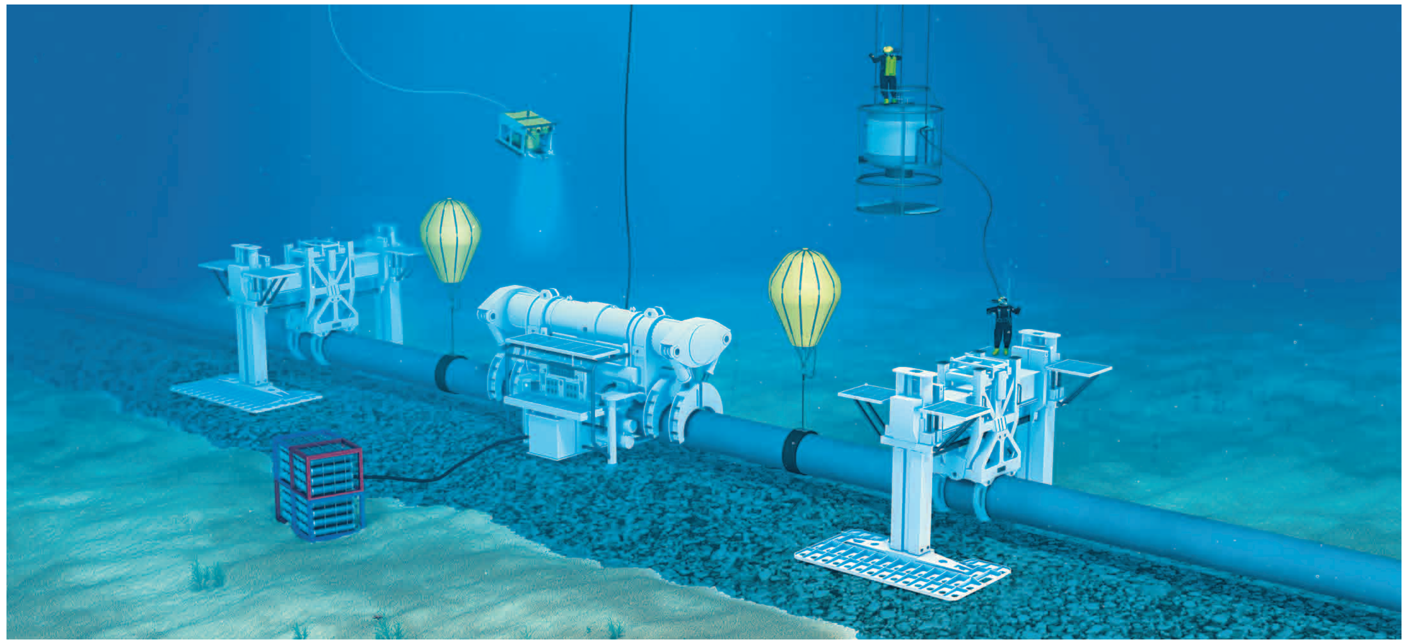
External Inspections

In the early years of operation, inspections will be carried out annually; the frequency of such checks will be reduced over time. Some portions of the pipelines will be inspected more often than others due to legal requirements and the results of risk analyses. The results of the inspections will also have an influence on the inspection schedule. The first external inspection of Line 1 is currently underway. This is an actual structural survey. "This inspection will confirm the position, depth and condition of the pipeline within the first year of operation and will provide us with the baseline data, against which the results of subsequent inspections can be compared. It will be conducted along the entire length of the pipeline, from Russia to Germany, including the onshore sections," says Janine Bailey, Survey Project Manager for Post Construction at Nord Stream AG.

The lion's share of the analysis will be performed from aboard the remotely operated vehicle (ROV) survey-support vessel Skandi Olympia. In the near shore sections, less than 11-metres deep, smaller vessels will be used to acquire the survey data. The inspection began in Russian waters in mid-June, and will continue until mid-October. The Skandi Olympia is currently en route in Swedish waters. An ROV will be launched from the Skandi Olympia, and will examine the exterior of the pipeline closely. "The pipeline will be visually surveyed with underwater cameras mounted on the ROV to check its condition, but that's not enough. We also use high precision survey sensors to accurately derive the position and depth of the pipelines relative to the adjacent seabed and intervention works. This process is extremely important for the assessment and monitoring of pipeline free spans. Where the pipeline is buried in trenched/intervention areas or has been naturally embedded into the seabed over time, we use an electromagnetic pipe tracking system to determine the position and depth of the pipeline beneath the seabed," explains Bailey. If all goes as expected, the ROV can spend several days underwater in order to collect data.

Internal Inspections

In the future, the interior of the two pipelines will be inspected by intelligent Pipeline Inspection Gauges (PIGs) that are currently being modified to meet the special requirements of the pipelines. The internal inspection has three main objectives: Although corrosion is not expected to set in during the operational lifetime of the pipelines, a magnetic instrument will measure the wall thickness of the pipelines, and would discover any sign of corrosion. A device measures the internal dimensions of the pipeline; it would detect any buckling, its precise position, size, and the coordinates. An inertial module unit also measures the exact run of the pipeline's curves. This data is used to conduct extensive stress analyses. All three instruments will be installed on an intelligent PIG so that the measurements can be made in a single run through the pipelines. The PIGs will be sent from the PIG launcher at the Russian landfall and travel with the gas flow to the PIG receiver in Germany in summer of 2013.



The “tie-in” process takes place on the seabed in an underwater welding habitat. Welding operations are remotely controlled from a support vessel. Divers assist and monitor the subsea construction work.

Living and Working Under Pressure: Divers Performed a High-Tech Mission on the Seabed

The Nord Stream Pipelines were welded together at depths of 80 to 110 metres with divers overseeing the process

The life support crew on the Skandi Arctic monitor the divers in the pressurised chambers onboard the vessel.

Worldwide, there are only about 30 technical divers specially trained to perform underwater welding, and all of them were on stand-by for the welding work on the Nord Stream Pipelines. Though the welding process was largely automated and steered from the dive support vessel, Skandi Arctic, it was impossible without the aid of qualified divers. “Everything is run from up on the ship, but we’re their hands,” explains Einar Flaa, one of the divers.

In 2006, Flaa joined Technip, the project management engineering company supporting Nord Stream on the underwater welding work of its pipelines. The 44-year-old Norwegian began working on the offshore construction and repair of oil and gas pipelines in the late 1990s.

Getting Down to Business

Before the welding on the seabed could begin, there was a lot of preparation on the part of the divers. They installed the equipment on the seafloor and monitored the procedures while the pipeline sections were cut, bevelled and welded by intelligent machinery. “All of the equipment comes in bits and pieces, and we have to unpack it and mount it,” says Flaa. The divers also set up the welding habitat, the dry zone where the divers work without diving gear, and the automated welding process takes place. When the habitat was set up and flushed dry of water, the ship sent down a big toolbox and the divers got down to business. “The specs are down to the millimetre,” Flaa explains. “In the welding habitat, you have to line up the pipes so that they are completely flush, and it can be time consuming.” There are pipe handling frames that keep the pipeline steady and can hold up to 150 tonnes of weight. Grips are used to adjust the angle and height by a hair, yet this is physically and mentally exhausting work. But for Flaa, as tiring as things can get: “It’s just a day at the office.”

Six Chambers for 24 Divers

When they were not on the seafloor, the divers lived in hermetically sealed living quarters pressurised to match the pressure of the depths at which they worked in order to avoid the need for long wait times during ascent and descent to their working environment. At depth, the water pressure is so great that a fast ascent would cause gas bubbles to form in the blood, which would result in serious physical harm. Whether it’s on the seabed, in the diving bell, or the cabins of the living quarters, the pressure is the same everywhere.

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A three-man diving bell brings the divers from the pressurised diving system where they live to their subsea work area.

Technical divers, including Einar Flaa, live in special accommodations pressurised to match the pressure on the seafloor where they will work.

Flaa enters the diving bell from the diving system he lives in during the hyperbaric tie-in work for Nord Stream.

The pressurised quarters in which they lived, ate and slept during the their three-week deployment was housed on the decks of the Skandi Arctic dive support vessel. These modern accomodations consist of six chambers, offering enough room for 24 divers. Just 12 divers lived in this saturated environment during the Nord Stream welding work. The chambers are linked by a series of hatches and tunnels. Each sleeping compartment is 5-metres long and 3-metres wide – not much bigger than a holiday caravan. “Compared to other vessels, this is the Rolls Royce of diving systems,” says Flaa. Before heading to the seafloor, divers spent about five days in the chamber to allow their bodies to adjust. The divers breathe a mixture of oxygen and helium during their time in saturation.

The deeper the dive they make, the higher the dose of helium, and the higher their voices become. When speaking with the supervisors on the vessel, the divers use a sort of voice equalizer called a scrambler. “You get used to what’s being said,” says Flaa. The most challenging part of the job for Flaa is dealing with the boredom of decompression, which lasts up to six days. “You get over-relaxed, and that’s when my mind starts to go home.”

How the Segments Were Connected

The hyperbaric tie-ins of Line 1 and Line 2 were completed in June 2011 and June 2012 respectively. Following a survey of the pipeline segments, equipment needed for welding was lowered to the seafloor from the Skandi Arctic dive support vessel. Divers placed the wire cutter at the end of each segment to cut the overlapping segments to the correct length in preparation for welding. Once cut, welding plugs were inserted into the ends, and inflated to ensure a perfect seal. A beveling machine was used to smooth the cut ends. The segments were lifted and shifted into position for welding, then the welding habitat was lowered over the ends. The habitat supplied is a dry zone were the divers worked without diving gear to set up an automatic welding machine completely controlled from the dive support vessel. For 24-hours a welding head rotated around the segment ends. The completed welds were inspected using ultrasound. Once the quality of the welds were confirmed, all of the equipment was retrieved.

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The construction of the pipe and spare part warehouse began in April this year and was completed in August.

Prepared for the Unexpected

Not far from the pipelines' landfall facility in Germany, Nord Stream has built a warehouse to store pipes and spare parts

On the grounds of the Lubminer Heide industrial and energy centre, not far from the pipelines' landfall facility, Nord Stream operates a warehouse where 450, 12-metre pipes are stored.

"It's the ideal location for the storage of replacement pipes and key spare parts for the Nord Stream Pipelines," says Peter Massny, Manager of Operations and Maintenance Germany for Nord Stream AG. That's because the nearby harbour enables pipes to be quickly transported by ship to the pipelines when needed.

"In fact, we don't anticipate that the Nord Stream Pipeline system will require any repairs during the course of its expected lifetime of more than five decades. Nonetheless, by storing the pipes we're well prepared for the unlikely event that a repair will be needed, since production later on would be both costly and time-consuming," Massny says.

The Region Benefits

Nord Stream invested about 5.5 million euros in the storage site. The contract for the construction of the warehouse was awarded to Stahlbau Stieblich, based in Güstrow, Germany. "We were pleased to award the contract to a company in the state of Mecklenburg-Western Pomerania," says Massny. Nord Stream awarded the contract to operate the warehouse to Gascade, the same company responsible for the operations at the landfall facility.

Construction of the warehouse began in April 2012. The building, now completed, measures 188-metres long, by 34-metres wide, and 10 metres tall, and sits on a site measuring roughly the size of three football fields. As early as June, when the concrete floor slab was laid, roughly 400 pipes were stockpiled on the storage area. A total of 40 pipes arrived by lorry at the site each day, and were stacked with a special pipe reachstacker so that they can lie three-deep in storage for at least 50 years with no loss of quality. The structure was developed specifically for this purpose. It ensures sufficient airflow around the pipes, and they can be visually inspected in their entirety at any time.

While the pipes were being stacked, the steel construction of the warehouse was erected. When this frame was in place, the roof and walls were added. The structure was built around the stored pipes, rather than trying to bring them, piece-by-piece, into the structure.

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