




Message from the President of Golder Associates



We at Golder Associates are devoted to identifying and understanding risks and to designing workable solutions that meet the unique needs of our clients. In this issue of *Technically Speaking*, the people who worked on the featured projects were interested in demonstrating our abilities to work with clients on all phases of a project, from inception (e.g., the 2006 Olympics in Italy), through the operational phase (e.g., water and air treatment in Brazil), and to closure (e.g., redevelopment of an explosives factory in Australia).

While preparing this message, it occurred to me that since our last issue of *Technically Speaking*, and during the course of preparing this one, the world was struck with one of the worst natural disasters during modern times – the Asian earthquake and tsunami that killed and displaced untold thousands of people. All of us at Golder were profoundly saddened and our employees and the company have since provided generous support to the relief efforts. Our readers may also be interested to know that we were very fortunate in that our many people working in and visiting Southeast Asia at the time were unharmed and not terribly impacted by the tsunami.

In closing, I'd like to take the opportunity to thank our clients and business partners for their support and for their contribution to our continued success.



Rick Firlotte
President

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Later this year, look for special features in *Technically Speaking* on Health & Safety, Sustainable Development, Water Resources and Air Quality.

Helping make the 2006 Olympic and Paralympic Winter Games sustainable



THE EYES OF THE WORLD WILL BE ON NORTHERN ITALY IN FEBRUARY 2006 FOR THE XX OLYMPIC WINTER GAMES AND IX PARALYMPIC WINTER GAMES – AND MANY PEOPLE WILL BE WATCHING THE GAMES' ENVIRONMENTAL PERFORMANCE AS CLOSELY AS THEY WILL BE OBSERVING THE ATHLETES. INCREASING ENVIRONMENTAL AWARENESS PUTS PRESSURE ON GAMES ORGANIZERS TO BUILD PERMANENT AND TEMPORARY EVENT FACILITIES THAT LEAVE A POSITIVE LEGACY IN AND AROUND TURIN.



To help this happen, the organizing body, Agenzia Torino 2006, appointed Golder Associates to provide technical support, organization and coordination of environmental monitoring of the Alpine site infrastructure. This has involved responsibilities before construction, during the work and after completion.

Monitoring covered 31 sites, including ski lodges, competition grounds, Olympic villages, infrastructure, snow guns, hydraulic works and roads.

Objectives of the monitoring program are to confirm compliance during construction, to collect data and to present it to authorities, and timely and effective response to possible non-compliance. Golder's work also includes setting specifications for monitoring air, soil, water, vibrations, noise and the ecosystem as a whole.

Golder's involvement right from the early stages of development through to the end allowed Games organizers to rely on consistency of procedures and the qualifications of personnel doing the work.

The result will be sustainable facilities that are an asset to the region on a long-term basis.

Brownfields development in Australia

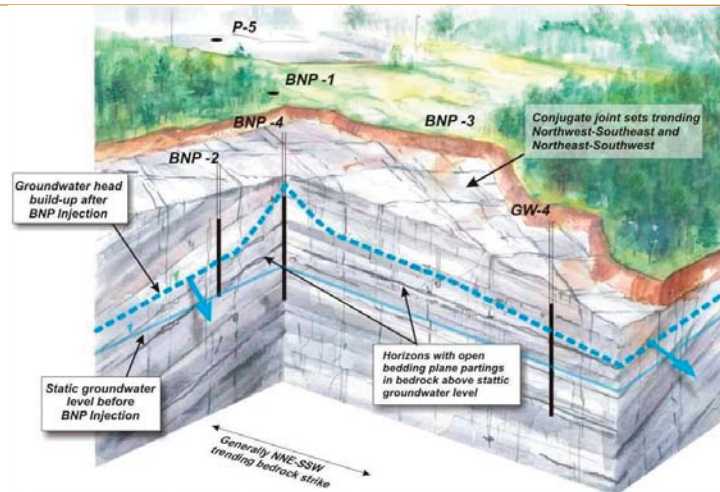
- a balanced approach

AS THE AUSTRALIAN CITY OF MELBOURNE HAS EXPANDED, A VAST 480-HA (1,200-ACRE) SITE HAS STAYED VACANT FOR YEARS, ALTHOUGH IT IS NOW ALMOST SURROUNDED BY DEVELOPMENT. THE REASON: THE SITE'S FORMER USE BY THE ALBION EXPLOSIVES FACTORY HAD LEFT HARMFUL LEVELS OF TOXIC SUBSTANCES IN THE SOIL. HOWEVER, THE LAND IS NOW BEING OPENED UP FOR HOUSING, PARKS AND COMMERCIAL USES.

Many developers are reluctant to build on "brownfield" sites such as Albion, because of concern for legal liabilities. However, Golder was able to demonstrate its ability to conduct a thorough analysis of each part of the property, and deal with the issues discovered to achieve an independent statutory sign off on the contamination status of the site, indicating the permitted uses and conditions of use.

This has meant nine years of involvement in the property. Some of the land had requirements for monitoring or maintenance of surface grades and cover soils. During design and remediation, decisions were made to leave areas that were uneconomic to remediate based on the potential land value. This residual contamination also requires management. This means that while remediation and third party sign off has been obtained, actions taken several years ago now need to be accounted for and the situation managed. Golder has helped the developer design the site infrastructure, satisfying these conditions and maintaining the integrity of the contamination status achieved following remediation.

Continued involvement from remediation concept to sale of individual lots means that this prime piece of real estate is an asset to the community.



Method for In Situ treatment of contaminated groundwater looks promising

NANOSCALE ZERO-VALENT IRON (NZVI) TECHNOLOGY IS GIVING NEW HOPE FOR PROTECTING GROUNDWATER AT RISK FROM UNDERGROUND CONTAMINATION, FOLLOWING A PROMISING TEST IN RESEARCH TRIANGLE PARK, NORTH CAROLINA, USA.

Industrial activities had left the soil and groundwater impacted with chlorinated volatile organic compounds (VOCs), found in many brownfield sites. After Golder analyzed the situation and determined that NZVI was a possible solution, monitoring wells and an injection well were drilled.

NZVI works by removing chlorine from the formula of the chemicals, producing non-toxic materials such as ethane and methane. At the test site, when a water-based slurry containing NZVI was pumped into the impacted soil, Golder researchers were gratified to see that within seven days, there was a reduction of over 90 percent from the baseline concentration of VOCs, which lasted over two months of regular monitoring. Most promising, concentrations of trichlorethene, the dominant contaminant, decreased from 14,000 µg/L to 2 µg/L, six weeks after injection.

The reactivity of NZVI can be substantially enhanced by depositing a small amount of a second metal (Pd, Pt, Ni, Ag, etc.) on the surface of iron to create a bimetallic particle – also known as a "BNP" (BNPs were used at the North Carolina test site).

The long-term in situ treatment implementation will also consider enhanced bioremediation.

Whatever the final result of the experiment, it seems likely that there will be a greater understanding of the best ways to treat impacted soils, thereby protecting groundwater and the rest of the environment.

Developing innovative waste treatment solutions in Brazil

THE LARGEST IRON AND SMELTING METALLURGICAL COMPLEX IN BRAZIL HAS HAPPIER NEIGHBORS THANKS TO RECENT UPGRADES TO THE WASTE-WATER TREATMENT SYSTEM.

The plant, operated by steelmaking giant Companhia Siderurgica Nacional (CSN), had received many complaints from nearby residents about unpleasant smells. After determining that the 20-year-old system was inadequate, Golder proposed that it be upgraded and that an air emissions containment system and a biofilter be installed. Since installation two years ago, Golder has assisted the client with system operation.

A second odor control project, at a printing plant, involved dealing with solvent vapors. Golder proposed modifying and upgrading the existing system, through installing a biofilter. To satisfy authorities and the client that the proposed solution would work for this application, Golder built and operated a pilot plant. Over two months, this program showed the biofilter's effectiveness and helped point the way regarding design of the full-scale installation, now under construction.



These projects were the first Brazilian application of biofilters for odor and hydrocarbon emission control.

A third recent project involved Petrobras, the largest petroleum company in South America, which is facing more stringent criteria for wastewater standards at two facilities that treat discharges from offshore drilling operations. Golder proposed an upgrade solution and performed bench-scale and pilot tests. This included developing a customized treatment process that combines oxidation of organics of concern with coagulation of dispersed oil and suspended solids.

After preparing the detailed engineering, Golder will supervise installation and startup of the upgraded systems.

Building bridges of trust between cultures in Calgary

THE IMPACT OF NEARLY A CENTURY OF MILITARY TRAINING ACTIVITY HAS BEEN CLEANED UP ON A 380-HA (940 ACRE) SITE NEAR THE WESTERN CANADIAN CITY OF CALGARY. IN THE PROCESS, BETTER AND MORE TRUSTING RELATIONSHIPS HAVE BEEN DEVELOPED BETWEEN THE MILITARY AUTHORITIES AND THE ABORIGINAL OR "FIRST NATIONS" PEOPLE WHOSE LAND IT IS.



The Harvey Barracks site, in continuous military use since 1910, had become scarred from artillery shells, lead from spent bullets, fuel from underground storage tanks, buried waste and other contaminants including potential radiological materials and chemical warfare agents.

In 1996, Golder was brought in to complete a comprehensive environmental investigation and oversee the cleanup. Challenges included the variety and dangers of the contaminants, and the size of the area involved. Dealing with these issues required developing an integrated database and geographical information system that catalogued hazards as they were found and addressed.

Being involved from start to finish allowed Golder to provide continuity that reduced the uncertainty of unknown problems being left in the ground on completion of the project. More importantly, Golder's long-term involvement helped build credibility with both the military authorities and the First Nations leaders. This in turn helped change the long-standing culture of distrust between these two groups into better understanding and cooperation.

Now that the cleanup has been completed, the First Nations people plan to develop the land for commercial use, a toll road and entertainment facilities that can help build a long-term economic foundation.

The Golder team was invited to a smudging ceremony organized by the Nation where anyone involved in intrusive work on the Lands was blessed to protect their spirit and the spirits of their ancestors.

Controlling coal mine waste in South Africa

INNOVATIVE USE OF TECHNOLOGY, FLEXIBILITY AND LONG-TERM DEDICATION HAS HELPED CONTAIN COAL MINE SLURRY OVER THE PAST 20 YEARS AT THE RIETSPRUIT COAL MINE IN THE EASTERN TRANVAAL, SOUTH AFRICA.

In 1987, the open-cast mine opened a new storage facility to deal with the slurry produced by coal washing. Golder helped find an appropriate site, and also proposed an innovative storage technique using paddock raising of the outer wall, which had been used by gold mines but never before for coal. The storage technique, which required regulatory approval, has over the life of the project had a cost of about one-quarter of that of conventional impoundment storage techniques used by the coal industry.

However, building the paddock walls involved careful manual work, calling for constant monitoring. As well, we found that the slurry tended to crack and erode, and thus we selected a geotextile that, when incorporated into the outer wall, provided the requisite barrier against internal erosion needed for long-term integrity.

The mine was decommissioned in 2000, but Golder continues to monitor the facility and provide ongoing advice on closure.



Over the past two decades, the property has had a succession of several different owners, so Golder's long-term involvement has been a tremendous asset to management, retaining the institutional memory of mining operations and particularly, the specific requirements for management of the slurry storage facility. The result has been sound environmental performance over the long-term on a cost-competitive basis.

For more information about the projects featured in this newsletter please contact us at: solutions@golder.com. Electronic versions of the newsletter are available at www.golder.com. Just follow the links to our "Library" and "Newsletters".

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A pipeline through difficult terrain



RESIDENTS AND INDUSTRIES OF WASHINGTON STATE, USA, WILL HAVE MORE SECURE ACCESS TO ENERGY THANKS TO THE REPLACEMENT OF A PIPELINE CONSTRUCTED NEARLY 50 YEARS AGO.

The Williams Northwest pipeline carries natural gas south from the Canadian border and north from the southwestern USA, and distributes it to customers throughout the Pacific Northwest and other parts of the country. However, there were concerns regarding the integrity of the pipeline, constructed in 1956, because of two pipeline explosions in 2003. The pipeline was idled until its safety could be proven.

To address these concerns, Williams Northwest decided it could replace the capacity of 431 km (268 miles) of 26-inch diameter pipeline in western Washington with approximately 133 km (80 miles) of 36-inch pipeline. Using the recently acquired team from PIC Technologies, Golder helped obtain Federal Energy Regulatory Commission (FERC) approvals and other federal, state and local approvals, prepared habitat

management and mitigation plans, performed local permitting and hydrological monitoring, and carried out the geotechnical work, including stream crossing design.

Other challenges came from the steep mountainous terrain along portions of the existing right-of-way and over 100 stream crossings, which in some cases called for directional drilling to avoid disrupting the stream beds. The area also contains fragile wetlands and many threatened and endangered species.

As well as helping gain the approvals for the new pipeline, Golder's work included decommissioning parts of the older pipeline that have reached the end of their service life. The result is a more efficient and secure pipeline system that can continue supplying energy to the region for decades to come.

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Technically Speaking is published for valued clients and employees of Golder Associates. This quarterly newsletter includes articles showcasing innovative and technically challenging projects that Golder professionals have worked on throughout the world. We value your opinions. Please contact Gregory A. Beckstrom, Managing Editor, at + 1 651 697 9737 or greg_beckstrom@golder.com if you have any questions or comments.

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