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The Murmansk Initiative - RF: 1994-1999 "Nearing the Finish Line"*

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ABSTRACT

"The Murmansk Initiative - RF" is a tri-lateral project developed to support Russia's ability to meet the London Convention's prohibition on ocean disposal of radioactive waste. The Initiative, under a tripartite agreement, has upgraded an existing low-level liquid radioactive waste treatment facility, increasing capacity from 1,200 m^3/year to 5,000 m^3/year, and expanded capability to treat liquids containing salt (up to 10 g/L). The three parties to the agreement, the Russian Federation, Norway, and the United States, have all contributed the project. All construction has been provided by Russia. Construction of mechanical systems (piping and valves, pumps, sorbent columns, settling tanks, and surge tanks) is nearing completion, with instrumentation and control (I&C) systems currently being installed. Delays to the I&C installation have occurred because changes in system specifications required additional U.S. supplied computer control equipment to be purchased, and clearance through customs (both U.S. and Russian) has been slow. Start-up testing has been limited to testing of isolated sub-systems because of the delays in the I&C installation. The current state of the Russian economy and completion of a cementation unit, which was not part of the original tri-partite agreement, have hampered final construction activities. Russian regulatory authorities have stated that final licensing for expanded capacity (5,000 m^3/year) would not be given until the cementation unit was on-line. Completion of the project is now scheduled for August 1999.

INTRODUCTION

The Project known as the "Murmansk Initiative," an ongoing collaboration between Norway, the Russian Federation and the United States of America [1], started in 1994. Cooperative design and feasibility studies were conducted from April to December 1995, when an agreed-upon scheme for the financing and construction upgrade for the facility was approved. The protocol (signed in Oslo in December 1995) between the three member nations specified financing responsibilities and called for construction evaluations at the 20, 50, 80 and 100 % completion milestones in the project. Completion of the construction phase of the project was scheduled for the first half of 1998. Under the conditions of the Oslo protocol, the construction phase includes start-up testing, now scheduled to be completed by 12/31/99. In June 1998, a technical review team inspected the facility at Murmansk, to assess progress and to finalize plans for start-up testing. Subsequent facility visits have been held in April and June 1999.

The objective of the tri-party collaboration is the expansion and upgrade of the low-level liquid radioactive (LLRW) waste facility located in Murmansk, Russia. The capacity of the planthas has been increased from 1,200 m^3/year to 5,000 m^3/year. It has been expanded to treat three different liquid waste streams: low-salt solutions (#1); Decontamination and laundry waste, medium salt content solutions, (#2); and High-salt solutions (#3). The low-salt solutions are currently treated at the facility. The upgrade project adds the capability to treat solutions #2 and #3, and will automate most of the processing with computer-controlled programmable logic controllers supplied by the U.S. to reduce occupational exposures.

The treatment plant is located at the facilities of the Russian company RTP Atomflot, in Murmansk, Russia, which provides support services for the Murmansk Shipping Company's nuclear icebreaker fleet. Except for the U.S.-supplied process control equipment, the new facility has been built completely with Russian technology.

The April 1999 site inspection showed that there was construction work remaining in electrical and in instrumentation and control (I&C) systems. Much of the equipment had been purchased and was either on-site (about 90%) or in transit to the site (about 10%). Approximately 90% of the mechanical equipment (piping and valves, pumps, sorbent columns, settling tanks, surge tanks) had been installed. Installation of much of the I&C systems had yet to be done. A major element of the I&C systems, computer-controlled programmable logic controllers (supplied by Honeywell) had been delivered, but installation was delayed. Changes in system specification required ordering additional components, and clearance through customs (permission to export from the U.S. and passage through Russian customs) has taken longer than expected.

The start-up testing will be conducted first using clean water and then using actual liquid wastes to be treated. Clean water will be used for hydraulic testing, and for system maintenance activities including addition and removal of sorbents. A Russian company Energospetsmontazh (ESM), a subsidiary in the Minatom system, has been contracted to carry out the start-up testing, which is expected to last about 3 months.

As with each inspection meeting conducted to date, new obstacles to completion appear. In this case, funding from the Russian government was not available to complete the cementation unit in the facility. This has implications for final licensing. In addition, continued construction activities have been affected by the difficulties resulting from the problems with the overall Russian economy.

FACILITY DESCRIPTION AND CONSTRUCTION STATUS

The final facility design and early construction phases have been described in detail in previous publications [1-3]. A schematic process diagram (Figure 1) illustrates the Murmansk facility components and the process scheme to be used for all of the waste types to be treated (solution #2). Solution #1, the low-salt and lower radioactivity waste, has historically been processed at the facility with filtration, sorbent and ion-exchange technologies. Because of their similarities and higher salt content, Solutions #2 and #3 (containing an average of 2 g/L salt, and 10 g/L salt, respectively) are treated in the same process units, although the liquids will be treated separately. The presence of decontamination reagents, especially complexants such as Trilon B (containing

EDTA and oxalate) in solution #2, presents an additional challenge because the complexing agents must be destroyed to prevent the degradation of specialized sorbents and salt removal systems. Salt removal by electro-dialysis and electro-membrane concentrators (Unit 6) are required because discharges into the Kola Bay have regulatory maximum concentration limits for salinity (about that of freshwater, even though the Bay is salt water).

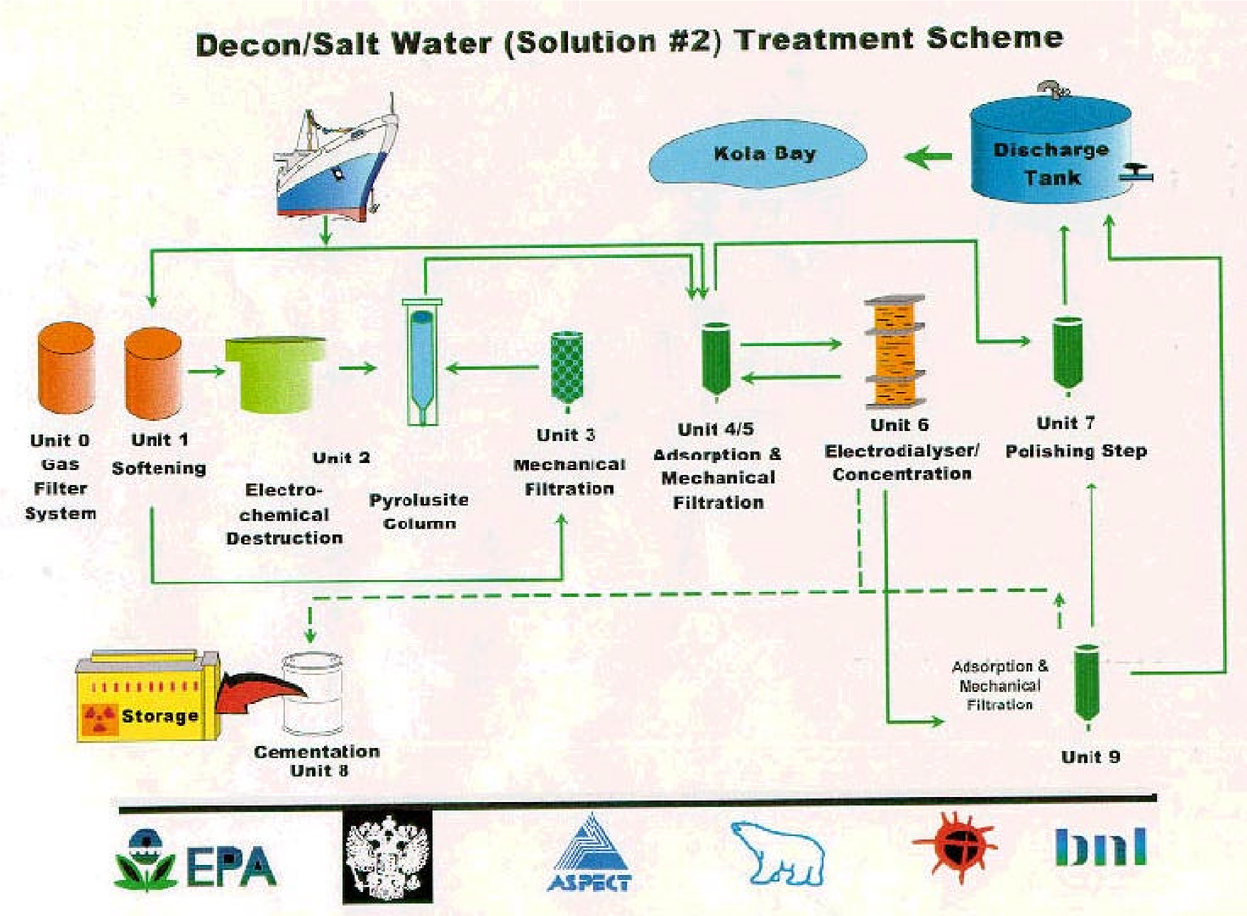

Figure 1. Solution # 2

One of the last major pieces of the processing system, the Unit 2 electrochemical destructor, was installed in the fall of 1998. This unit will destroy the organic complexants by electrolysis, which also produces hydrogen gas as a by-product. Because of this feature, the need for and design of this unit were reviewed carefully to assure that safety requirements were met, and that projected facility treatment capacity would still be achieved. To meet facility capacity requirements, the operating parameters for the unit, which is an adaptation of a commercial hypochlorite generator, were modified from a recirculating "batch" mode to a once-through process. Immediately downstream is a catalytic bed composed of pyrolusite (manganese dioxide) to complete the destruction of EDTA and oxalate. Process requirements limit EDTA and oxalate to maximum concentrations of 1 mg/L and 2 mg/L, respectively. Hydrogen gas generated in the process is diverted to the off-gas system and mixed with air to below explosive limits, passed through a HEPA filter, and vented.

The I&C system installation has progressed since the April 1999 inspection. Wiring and motors for motor-operated valves are in place. Cable runs to switching and control points are nearly done. However, installation of the computer-controlled PLC system, a major component of the I&C system, only recently started. The PLC system was paid for separately under the US TIES program. Delays in the delivery of the PLC system occurred initially because there were problems with getting the equipment through Russian customs without paying import fees. In addition, slight changes in process design, identified after the equipment had been ordered, required the purchase of additional equipment. These items were identified specifically at the June 1998 inspection meeting and ordered immediately. Training of Murmansk technical personnel (also included in the contract) on the use and maintenance of the PLC systems is now being organized and completed.

START-UP TESTING PLAN

The start-up plan for testing the treatment systems consists of individual unit and piping systems tests using non-radioactive liquids. These will be conducted as each unit is completed and becomes capable of being tested and is essentially a physical check for piping leaks and valve operability. As noted earlier, Energospetsmontazh (ESM), a Russian subsidiary company in the Minatom system, has been contracted to carry out this stage of testing. ESM has extensive experience in conducting start-up activities at other Russian nuclear facilities. At the April 1999 inspection meeting, ESM presented a draft plan and procedures for their activities at the Murmansk facility. However, all their testing will be limited to non-radioactive testing.

Testing with radioactive solutions will be carried out once all systems have been certified for operability by Russian authorities. Plans for the start-up phase have been written and are awaiting approval by the Russian regulatory agencies.

MORE LESSONS LEARNED

Financing has been the more significant issue in the last year. During the June 1998 inspection meeting, the Russian project managers pointed out that completion of the construction phase of the project was impossible without $313,000 (US) additional funds. This would cover completion of the cementation unit, on which work had stopped because Russian government funding stopped. Local regulatory authorities stated unequivocally that final licensing to 5,000 m^3 capacity would not be approved without cementation capability. As found in earlier stages of the work, continuation through the end of this work requires a strong commitment to finish. This latest need for funds was in addition to approximately $750,000 requested (and later approved) at the 50% completion meeting in October 1997.

One lesson continues in different forms. The complexity of monitoring the project (not quite as rigorous as project management) from a distance of 5,000 km and over eight time zones continues to be challenging. Previously, discovering and reviewing facility and process design changes in a timely manner had proved difficult. The most recent element involves the U.S.-supplied, computer-controlled system and PLC components. These had to be ordered and manufactured specifically for the facility; a subsequent Russian design change added approximately 5% to the cost of the equipment. Installation and training were included in the contract, however arranging this aspect of the work has been troublesome. The Russian project managers for the Murmansk project have had discussions with the Russian Honeywell subsidiary, which helped develop specifications for the system, but the contract principals are BNL and Honeywell, USA. Thus, scheduling installation and training has been difficult. Installation began late in December 1998, as a result the start-up testing program has been delayed.

CONCLUSIONS

The project known as the Murmansk Initiative continues as one of the only examples of civilian, tri-lateral co-operation involving Russia. The project has fostered co-operation between different Russian organizations and authorities, and between governments. Western methods of project management, with close project follow up, including quality control and quality assurance, are being adapted to Russian methods. In the process, the Russian authorities are gaining an appreciation for Western methods of applying environmentally acceptable technologies. Western participants, in turn, have learned more about innovative treatment technologies developed by Russia.

There have been and will continue to be many challenges to overcome. Cultural differences and the continuing funding problems have tested all parties' patience and professional and technical skills. However, the fact that there is a common goal and vision shared by all parties has meant that work continues to progress and is rapidly nearing completion.

The Murmansk Initiative is an introduction to other important projects within Russia.
This project is important because it represents one of the first waste management initiatives in the north-west of Russia with foreign partners. When it is operational, the Russian Federation will be able to comply with the international prohibition on the ocean disposal of low-level liquid nuclear wastes. Additionally, the completion of a similar plant in the Far East of Russia will allow the Russian Federation to accept this amendment to the London Convention.

The treatment facility in Murmansk will play an important role in the treatment of the liquid radioactive wastes generated during the dismantling of decommissioned nuclear submarines.

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