INSIDE
TECHNICAL CO-OPERATION

International Atomic Energy Agency

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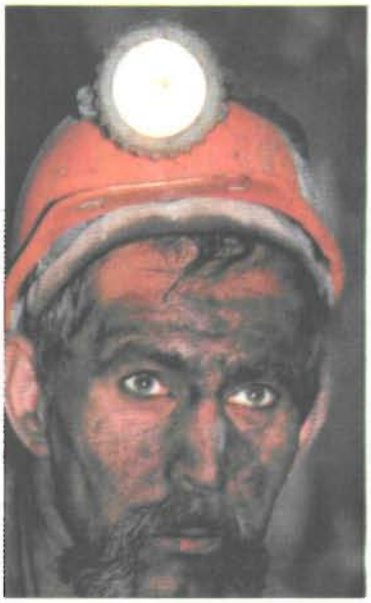
Nuclear technology cleans coal emissions

Fresh air is a luxury around Poland's northern industrial city of Szczecin, near the port of Gdansk. Heavy use of low grade coal for power generation pollutes the atmosphere with large quantities of sulphur dioxide (SO_2) and nitrogen oxide (NO_x). As a direct consequence, the surrounding forests are damaged and the incidence of many respiratory system diseases is alarmingly high.



Thousands of jobs in Poland depend on clean use of domestic coal. (Credit: PAP/CAF R.Koszowski)

When fossil fuels (especially coal and oil) are burned, "acid rain" is produced as SO_2 aerosols become sulphuric acid and NOx aerosols change into nitric acid by photochemical conversion in the atmosphere. Not only does acid rain destroy vegetation and buildings, the gases are also believed to contribute to "global warming." Most nations around the world are now committed to containing them, and recent global treaties require all countries to pass and implement laws limiting national SO_2 emissions.

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Restoring agriculture in contaminated zones

Life today in many ways appears normal in rural areas of Belarus and Ukraine affected by the 1986 Chernobyl nuclear accident. But appearance masks a serious difference: there remains virtually no market for products of these farming areas. The crops and foodstuffs do contain radionuclides, but often at levels well below the conservative limits set by the Codex Alimentarius of the United Nation's Food and Agriculture Organization (FAO) and the World Health Organization (WHO). Nonetheless, public perception continues to shun foodstuffs from contaminated areas.

IAEA technical co-operation projects in Belarus and Ukraine are seeking to address this problem by offering cropping alternatives and introducing new technologies. In Belarus, the concept is to promote production of rapeseed and convert its oil into industrial lubricants (greases, oils and other products). Belarus scientists have found that some rape varieties store radioactive nuclides from the soil — caesium and strontium (Cs137 and Sr90) are the ones of concern now — in

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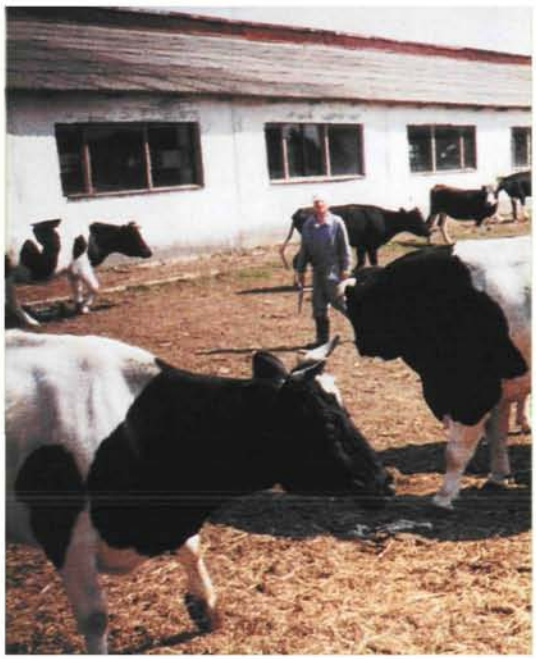
the stalk and seed coat, not in the seed. Rapeseed oil can be easily processed to make biofuels. Belarus has refineries and therefore the technology and know-how to do this.

IAEA's TC project began in 1995 by assisting its principal counterpart, the Belarus Research Institute for Soil Science and Agrochemistry (BRISSA), to identify rapeseed varieties that could provide high seed yields in that area, and optimal cultivation conditions and practices. These are crucial factors because while 200,000 ha are suitable for rapeseed, only 40,000 ha can be sown each year to comply with a five-year crop rotation regime.

Several key issues must be addressed: What can be done with the stalks? Can they be buried, or must they be incinerated? Can the protein-rich seed coat be treated to make animal feed and replace some of the expensive food concentrate that is now imported? Can rapeseed be widely grown as a sort of natural 'vacuum cleaner', just to collect radionuclides from the soil?

Over the next few years, the Belarus authorities, with technical assistance from the IAEA, will be working on these issues. The first stage is to develop a pilot plant to process rapeseed oil and produce lubricants. Already, some greases produced on a laboratory scale have been tested at the Technical University in Vienna. This development could lead to scaling up the industrialization process. The required financial support is expected, mostly through the European Union.

An important IAEA restoration effort in Ukraine focuses on milk and milk products from a factory in Ovruch, an historic northern town 100 kilometres west of Chernobyl, which once processed 550 tons of milk a day. Since the accident, production has dipped significantly because the number of dairy cows in the region has declined and milk from the affected areas has varying amounts of radionuclides. The project takes a two-pronged approach: determining the radionuclide content of milk from all sources that supply the plant, so that the agriculture ministry can identify the farms producing contaminated milk and initiate improved on-farm practices; and, at the plant itself, monitoring the level of contaminants in milk and other products during bulk processing.



Contaminated milk produced on Ukrainian farms may soon be made safe using a new process. (Credit: E. Voice)

The project is providing laboratory equipment to the plant and training personnel in using instruments to detect and accurately measure caesium-137 and strontium-90 in incoming milk and outgoing products. The milk plant director Anatoliiy Kushnirchuk is optimistic that dairy farming would increase in the contaminated areas if, in addition to on-farm help, contaminated milk could also be processed in the factory to make radionuclide-free products.

The technology to do the latter may be at hand: magnetic separation. It was recently invented by scientists in Bristol, England, to remove radionuclides from contaminated water at nuclear sites. The patent is now owned and marketed by a company called Selentec in Atlanta, Georgia. It has been tried and tested and "works very well for water... takes everything out", an expert told *Inside TC*. A large scale test for milk clean up was carried out in the US and confirmed the technology's effectiveness. Field tests in Ukraine were an astounding success. Levels of radioactive caesium-137 were reduced by 95% making the milk safe to drink. The US Government is prepared to invest US$1.5 million in a pilot plant at Ovruch.

Magnetic separation would enable the Ovruch plant to process milk products in bulk, and expand production to fruit juices and baby foods as well. There are some 1.5 million small children who would benefit from this local production of milk and foods. Safe baby food is now 'imported' from other areas and costs savings on transportation alone would be sizeable.

Only when these contaminated lands regain some economic value and produce saleable products will the economic dilemma of rural areas begin to be addressed. Rapeseed and milk products offer a promising new beginning to farm communities that have been very hard hit over the decade since the accident.

One way is to switch from coal to other primary energy sources such as hydropower, natural gas or nuclear. But for Poland these are not currently options: It has no viable hydro source; it cannot afford to pay hard currency to import natural gas from Russia; and its nuclear power programme is postponed indefinitely. For the foreseeable future, Poland must rely on its huge reserves of brown coal (estimated at over 14 billion tons). Indeed, the livelihoods of hundreds of thousands depend on the industry.

The key question is how to ensure that new industrial production is not as environmentally damaging as in the past and that gas emissions are in line with EU standards. Polish legislation enacted in the early 1990s requires utilities to progressively reduce SO_2 emissions, beginning in 1997. Technologies are readily available for removing either SO_2 or NO_x from the flue gases of individual coal fired power plants before they are emitted into the atmosphere, but to date there was none that could extract both in one single-stage process.

A coal-fired power plant in Szczecin is now the site of a four-year IAEA technical co-operation Model Project to demonstrate, on an industrial scale, a 'novel' technology that can do just that. Electron beam dry scrubbing (EBDS) works by recycling the flue gases through a chamber, before they escape from the chimney, and exposing them to low-energy electron radiation from an accelerator. As a result the toxic SO_2 and NO_x are transformed to other chemical forms. By adding ammonia to the chamber, the resulting by-product, a dry powder, can be used as fertiliser. Other cleaning systems do not have this beneficial effect and produce a lot of waste. Although it is a radiation process, no radioactivity is produced in the operation and there is no residual radiation.

EBDS was developed some 20 years ago, principally in Germany and Japan. It is novel only in that it has not been used on an industrial scale, except in demonstration plants in Germany, Japan and the United States. By the time it came out of the laboratory and became available for industrial scale use in the mid-80s, utilities in these heavily regulated countries had already fitted most older coal-fired power plants with other proven scrubbing techniques, or had committed to installing more efficient boilers that would produce less emissions.

Studies carried out in Germany, Japan, USA, as well as in Poland - where an earlier Agency technical co-operation project helped set up a pilot EBDS plant near Warsaw in 1988 - have shown that the technique is 25-30% less costly to install and to operate than conventional systems. When NO_x removal also becomes compulsory, the advantages of EBDS will be greater. The value of the agricultural by-product and the relatively much smaller waste disposal problem make it additionally attractive.

There is a strong interest in EBDS across the energy sector in Poland, among its neighbours and in developing countries that are industrialising fast and have large coal reserves. Ukraine has an ongoing programme and the Agency has just launched a new technical co-operation project to assess the option in Bulgaria.

Poland has opened the doors to the Szczecin plant, allowing the IAEA to bring visitors from other countries who are keen to see it operating. Of these, China which plans to install cleaning systems in some 60 power plants has recently contracted with a Japanese company to fit a power plant with EBDS. Further down the road are India, Indonesia, Malaysia, the Republic of Korea, Singapore and Thailand. In Latin America, Brazil, Chile and Mexico already have pilot projects and are closely watching progress in Szczecin.

The Polish Government is investing 60% of the $20 million needed to set up the EBDS system, and all the personnel and operation costs. The remaining 40% is shared between Japan, the Republic of Korea and the IAEA. Sweden and the US may also contribute. The project plant is scheduled to be fully operational by the end of 1998. Hopefully, it will show Poland a way to attain European emission standards without having to compromise industrial growth and demonstrate to the energy sector a cost efficient and environment friendly technology. Currently industrial restructuring and privatisation are influencing the energy sector and, at the end of the day, the economics and efficacy of EBDS itself may also decide its future in Poland and in many other developing countries.

Many developing countries are investigating the EBDS technology demonstrated in Szczecin. (Credit: M. Samiei/IAEA)

Getting a handle on water pollution

Protecting water resources from harmful and costly chemical, biological and radiological pollution is a high priority on the global environmental agenda. In collaboration with several national and multilateral agencies, the IAEA has been carrying out specialized scientific studies that are proving critical in plans to prevent irreversible damage to Egypt's Lake Manzala and Europe's Black Sea.

Lake Manzala is a 50 km long coastal lagoon in Egypt's Nile Delta, located Northwest of Cairo and bordered on its eastern side by the Suez Canal and the city of Port Said. The lake is a depository for large quantities of untreated city sewage and contaminants, which ultimately flow into the Mediterranean. Left uncontrolled, this pollution threatens the health and livelihood of millions of inhabitants across a densely populated region.

A pre-project study, funded by UNDP, to measure contamination in Lake Manzala was carried out with the active participation of the IAEA Marine Environment Laboratory (MEL) in Monaco. This initiative, undertaken jointly with scientists from Egypt's National Research Centre in Cairo, involved a wide sampling of water, sediment, and fish in major areas of contamination. MEL's participation centred on analyzing chemical contaminants such as chlorinated and petroleum hydrocarbons and trace elements, a task that has required specialized equipment and expertise.

Findings from the data collected enabled a comprehensive environmental impact assessment of the lake. Moreover the study has made a critical contribution toward development of an artificial wetland that would prevent pollutants from Cairo from seeping through the Nile delta into the Mediterranean. This upcoming Global Environment Facility project (GEF) will cost over US$ 11 million and will demonstrate the value of engineered wetlands as a cost-effective, ecologically sound method for trapping sediments and pollutants from municipal, industrial and agricultural sources.

Sampling of weeds to determine organic contaminants in Lake Manzala.
(Credit: M. Horvat/IAEA/MEL)

In many other locations around the world, MEL is using isotope based analytical techniques in to understand both freshwater and marine pollution problems. These techniques are very helpful in identifying contaminants, whether radioactive or not, tracing their complex pathways in the environment and investigating their biological effects.

They are now being extensively employed in assembling information on pollution of the Black Sea. Its extended river network, or catchment area, comprises some 300 rivers, extending as far as Munich to the west, Minsk to the north, and Ankara to the south. Some of Europe's largest tributaries, such as the Danube, Dniester and Dnieper, flow into the Black Sea. The larger geographical area is home to an some 160 million people.

Little more than 30 years ago, the Black Sea harboured a teeming animal and plant life, which included dolphins and monk seals. Its waters served as the breeding grounds for a vast array of fish, a vital source of protein for the six countries sharing its shores (Bulgaria, Georgia, Romania, Russia, Turkey and the Ukraine). Hundreds of thousands of eager summertime vacationers flocked to its beaches to relax, swim, and cool off.

But today, the Black Sea ranks as one of the world's most heavily polluted water bodies, with its life-supporting capabilities very seriously impaired. Across the area, beaches are regularly cordoned off due to unsanitary conditions. Commercial fishing has all but disappeared, and the tourism sector is in crisis.

Governments of the six adjacent countries have launched concerted actions aimed at stemming pollution. Responding to this strong regional commitment, international aid organizations have became involved. In 1993, the GEF started a series of large-scale projects aimed at saving the Black Sea, however none of these sought to directly address radioactive pollution, a major concern, or to apply radiochemical tracer techniques, which the Agency's MEL has several decades of experience. Following an inter-agency meeting between GEF, UNEP, the World Bank and others, the IAEA was invited to add its expertise.

MEL is now collaborating with local Black Sea scientific institutions including Turkey's Çekmece Nuclear Research and Training Centre, Ukraine's Institute of Biology of the Southern Seas at Sevastopol, Romania's Environmental Radio-activity Laboratory and Bulgaria's

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IAEA: Improving the environment

Some 25 years from now about 60% of the world's population will live in urban areas. Meanwhile the size of many cities — particularly in developing countries — is expanding beyond the capacity of infrastructure to sustainably support it. Environmental problems including water and air pollution, sanitation, ozone depletion are having serious human health consequences for many of the new "mega-cities" such as Mexico City, where air pollution contributes to 12,000 deaths per year, and Bangkok, where high lead exposure from car emissions has been found to reduce the average IQ of children.

This edition of *INSIDE TC* explains how IAEA is building new partnerships with governments and international organizations to assess and plan environmental mitigation, and apply nuclear techniques to help solve environmental pollution problems in a sustainable manner. These investigations and techniques involve a variety of applications, from studies using isotopes as tracers for selected pollutants to adaptation of electron accelerators for cleaning flue gases from fossil-fueled power plants. As described in the last edition of *INSIDE TC*, the IAEA is also an important technical resource for national programmes in water management, geothermal energy production and environmental management including the mitigation of marine pollution.

MEL scientists taking samples in the Persian Gulf. (Credit: MEL)

Guarding the oceans:

Uncontrolled human activities are putting great strains on the marine environment in many regions of the world. Cities such as Cairo, Sao Paulo, and Jakarta spew tons of pollution into the ocean every day turning coastal areas into dumps void of any underwater life and threatening the livelihood of people and the ecology of the sea. Knowledge about pollutants as well as their interaction with natural marine processes provide the basis for making informed decisions for effectively managing international waters and preventing a further degeneration of the marine environment. Only with such understanding can the right choices be made.

The IAEA Marine Environment Laboratory (MEL) helps Member States to address the problems of polluted oceans and coastal zones. Numerous analytical techniques are used to investigate radionuclide contamination, sedimentation, chemical concentrations and dispersion of waters among others. MEL's training programme both in-house and in the field aims at increasing Member States capacity to understand, monitor and protect the marine environment. The laboratory is also an international centre for analytical quality control services for radioactive and non-radioactive marine pollutants.

Selected isotopic tools in hydrological and environmental studies

Isotope systems	Chemical form	Application
^{3}H $^{3}He/^{3}H$ ^{85}Kr	H_2O	Indication of recent recharge; infiltration rates in the unsaturated zone; transport mechanisms: fissure flow, matrix exchange; delineation of protection zones.
$^{2}H/^{1}H$ $^{18}O/^{16}O$	H_2O	Identification of recharge areas; interconnection with surface waters; aquifer leakage; salinization mechanisms; recycling of irrigation water; identification of paleowaters.
$^{14}C/^{12}C$ $^{13}C/^{12}C$	HCO_3^-	Identification of paleowaters; groundwater dynamics; validation of groundwater flow models.
$^{15}N/^{14}N$ $^{18}O/^{16}O$	NO_3^- NH^+_4 N_2	Identification of pollution sources; and of microbial dentrification.
$^{13}C/^{12}C$ $^{2}H/^{1}H$	CH_4	Identification of methane sources.
$^{34}S/^{32}S$	$SO_4^=$	Pollution processes in groundwater, acidification; sources of H_2S, salinity; acid mine drainage; groundwater flow in geothermal systems.

Looking into the Greenhouse

Isotopic techniques have long proved valuable in studying groundwater and improving water resource management. More recently, they have been applied to investigating "global warming" and climate changes.

Data collected on precipitation may provide clues for a long-term solution to global warming. (Credit: J. Marshall/IAEA)

Spanning more than 6 million km², the Amazon Basin contains roughly half of the world's tropical forest. This gigantic evaporative basin accommodates roughly 80,000 plant species and possibly 30 million animal species, mostly insects. The Amazon River contributes 20 percent of the world's river discharge into oceans. But accelerating deforestation is seriously threatening this unique ecosystem and, with it, the global environmental balance.

The IAEA has been working to understand this phenomenon for more than a decade. In 1985, the Agency launched a project supporting environmental research in Brazil. The multi-disciplinary, isotope-aided studies of the effects of changing land use on the ecology and climate of the Brazilian Amazon combined the efforts of some 80 scientists from several Brazilian institutes. The Agency supplied laboratory equipment and provided expert missions to co-ordinate and advise local counterparts, 23 of whom were granted training abroad. The initiative received five years' funding from Sweden and support from other research organizations outside Brazil. The joint FAO/IAEA Division and the Isotope Hydrology Section of the Agency's Division of Physical and Chemical Sciences provided technical back-up.

Concluding their work in 1993, the Amazon Basin studies validated a regional isotope model of the transport of water, revealing that 50 percent of the Basin's precipitation consists of recycled water. This high contribution of recycled water makes the water cycle sensitive to deforestation, which on such a large scale will change the regional water balance through reduction of the evapotranspiration flux to the atmosphere. This causes more water to run off to the rivers and local temperatures to rise. Results from today's climate models suggest, moreover, that a complete and rapid destruction of the Amazon forest would be irreversible, having serious consequences not only for the local but also for the global climate.

The Amazon Basin studies are but one example of the widening scientific concern that large-scale human activities — such as deforestation and energy production — may significantly alter the world's climate in the near future. Global warming due to the steadily increasing concentrations of the so called "greenhouse" gases (GHGs) is one part of that impact. Naturally occurring GHGs, primarily water vapour and carbon dioxide (CO_2), are vital in regulating the temperature of the earth and its atmosphere. However, excess emissions — mainly of CO_2 from the combustion of fossil fuels, methane (CH_4) produced from agricultural production and chlorofluorocarbons (CFCs) synthesized in various industrial processes — could cause temperature and rainfall patterns to shift and natural ecosystems to be destroyed.

So far, it appears that man-induced changes on the climate are fewer than those occuring naturally. Nevertheless, climate change remains a serious long-term concern because any alteration in the radiative balance of the atmosphere will lead to changes in evaporation and precipitation. To understand the complex processes regulating the global ecosystem, an integrated research approach needs to be taken involving analysis of both present and past climate changes. Here again, environmental isotopes are powerful investigative tools.

The IAEA-initiated Global Network for Isotopes in Precipitation (GNIP) became operational in 1961 when a world wide survey of the isotope composition of monthly precipitation began in collaboration with the World Meteorological Organization (WMO). The

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In Brief: Updates of stories and news events

Partnership with Uppsala University develops

The IAEA is a Board member of the International Science Programme (ISP) of the Uppsala University in Sweden, which promotes research capacity in developing countries through the exchange of scientists and post-graduate education in physical and chemical sciences among others. The Agency is making arrangements with Uppsala University to strengthen co-operation in two areas.

To benefit from their so called "sandwich programme", Agency fellows receive training both in-country, in Sweden and in other nordic countries under ISP supervision to obtain advanced degrees and return home to train others in the application of nuclear techniques for scientific and economic development.

This IAEA sponsored training activity is specially targeted at LDC's, and a dozen candidates from Ethiopia, Namibia, Senegal, Sudan and Zaire have already been selected. The IAEA is also securing Uppsala's active collaboration for the implementation of TC projects in fields of mutual interest such as environmental monitoring and treatment of industrial waste water.

Interested undergraduate students in related disciplines should contact their national Atomic Energy Commission for further information.

Sterile flies released throughout Zanzibar

An eradication trend continues to be documented through field data recording "zero wild fly capture" over the last several weeks. The female tsetse colony size at Tanga, Tanzania has grown to 635,000 enabling a production of over 80,000 sterile males per week. The project management team has decided to expand aerial releases of sterile males from the southern part of the island to cover its entirety (see Cattle Killer meets its match, *INSIDE TC*, March 1996).
During a field visit by the Director General in early May, a Zanzibari herdsman stated that his cattle were healthier and stronger since the wild tsetse fly population had been reduced.

Looking into *(from page 6)*

primary aim was to collect systematic global isotope data (oxygen-18, deuterium and tritium) to characterize the spatial and temporal variability of isotope concentrations in precipitation. The data gathered has been used extensively in hydrological investigations within the scope of water resources inventories, planning and development.

The network started with around 100 meteorological stations collecting data from more than 60 countries and territories. Some years later, the total number of stations in operation reached 220. The network's database has also proved indispensable in palaeo-climatology, and provides important input for verifying and improving atmospheric circulation models.

In support of these global investigations, the Agency has provided training and equipment in isotope applications through 13 technical cooperation projects during the last 10 years at a total budget of $28.1 million. Over 100 scientists from developing member states have been trained in related disciplines through workshops and training courses during the period. Support continues to be provided through coordinated research programmes (CRPs) that support national environmental investigations. For instance, Argentina is participating in a CRP to reconstruct paleoclimatic and palaeoenvironmental conditions during the last glacial cycle (20,000 years ago), in cooperation with 13 other countries. Argentina's lead scientist on the project is Dr. Hector Osvaldo Panarello of the National Atomic Energy Commission, who participated in Agency training courses in Latin America during 1991 and 1993. Initial results from the project are quite significant as they reveal a temperature difference between Holocene and the Last Glacial Maximum of about 5 degree Celsius. These results have important implications for the modeling of global climate.

Getting a handle *(from page 4)*

National Institute of Meteorology and Hydrology. Technical co-operation is helping build local scientific capacity and quality control, with the goal of assembling reliable and representative baseline data, and ultimately enabling recipient institutions to undertake pollution monitoring activities on their own.

Within two to three years, the four countries currently participating in the project will be able to analyze marine samples for all the significant radionuclides, and to apply radiotracer techniques to study the behaviour of non-radioactive pollutants. For the first time, they will have in their own hands the tools to assess the ecological destiny of the once bountiful Black Sea. With such knowledge in hand, the burden shifts to the region's decision-makers, business enterprises and the wider public to translate this scientific knowledge into positive environmental action.

Tracking pollution in the River Plate

Montevideo is justifiably proud of its urban beaches which lie, in long stretches, along the Uruguayan capital's frontage on the River Plate. But pride has been invaded by concern in recent years as routinely taken samples began to show coliform bacteria in excess of 3,000 per 100 millilitres. This level of bacterium indicates the presence of sewage, but its exact source was unknown.

The River Plate is an unusual river. It would be a sea if its water was clear and salty. In fact it is a giant basin formed by the outflow of two great rivers, Parana and Uruguay. Shaped like an inverted funnel it flows in a northwest-southeast direction, between Argentina and Uruguay, into the Atlantic Ocean. Where the brown river meets the blue ocean it is more than 100 kilometres wide.

Nor are the pollution problems of the River Plate limited to organic matter. The vast basin is brimming with industrial wastes from hundreds of small tanneries around Montevideo Bay and effluent from Uruguay's premier port. The once popular beach resort of Carasco has been closed for many years because of high pollution. Most of Montevideo's 1.5 million people live quite close to the river and the basin is heavily used for fishing and recreation. But resources and data to address growing environmental problems are limited and much remains unknown.

Montevideo has been constructing a modern sewage system for many years but it remains incomplete. A lot of raw sewage is deposited into two small rivers, Pantanoso and Miguelete, which pollute Montevideo Bay and the River Plate. The main part of the present engineered disposal system uses a well-tried technology called an "outfall" that pipes sewage from a coastal station and discharges it in the

Pollution threatens Uruguay's beaches. (Credit: J. Marshall/IAEA)

Plate, several kilometres away and at a depth of about 10 metres. Sewage is discharged at a pressure calculated to disperse it so that bacteria die-off is achieved.

Tracking the movements of sewage and other pollution in this vast expanse is a herculean high tech task. An IAEA technical co-operation project that began in 1991 used isotopic techniques to establish that sewage from far out in the river could flow back infrequently to the beaches when specific riverflow, tides, winds and ocean currents combined. But it has also confirmed, happily, that the outflow system is functioning well. Project-generated data on the river dynamics are being used as inputs in city plans by the Uruguayan Ministries of environment, health, and industry as well as the Montevideo Municipal Authority. They are now working in partnership with the directorate of nuclear technology (DINATEN), which is the IAEA's counterpart to monitor pollution and plan remedial action.

Through project-provided training, know-how and technology — including gamma counters, a gamma detection system and an automatic multi-sample analyser, and devices for water sampling at various depths — DINATEN and the municipal authority have improved their environmental monitoring capabilities.

Other IAEA technical co-operation projects have been planned to help in a systematic manner. While the initial project focused on water flow patterns, a second, now being completed, used isotopes and fluorescent tracers at various points of the basin and ocean side of the city, to study the movement of sediment. A new project, expected to start in 1997 will analyse the contaminant load of sediment in and around the bay and the 'age' of the contaminants so that the planners know what has been deposited there in the past 30-40 years. Expert services and training will be provided to prepare the very special field equipment such as dredges with detectors, and to do the tracer injections and measurements. The technique to date sediment using environmental lead-210 will be applied for the first time in the basin.

Step by step the scientific evidence generated through isotopic techniques is providing the foundation for the Uruguayan authorities to formulate sound environmental policies and take effective remedial action. It is a long-term process requiring a solid developmental partnership--one that the IAEA has committed itself to in Uruguay and in many other developing Member States.

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