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Water Pollution Control and Management

Gilberto Muraro, Professor of Public Economics, University of Padua;
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The scarcity of fresh and clean water is a dominant feature of the contemporary world. It is well known that in the poorest countries the problem has reached a dramatically serious level. It is a common estimate that one sixth of the world's population, approximately 1.1 billion people, do not have access to safe water and 2,4 billion lack basic sanitation. Besides the tragic peak, the problem remains relevant in the rest of the world. Increasing population and increasing per capita consumption produce an increasing demand for water. Even more important, they produce an increasing level of "potential" pollution. And this is true at every stage of development. Only the kind of impact differs: more agricultural run-off in water sources in developing countries, more dumping of industrial waste, particularly chemical discharges in groundwater, in developed countries.

In both cases, if we want to save our future, there is a need of a severe policy of water protection. However a severe policy is a costly policy, and it can have a remarkable impact on the other factor of social well-being, the per capita income. Therefore, a high level of effectiveness and efficiency in water protection policy is needed.

Effectiveness and efficiency mean appropriate rules and institutions. As for the rules, they imply choosing the targets, defining the constraints, distributing the burden, stimulating environment friendly technical progress, introducing incentives and sanctions. And the choice of institutions calls for the definition of the territorial domain, the balance between political representation and technical authority in the decision process, the relation with the general government at its different levels and a place for people's voice to be heard. All the rules and institutions, in order to work fine, must fit into the peculiar history and situation of each country. At the same time, they are common criteria of rationality to be respected and there are "best practices" around the world that deserve to be studied and adopted. The right policy is therefore the result of two attitudes to be wisely mixed: know yourself and look to the others. The story of water policy in Europe is a good example from this point of view: it shows a large room for national measures, but the Directives from the European Commission impose a joint effort and a common basis of objectives and criteria; and needless to say, both sides of the European policy, the national side and the communitarian one, show reciprocal influences in their evolution.

The present Newsletter is clearly inspired by such an approach and it aims at helping to further develop it. The content deals with both the problems and the policy mechanism: pollution and health impact, on the one side, and technology and criteria for control and management, on the other side. It offers an overview on the recent development of integrated water policy in Europe. It is especially useful to examine these methods in their effort to find out the right relation between local governments, national governments and Community. The Subsidiary principle dictates the guidelines in shaping that relation and it may offer useful suggestions also for a vast and diversified country like China.

EU ministers divided over car-emissions rules

The new strategy proposed from the European Union would require vehicle manufacturers to cut average emissions of their new cars from the current 162 grammes per kilometer to 130 g/km by 2012 through vehicle-technology improvements, while asking other players, including tyre-makers, fuel suppliers, repairers, drivers and public authorities, to contribute to a further 10 g/km reduction.
EU environment ministers unanimously backed a Commission plan that would force car manufacturers to implement steep cuts in vehicle emissions, but they failed to come any closer to agreeing on how the burden of these reductions should be spread out between makers of small and large models.
While the former are already on track to meet the 2008 target of 140 g/km and want the tough standards to apply to individual manufacturers at fleet level, the latter say it is unfeasible to subject manufacturers of larger cars to the same standards as light-weight vehicles.
Carbon emissions from newly registered cars in Germany still averaged at 172.5 g/km in 2006. However, German automakers insist that their cars simply respond to consumer demand for bigger, safer and more powerful cars and that it would be unfair to penalize them for it.
Since ministers failed to agree on suggestions for solving the dilemma, they will leave it up to the Commission to propose at the end of the year or early in 2008 a new definitive solution to this issue.
Meanwhile the European Parliament has just submitted a report that advocates sharing the task between manufacturers, by setting separate targets for models, according to their size and the cost of achieving emission reductions, in order to take into account the large variation in consumer preferences regarding passenger cars and the different composition of manufacturers' fleets.

Sustainable Transport

The Commission set out a ten-year strategy on sustainability in the transport sector in its White Paper on Transport Policy. The strategy focused predominantly on balancing the different modes of transport, harmonizing legislation within specific sectors, and enhancing transport

safety. However, in an enlarged EU, under pressure from accelerating globalization, high oil prices and transport-targeted terrorist attacks, the EU is looking to adapt its initial strategy.
To reduce the environmental damage caused by the prevailing trend to use road and air transport and to address its increasing congestion problems, the EU wants to promote alternative modes of transport.
Due to its potentially detrimental impact on the environment and public health, the transport sector poses one of the greatest policy challenges for sustainable development within the EU.
The environmental impacts of transport activity include: emissions of greenhouse gases that are widely perceived as the main cause of global warming; emissions of compounds that make the ozone layer

thinner, causing damaging infiltration of ultraviolet radiations.
Most of the above mentioned environmental problems are related to road transport, which is the dominant mode of transport in the EU. Road transport accounts for about 84 per cent of CO_2 emissions from transport.
In addition to the indirect health impact from noise and air pollution, transport activity is responsible for serious injuries and death through traffic accidents. Accidents occur mainly in road transport. In the EU, about 42,000 people are killed in road accidents every year.

Biofuels for transport

The EU is promoting the use of biofuels as an alternative energy source for transport. Already in 2003, it set itself an indicative target of increasing the use of biofuels in energy consumption to 5.75% by 2010. However a 2007 progress report shows that it will likely only achieve a biofuels share of 4.2% in that year. Therefore, the Commission proposed in its 2007 “Energy Package” to step up its effort and demanded a mandatory target of 10% by 2020.
A wide range of biomass products such as sugar cane, rapeseed, corn, straw, wood, animal and agriculture residues and waste can be transformed into biofuels for transport.
Generally, a distinction is made between first-generation biofuels (mainly produced from crops such as sugar beet and rapeseed) and second-generation biofuels (from ligno-cellulosic or ‘woody’ sources or via new technologies to convert biomass into liquid “BTL”).
The two main first-generation biofuels are bio-ethanol and bio-diesel. Brazil and the US are the main production regions for bio-ethanol; the EU has the largest production of bio-diesel. Germany, France, Sweden and Spain are the leading EU countries regarding the use of biofuels for transport.
The advantage of using biofuels lies in their

generally lower emissions of greenhouse gases and the fact that, unlike oil and gas, they are more abundant and domestically available. Another plus is that the domestic production of biofuels could help European farmers after the reform of the Common Agriculture Policy as they offer new income and employment opportunities.

Maritime Safety

Following oil spills that devastated European coasts in the past decade, the Commission is taking further action to improve maritime safety by preventing accidents and pollution and better controlling their effects. Its proposals also seek to enhance passenger and crew safety against the risks of accidents and terrorist attacks.
Countries are required to verify whether ships flying under their flag comply with international safety standards (Flag State Control). However, existing conventions leave an important degree of discretion to flag States, and ships in international voyages can easily deviate from the rules.
The Commission is proposing to make rules on responsibilities of flag states mandatory for all member states, with regular audits and assessments; though member states didn’t appreciate it saying that it would generate too many additional costs for their administrations.
The Commission also wants to strengthen its system of port state controls. Indeed, flag state controls may only be applied to ships flying under an EU member state flag but accidents in EU waters are often caused by substandard ships from third countries.
Consequently, the EU decided to increase the number of controls, demanding that member states inspect 25% of all foreign ships. However, this purely quantitative control system generated considerable costs and inconvenience for ships that were safe because they nevertheless had to undergo repeated checks. Furthermore,

despite achieving a five-fold increase in the number of inspections, unsafe ships continued to slip through the system.
The Commission is thus proposing a new regime where 100% of individual ships are inspected. The new system would take into account ships’ risk profiles, subjecting higher-risk vessels, including all passenger ships and oil and chemical tankers of more than 12 years in age, to more frequent checks.

Waste Prevention & Recycling

As a first step, a revision of the EU Waste Framework Directive has been submitted to the Council and Parliament for approval. The new draft directive merges with the existing directives on hazardous waste and

repeals the Waste Oils Directive which is now considered outdated. Here are the main elements of the proposed new strategy:

_ Life-cycle approach: The strategy proposes to look beyond the pollution caused by waste to consider its potential contribution to a more sustainable use of natural resources and raw materials.

_ Prevention: Member states will be required to develop waste prevention policies that will “reach out to the individuals and businesses” responsible for waste generated in the first place. These will have to be adopted within three years following the adoption of the revised waste framework directive.

_ Recycling: EU-wide environmental standards on recycling will be adopted to “support the development of an EU market for secondary (recycled) materials”.

_ Incineration: A revision of the IPPC Directive (Integrated Pollution Prevention and Control) will be tabled and will set an ambitious benchmark to improve energy recovery from municipal incinerators.

Sustainable chemistry

Public concerns regarding environmental, health and safety issues of chemicals have resulted in growing interest for green chemistry.

With the new EU legislation on chemicals in place, greener and safer products are set to represent the single biggest part of the European industry’s innovation capacity and become a major source of future business and revenue.

To meet this challenge and maintain its global leadership, the European chemical industry (CEFIC) and the European biotech industry launched a new technological platform for EU on sustainable chemistry. The platform identified three key sectors which are considered vital for innovation-led growth in the chemical sector:

_ Industrial biotechnology: Using biological raw materials to develop products such as pharmaceuticals, bio-colorants, solvents, bio-degradable plastics, vitamins, food additives, bio-pesticides and liquid biofuels.

_ Materials technology: Developing new materials with better performance including processing and recyclables.

_ Reaction and process design: Working towards faster, cheaper and cleaner production processes for existing chemicals.

In addition, a horizontal group was set up to look into strategic approaches to eco-efficient innovation other than just cost reduction and environmental performance. This includes economic or financial barriers, regulation and societal acceptance of chemicals, including the promotion of alternatives to animal testing.

The European Legislative Framework for Water Protection: an Overview

Mariachiara Alberton, University of Siena
Massimiliano Montini, University of Siena

Water legislation was one of the first sectors to be covered by the European environmental policy and consists of more than 25 water related directives and decisions.
The first phase of EU water protection began in the '70s laying down standards for rivers and lakes used for drinking water extraction and binding quality targets for drinking waters, fish waters and groundwaters (i.e. Directives 78/659/EC, 79/923/EC, 80/68/EC, 76/464/EC).
The second phase of water legislation began in the '90s addressing water pollution by nitrates and large industrial installations (i.e. Directives 91/676/EC and 96/61/EC).
Despite thirty years of extensive water protection legislation, the general state of water in Europe has not improved yet, due to several reasons, such as the low level of implementation and enforcement in Member States, the growing consumption and use of chemicals, and the lack of integration of the environmental policy in other relevant policy sectors (agriculture, energy, transport, land use planning, product policies, etc.).
Therefore, both the European Council and Parliament have demanded a new and more co-ordinated water legislation at the European level. During the '90s a revision process of EU water policy was initiated, finally achieved in 2000 in a comprehensive new water law, namely the Water Framework Directive, (WF Directive 2000/60/EC).
For the first time, the WFD established an overall objective for all surface, groundwater and coastal waters in the EU to be achieved by 2015, repealing a number of Directives (i.e. Freshwater, Dangerous Substances, Groundwater Directives), and introducing a combined approach in tackling water protection, namely the use of environmental quality standards of water bodies and emission limit values of any discharge of effluent to them.
The WFD provides a wide range of management tools, such as water pricing, public involvement, long-term and integrative planning and tries to overcome the lack of implementation of previous legislation on water pollution, establishing extensive reporting obligations and engaging Member States and the European Commission in a *Common Implementation Strategy* (See: http://europe.eu.int/comm/environment/water/water-framework/implementation.html).
The WFD aims at protecting the physical and biological integrity of all aquatic ecosystems, establishing a basis for moving towards sustainable human water use, preventing any further deterioration in the status of surface and groundwater and reducing surface and groundwater pollution achieving a "*good status*" for all waters by December 2015. A "*good status*" is defined by Article 2 of the Directive according to the type of water: a) for surface waters, a "*good status*" means "*good ecological status*" (biological, hydro-morphological and physico-chemical status) and a "*good chemical status*" (existing surface water meets quality standards at European and national level); b) while for groundwater, a "*good status*" means a "*good quantitative status*" (the abstraction is less than the natural recharge) and a "*good chemical status*" (the existing quality standards are met).
The WFD sets several obligations for Member States, namely it requires to establish river basin districts, which are river catchments or groups of catchments, as basic management units; to designate competent river basin authorities and prepare for each river basin district a river basin management plan including a programme of measures; moreover, to review and update the river basin management plans and associated programmes of measures on a six-yearly basis.
Another important feature of the WFD is that it encourages active public consultation and involvement

in the decision making process about future pollution control investment.
In particular, for each river basin district, the following written documents shall be made available by the Member States to the public (for at least 6 months) : the work programme for the production of the plan (at least 3 years before the beginning of the plan period); an overview of the significant water management issues identified in the river basin (at least 2 years before the beginning of the plan period); the draft copies of the river basin management plan, (at least 1 year before the beginning of the plan period); on request, access to background documents and information used for the development of the draft plan.
As already mentioned, the WFD introduces also a gradual water pricing system as an incentive to sustainable use of water resources. Accordingly, Member States should ensure that the price charged to water consumers reflects the true costs, namely 1) financial costs, which are the costs for supply, administration and maintenance; 2) environmental costs, which include the costs of waste caused by water use on ecosystems; 3) and resource costs, i.e. the use of resources that lead to the disappearance of certain options for other uses.
The legal transposition of the WFD into national legislation was due by 22 December 2003 by the old Member States and by 1 May 2004 by the 10 new Member States. According to the "*Seventh Annual Survey on the Implementation and Enforcement of Community environmental law*" (See: SEC (2006) 1143, Brussels, 8 September 2006), the WFD implementation process in the EU Member States was the following: in December 2005, the European Court of Justice condemned Belgium and Germany for not adopting the necessary legislation on time (Cases C-33/05 and C-67/05, respectively). At the end of the 2005, cases were still pending in the Court against Luxembourg, Italy and Portugal. During the year 2005, the Commission sent reasoned opinions to Greece, Italy and Spain for failing to meet the deadline of 22 June 2004 for providing information on river basin districts and the authorities responsible for managing them.
It also sent warning letters to the same Member States for failing to provide the first analyses on individual river basin (due on 22 March 2005). The next Annual Survey on EU environmental law implementation and enforcement is expected in late 2007.
As shown by this brief analysis, the WFD represents a step forward compared to the previous EU water legislation, because it introduces several policy instruments and administrative processes which should contribute to a clearer and more efficient water management and use.
On the other hand, Member States could benefit from many exception possibilities, which means that the harmonization of national water policies within the European Union could be compromised and the risk of a race to the bottom for water standards selection could be high.

Water, Health and Development

Carole Maignan, Former WHO and FEEM

The relationship between water and health is often considered as rather straightforward. Bad water creates bad health. Water is also associated with a series of diseases such as malaria or diarrhoea, and the absence of it means all kind of life impossible. The aim in this short essay is not to list all the diseases coming from water, whether they are induced by its quality or its presence. It is to analyse the links between water, health and development. The later being at the centre of the argument.
In the first section we will discuss briefly the role of water and sanitation and its main challenges at the international level. The second section will bring to light simple and clear case-studies which manage to combine water, health and development. We will use them to emphasize the key strategic issues when resolving a water and health problem.

Most international organisations dealing with development and/or health have to come across water and sanitation issues. The World Health Organization for example works on aspects of water, sanitation and hygiene. This sector is linked with an incredibly high health burden and where interventions can make a major difference. Nonetheless the present state of knowledge about water, sanitation and health and how to go about it is rather poor. One of the indicators of development is the presence of drinking water and sewage systems. This is mostly known for developing countries in Africa or Asia but in the WHO European region[1] 120 million people are also without access to safe drinking water and even more are without sanitation. This concerns of course, mostly low income countries. For middle and high income countries, chemical and microbial pollution is also present and needs to be acknowledged and treated.
WHO supports Member States with water and sanitation program by helping to develop the implementation of the Protocol on Water and Health, the first instrument for prevention, control and reduction of water-related diseases, and by carrying out capacity-building activities at the regional, subregional and country level.
In addition to the "continuous" water control required, water is also at the centre of any crisis whether it is due to environment, wars or earthquakes. Whenever catastrophes such as these occur, the first scourge to appear is linked with water and sanitation infrastructure being destroyed during a crisis and creating even more harm. In order to respond to emergency and longer term needs, guidelines are offered to countries. They can appear very obvious but are not always followed. For example, environmental management practices in health care facilities for water have the following guidelines: health care facility should provide safe water, and the quality of water should be sampled periodically to check for bacterial contamination. For safe drinking water, a series of rules are given:
_ where safe water is not available, boil water for 5 minutes to render it safe or use water purification units;
_ store water in hygienic environment;
_ dispense water from storage container by an outlet fitted with a closure device or tap;
_ clean the storage containers and water coolers regularly.
Besides these basic rules to survive in a crisis or to maintain a safe level of water quality, the international community dealing with development has also taken interest in water. Indeed, the Millennium Development Goals include an "MDG drinking water and sanitation target". The target is to halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. MDG's main aim is to set countries on a common goal to push back poverty,

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inequality, hunger and illness. The drinking water and sanitation target is therefore at the centre of this goal. The target is facing many challenges. The main ones are linked with:

_ The choice of indicators, it is indeed very difficult to measure "sustainable access" to safe drinking water and sanitation. It is usually considered to be half an hour walk between habitation and where safe drinking water can be accessed. The measure is very subjective and depends a lot on weather conditions and the type of landscape. It is therefore not satisfying. It will also depend a lot on the level of income of the population as people with a car will not have to walk there for example.

_ The achievement of the target: business is leading to a potential non achievement of the MDG target. Indeed, to reach the target, we need to provide sanitation services to an additional 450 thousand people a day from 2005 to 2015, and to 300 thousand people a day as for drinking water.

_ The urban-rural issue. This issue is not only linked to the gap between relatively well equipped urban areas and hardly any infrastructure in the rural ones, but also to the rapid pace of urbanization. The tendency to move to ever so huge cities and conurbations requires a major effort even to keep up with the current coverage levels. In addition, there is within the same urban area high discrepancies between different neighbourhoods, with poor suburban areas often lacking of basic sanitation and rich centres covered with all the facilities. In rural areas, there is a huge backlog of rural people lacking of basic sanitation and safe drinking water. In both rural and urban areas, we observe a common feature that water and health problems are linked with poverty. Indeed, sanitation in slum areas is often lacking and a growing concentration of people with very low income rely only on public and shared facilities which lack of hygiene. Even though marginally, these situations are also present in high-income countries with a particular population (e.g. Rome, clandestine immigrants).
These observations call for an intensive mobilization of resources to reduce the vast coverage gap between urban and rural populations but also between low income and high income populations.

At this point, we need to clarify what determines health and in particular what are the key strategic factors in order to have a successful change regarding health issues. According to the WHO report of 1995, poverty is recognised as the biggest killer and the greatest cause of ill-health and suffering across the globe. Extreme poverty is listed in the International Classification of Diseases; it has a code like other diseases, Z59.5. Once this is acknowledged, then the link between health, water and development becomes clearer. Successful stories about water access and sanitation will be stories that consider not only the quality of the sources of water but also the economic, and social aspect of the population at stake. In this second section we will illustrate these aspects using two successful stories which consider water quality, health and economic issues. There are bringing into light interesting aspects about how to introduce changes within a community regarding important characteristics such as water and health. For these two case-studies, key words keep coming back: incentives, integrated programmes and system flexibility. These keywords are useful in many other issues linked with public health, environment and development issues.
The first case regards the implementation of wells within small rural communities in Zambia. It is based on a research investing 2300 traditional sources of water and undertaking over 200 pilot projects with communities making low-cost improvements to existing sources. The findings of this research are very instructing in terms of priorities to be given when making improvements linked with water and health. Firstly, one needs evidence: the lining of wells provides water with as low risk of contamination as a conventionally protected well at one-tenth of the cost. Secondly, one needs ownership: it is noted that people are prepared to pay a large part of the cost especially if owned by a single family. A small subsidy can lead to enormous changes. Thirdly, one does not necessarily need costly infrastructure: low-cost pumps are far more popular than windlass. When the project was presented to the government, it was initially thought as too simple, not modern enough or going backwards. Once it was achieved, given the popularity and efficiency of the low-cost pumps, the government was convinced. Finally, smaller communities prefer lower technology solutions as they are seen as more sustainable. These four main findings are all relatively obvious but often forgotten when trying to implement wells or any changes in a community. Ownership, low-cost and low-technology seem to be the base for success in this particular case.
The second case concerns the provision of clean water in rural Lao PDR, where malaria and diarrhoea

are the most serious health problems. The impact of these diseases could be decreased by simple personal and environmental sanitation which itself needs a behaviour change of villagers themselves. Clean water is the primary concern of villagers. At a national level, access to safe drinking water is estimated at 44 per cent. The Clean Water and Sanitation project tried to achieve behaviour change using Primary Health Care by linking it to the provision of clean water. The aim of the project was to have an impact on the health situation through the provision of clean water and primary health care training. This has been implemented after the experience of previous projects with limited success, in attempting a change in behaviour of the villagers. The results of this project are measured with the improvement of the villagers' quality of life: a decreasing incidence of malaria and diarrhoea but also recognition of the correlation between sanitation and disease prevention, which is what the villagers needed in order to induce a behaviour change. Provision of clean water by itself is indeed not sufficient but needs to be associated with the health sector. This model reveals three main findings: integration between primary health care and clean water in a meaningful way is successful, the choice of technology needs to be appropriate, the service to the least advantaged is present by reaching out the villages which are "off the track" so equity is respected. Again in this short description, integration between sectors, awareness of the community and sustainability of the improvements are crucial to the success.
These two short case-studies have been chosen in this essay because they synthesize the main characteristics necessary to improve health, water and development. More projects and national and international programmes should consider these aspects in particular in the light of what the previsions announce: by 2025, 40 per cent of the world's population will live in areas of water stress and by 2050, 25% of the world's population will live in areas of water scarcity. These figures are not to be taken lightly and we all have the duty to do our best to improve water, health and development whatever our speciality is.

1 WHO European region covers 52 countries.

Water Pollution and Human Health in China: A Brief Overview

Liangshu Qi, Tsinghua University

On March 5, 2005, Wen Jiabao, Prime Minister of China, made a commitment when he presented the Government's work report at the third session of the tenth National People's Congress: "To ensure that people have clean water to drink, fresh air to breathe and a better environment in which to live and work." He noticed that immediate steps should be taken to address the pollution problem which is severely affecting public health safety. "We should focus on the prevention and treatment of water pollution, strengthening the treatment of industrial, urban pollution and the treatment of rural water source pollution. With the implementation of a strict total amount control system, we will intensify environmental surveillance and implementation."
From "making the Huai River clean within ten years" to "ensuring that people have clean water to drink", the Chinese government has shifted to a more pragmatic attitude with respect to the treatment of water pollution. At the same time, this shift also reflects the graveness of water pollution in China and the difficulty of remedying.

Water Pollution in China

The rapid economic growth and industrialization/urbanization that China has experienced since early 1980s, coupled with the insufficient investment in water supply and treatment infrastructure, have given rise to continuous degradation of water pollution. A survey on drinking water sources in key protection cities carried out by the State Environment Protection Administration (SEPA) in 1989 found that 48% of surface water and 20% of groundwater could not meet the national standards. In 2003, only 38.1% of the 407 key monitoring sections of China's national environmental monitoring network in the Seven River Basins were recognized as class I, II or III; 32.2% were recognized as class IV or class V, and 29.7% worse than class V. In 2005, the three figures were 41%, 32% and 27%, respectively[1] (See table 1). It is clear that the problem of water pollution has not been eased despite of the government's efforts since 1990s. [table 1]
While the quality of water resources continues to deteriorate, water pollution accidents have occurred frequently. The number of water pollution accidents amounted to 3988 between 2001 and 2004. Since 2005, serious water pollution accidents have happened in succession:
_ After an explosion on November 13th 2005 at a petrochemical plant of Jilin Petrochemical Corporation, a mass of nitrobenzene was spilled into the Songhua River. More than ten cities along the river suffered from the accident. Harbin, a metropolitan in north China, was forced to shut down its water supply for one week;
A store pool of a chemical plant in Lengshuijiang city, Hunan province, collapsed and released wastewater into the Zi River on November 27th. This resulted in an emergency water shut down for 12 hours in Lengshuijiang city;
_ A smelt plant in Shaoguan city, Guangdong province, released wastewater containing cadmium into the Bei

Table 1 Water Quality in the Seven River Basins in 2005

Rivers		Class I, II	III	IV	V	Worse than Class V
Nothern	Yellow	7	27	34	7	25
	Huai	3	14	38	13	32
	Hai	17	5	48	6	54
	Liao	14	16	22	8	40
	Songhua	5	19	45	12	19
Southern	Yangtze	56	20	11	2	11
	Zhu (Pearl)	55	21	18	0	6

Unit: %. Source: China Environment Bulletin 2005. Available Online: http://www.sepa.gov.cn

River on December 15th, threatening the drinking safety of millions of residents in Shaoguan, Qingyuan, Yingde cities along the river;
The Zhu (Pearl) River delta suffered a salty tide under the simultaneous influence of astronomic, hydrological and meteorological factors on December 25th. Consequently, the municipal water supply in Zhuhai, Zhongshan and Fanyu cities was stopped due to the high levels of chloride in water sources;
In January 2006, wastewater containing cadmium was spilled into the Xiang River by the Xiagang port in Zhuzhou city, Hunan province, because of a mistake in water conservancy construction.

The Health Impact of Water Pollution

Water is the source of life. Adequate supply of clean drinking water is a basic need for all human beings. However, water pollution in China has deprived millions of people of this basic need.
With the rise in release amount of industrial and human wastewater and the increase in use of pesticide and chemical fertilizer, many rural drinking water sources have been polluted. Now, pollutants in these water sources have far exceeded the control limits. In November 2004, Minister Wang Shucheng, Ministry of Water Resources (MoWR), remarked that according to a survey conducted by health and water resource administrations, only 66% of rural residents had access to drinking water that met the standards set by the 'Principles of Implementing Standards for Drinking Water Quality in Rural Areas'[2]. Preliminary surveys show that more than 300 million Chinese people are exposed to unsafe drinking water, and among them 190 million people drink polluted water containing hazardous substances that exceed water quality standards (xinhuanet.com, 21 May, 2005). Several investigations on drinking water sources found that there were hundreds of kinds of hazardous organic matters in the water. Furthermore, irrigation with polluted water has led to the pollution of soil, grain, vegetables, livestock, poultry and fishing products by mercury, cadmium, arsenic, lead and other toxic or hazardous organic matters.
The drinking water safety of urban residents is not optimistic, either. In 2005, a survey on 409 samples of pure water sold on market indicated that the standard-exceeding rates for total count of bacterial colonies and coliform were 49.06% and 27.31%, respectively. 30% of samples exceeded the standard of nitrite, while the standard-exceeding rate for PH value was as high as 52.12% (People's Daily Online, 2 September 2005).
Water pollution has had significant negative effect on Chinese people's health. By the end of 1990s, liver and stomach cancers had become the leading causes of cancer mortality in rural China. Now China has the highest liver cancer mortality in the world, with about half of the 1 million newly diagnosed patients and half of the liver cancer deaths in the world being found in China each year. In May 2007, the Ministry of Health (MOH) disclosed a statistic of death causes in 30 cities and 78 rural counties: cancer topped the list of 10 most lethal diseases for China's urban and rural residents in 2006. The cancer mortalities of urban and rural residents have increased by 18.6% and 23.1% since 2005. Although diet and life style may play a role in the increased cancer rates, environmental factors are relevant undoubtedly. Some health experts explicitly blame pollution, especially water and air pollution for cancer rise in China (chinadialogue.net, 17 May 2007).
Research shows close association between water pollutants released by industrial enterprises and cancer morbidity of residents in surrounding area (Deng, Yang and Zhao, 1987). In rural China, some "short-life villages" have emerged, where cancer morbidity is extremely high due to water pollution. Serious water pollution of the Liao River has caused Liaoning province a high incidence area for cancer.
The poor quality of drinking water was mostly characterized by organoleptic and bacteriological indicators in the past, but now more and more chemical, even toxicological standards are exceeded. The drinking water quality and hygienic situation of rural residents cannot be ensured. Many people fall ill since they drink polluted water. According to the results of some local health surveys, the morbidities of bowel disease, cancer, and congenital malformation in water-polluted areas are higher than those in reference areas.
The health risk of water pollution is exacerbated by the weak public health system. In China, with more than 50 epidemics being likely to spread through drinking water, serious epidemics such as typhoid, paratyphoid and cholera have exploded in some regions. Besides, in some regions the unsafe drinking water sources contribute to the increase in schistosomiasis incidence. Among 60 million people living in schistosomiasis areas, 11 million do not have safe drinking water (People's Daily Online, 21 March 2005).
In addition to shortening people's life span and decreasing living quality, diseases induced by water

pollution have caused enormous economic loss. A study on Hengshui city estimated that the total health loss caused by water pollution was 18.68 million RMB yuan (lower bound) in 2000, equaling to 0.06% of GDP (Wei, Meng, and Bai, 2000). Another study on Xi'an city estimated that the total health loss caused by water pollution was 149 million (lower bound) to 1.29 billion (upper bound) RMB yuan, accounting for 0.23% to 2.02% of GDP (Xu, Cao, and Hu, 2004)

China faces Challenges

To mitigate the health risk of water pollution, the following two packages of measures are crucial (Wu et al, 1999).

First, to improve water supply and sewage treatment infrastructures, thereby reducing the risk of exposure to toxic and hazardous industrial effluents as well as infectious and parasitic disease for urban and rural residents. This measure's major obstacle is financing. The nature of water resource as a public good determines that the investment in water supply and sewage treatment infrastructure by private sector is much less than social optimum. Government intervention can hardly solve the financing problem, either. While public funds fall short of demand, domestic banks have little interest in this kind of loans.

Second, to integrate water resource management systems and to strengthen the cooperation between environment protection and public health administrations. At present, the jurisdiction of water resource management is scattered among MoWR, MOH, SEPA and local governments, and is mingled with the economic development policies of governments at various levels. In order to address the problem of public health and water resources, SEPA and other relevant administrations should take health impact into account in their management activities, and a specialized institution should be established to coordinate the function of different administrations.

In fact, the biggest challenge lies in the complex interest conflict between upstream and downstream, mainstream and branches, different regions, central and local governments, and different administrations. The central government, which is trying to find a balance between the two extremes of development strategy, i.e. pragmatism and ecologism, has not only to pay the cost of pollution control, but also the cost of some regions for their loss in economic revenues due to pollution control. In January 2007, Zhou Shengxian, minister of SEPA, reported the current situation of water environment and water pollution control at the 25th session of the tenth National People's Congress: "Water environment still faces serious situations. New problems come when old problems have not been solved. As the release amount of major water pollutants evidently exceeds environmental capacity, complaints against water pollution accidents are increasing." Important information from the report is that China still has a long way to go in controlling water pollution.

1 Water quality in China is categorized based on the Environmental Quality Standards for Surface water-1 (GB3838-2002).Water Class I/II/III is regarded as'good', IV/V 'moderate' and V+ 'poor'.

2 The Standards for Drinking Water Quality, which had been in force until July 1st 2007 were established in 1985. With only 35 standards, China's water quality requirement was much lower than that in developed countries. Moreover, a set of lower standards, i.e. 'Principles of Implementing Standards for Drinking Water Quality in Rural Areas', was used in rural residential areas (Li, Zhou and Liu, 2005).

References

chinadialogue.net, 17 May 2007: www.chinadialogue.net/blog/show/single/en/1014-Health-expert-blames-pollution-for-China-cancer-rise

Deng SJ, Yang SS, Zhao SC (1987), "*Epidemiological Study of Cancer Mortality and Congenital malformation in a Petroleum Sewage Irrigated Area*" (in Chinese), China Medical Prevention (Zhong Hua Yu Fang), Vol.21, No.5, pp. 265-267.

Li G, Zhou H, Liu X (2005), "Development Trend and Characteristic of Standard for Domestic Drinking Water Quality in China" (in Chinese), *China Water Resources*, 2005 (9), pp.40-42.

People's Daily Online, 21 March 2005: env.people.com.cn/GB/1073/3258905.html

People's Daily Online, 2 September 2005: politics.people.com.cn/GB/1027/3710444.html

SEPA (2002), "Environmental Quality Standards for Surface water (GB3838-2002)".

Wei Lidong, Meng shujin, Bai Zhihe (2003), "The Assessment on the Economic Loss Caused by Water Pollution in the Urban Area of Hengshui City" (in Chinese), *Journal of Hengshui Normal College*, Vol. 5, No. 3, pp.41-43.

Wu C, Maurer C, Wang Y, Xue S, Davis D.L. (1999), "Water Pollution and Human Health in China", *Environmental Health Perspectives*, Vol. 107, No.4, pp. 251-256.

Xu Weiping, Cao Zidong, Hu Jian, 2004, "Health Danger Evaluation of Urban Water Pollution for the Xi'an City" (in Chinese), *Journal of Xidian University (Social Sciences Edition),* Vol.14, No.2, pp.37-41.

Xinhuanet.com, 21 March 2005, news.xinhuanet.com/newscenter/2005-03/21/content_2725663.htm

Advanced Wastewater and Organic Waste Treatment: Innovative Italian Experiences with Relation to the Increasing Environmental Concerns

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Franco Cecchi, Department of Science and Technology, University of Verona

Introduction

The paper deals with some processes in the fields of civil wastewater treatments and organic waste in Italy. These processes were studied by the authors in pilot scale situated at the Universities of Venice (Treviso), Verona and Ancona and designed for the full scale application by Ingegneria Ambiente s.r.l. The topics investigated by this research group are: the integrated treatment of organic fraction of municipal solid waste (OFMSW) and wastewater, phosphorus removal and recovery as a fertilizer (struvite crystallisation process), the Alternate Cycles Process (ACP) joint to the ultrafiltration membrane (MBR) to reach levels of water quality high enough for reuse purposes, and the Alternate Cycles Process applied to sludge treatment.

The integrated treatment of organic fraction of municipal solid waste (OFMSW) and wastewater: the Treviso plant

The co-digestion process generally considers the treatment of organic municipal solid waste with sludge originated from wastewater treatment plants, or with other biowaste, like agro-wastes or manure. In Italy, this situation is now more frequent than the treatment of the sole organic MSW. This trend is not very usual in the rest of Europe: De Baere (2004) reports that the co-digestion process treats some 10% of the organic waste treated in anaerobic digestion plants.

Treviso waste treatment plant

The plant of Treviso (Fig. 1), where the AD-BNR-SCP process is applied (1994; Pavan et al., 2000), can treat up to 20.000 m³/d of civil wastewater and up to 10tons/d of SC-OFMSW coming from Treviso municipality, where separate collection of waste from restaurants, markets, canteens and households is used for managing the organic fraction of MSW (Bolzonella et al., 2005b).

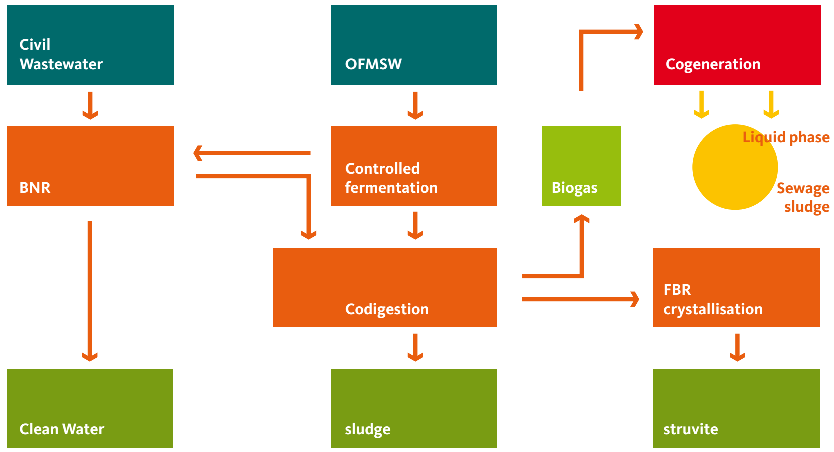

Figure 1 Flow scheme of Treviso wastewater treatment plant

After collection, waste is treated for the removal of inert material and then mixed with waste activated sludge originated from the wastewater treatment plant to a final concentration of 4-6%. The blend is then digested in a 2200 m³ mesophilic reactor working with a Hydraulic Retention Time (HRT) for about 30 days and an Organic Loading Rate (OLR) at 1 kgVS/m³ per day. The observed SGP for treated mixture is about 0.40 m³/kgTVS_{feed} while the SGP for the OFMSW, estimated on a mass balance basis, is about 0.7-0.8 m³/kgTVS_{feed} (100 m³/ton). In terms of biogas production enhancement, an increase of 4.000-5.000 m³/month (when only secondary sludge was treated) to some 20.000 m³/month when adopting the co-digestion process was observed (Pavan et al., 2004).
The specific energy input for the selection line is some 60 kWh/ton. The treatment capacity is now passing to 20 t/d without a significant change in the energy input for the sorting line, therefore this data can be as low as 40 kWh/ton. The nutrients in the digester

1/3

supernatants - after dewatering - are treated with the struvite crystallisation process for N and P reclamation as fertilizer (Battistoni et al., 2002). Pavan et al. (2004) showed that typical costs for organic waste treatment are about 50 euro per ton and personnel is the main cost item (30%), while the disposal of inert material accounts for some 23% of the cost.

Phosphorus removal and recovery as fertilizer (struvite crystallisation process)

The struvite crystallization process (SCP) without addition of chemicals to block phosphorus is a promising technology applied to the treatment of anaerobic supernatants. A demonstrative plant has been operating since 1999 at Treviso's WWTP. The plant (Fig. 2) is fed with anaerobic supernatant produced by belt-press dewatering of anaerobically digested sludge.

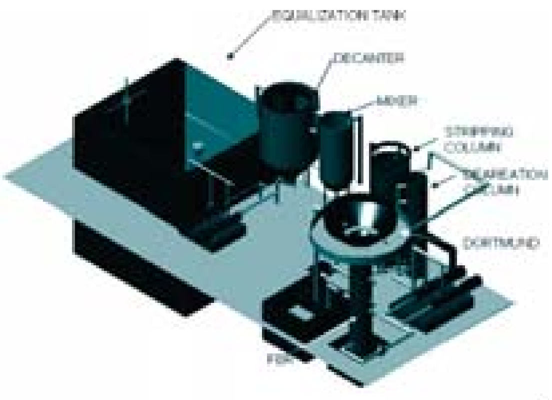

Figure 2 Scheme of the demonstrative plant for struvite crystallization process (SCP).

The feeding flow rate is firstly stripped with air in a stripping column to increase pH, then it flows to the de-aeration column, and is then pumped into a 1 m^3 volume fluidized bed reactor (FBR). The SCP unit treats up to 2,0 m^3h^{-1} of anaerobic supernatant in a continuous mode. A Dortmund apparatus at the top of FBR avoids the wash-out of fine materials (linear velocity of 6 mh^{-1}). The effluent of the FBR is then recycled to the stripping column and the final effluent is obtained from the de-aeration column discharge. [table1]
From the above reported examples, it is clear that the anaerobic co-digestion of waste activated sludge from BNR processes together with other organic substrates determines an anaerobic supernatant rich in nutrients (some 400 $mgNl^{-1}$ of ammonia and up to 100 $mgPl^{-1}$ of phosphates) which are recycled into the wastewater treatment line. These loads of nutrients can be conveniently blocked by applying a struvite crystallization process (SCP) where nitrogen and phosphorous are fixed in struvite crystals together with magnesium ($MgNH_4PO_4$). [table2]

Table 1 Main characteristics and geometric dimension of the plant for struvite crystallization process

Section	Volume, geometry, flow rate
Mixer	Φ=0.9 m, Vtot=1.3 m^3
Decanter	Φ=1.6 m, Vtot=4.7 m^3
Equalization basin	Vtot=48 m^3
Pumps P2	0.8-4.9 m^3/h
Stripper	Vtot=1.33 m^3
De-aeration column	Vtot=0.53 m^3
Fluidized bed reactor	Vtot=0.85 m^3
Dortmund	Vtot=0.80 m^3

Table 2 Characteristics of digester supernatants during the co-digestion of WAS and CDE

Parameter	Unit	Value
pH		7,0 - 7,3
SCOD	mgl^{-1}	1200
PO_4-P	mgl^{-1}	40 - 60
NH_4-N	mgl^{-1}	400

The SCP has been widely applied for the treatment of anaerobic supernatants coming from digestion of WAS and co-digestion of WAS together with solid organic wastes, however its application can be performed for any anaerobic supernatant whose chemico-physical characteristics are similar to the following: phosphorus concentration higher than 30-50 $mgPl^{-1}$, ammonia >300 $mgNl^{-1}$, magnesium > stoichiometric request and alkalinity > 900 $mgCaCO_3l^{-1}$. The operational costs determined by the application of the SCP are essentially due to energy consumption for pumping devices. Following the two possibility to perform the phosphorus crystallization, with and without seed material, the operational costs can be distinguished. When using quartz sand as seed material, costs are 0,24 euro per m^3; when the auto-nucleation is obtained, a lower cost can be reached (down to 0,16 euro per m^3). Both cost analysis do not consider the possibility of selling struvite as fertilizer. The comparison of these costs with those published for the Crystallactor® process (mainly due to addition of chemicals), reveals

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the FBR process to be the cheapest way to remove and reclaim P or P and N from anaerobic supernatants.

The Alternate Cycles Process (ACP) joint to the ultrafiltration membrane (MBR)

The treatment of domestic wastewater by means of an alternate cycle process coupled with a submerged ultrafiltration membrane is considered. From the operating costs point of view, this choice permits the achievement of the reuse purpose with a remarkable cost saving, thanks to the optimization of the air supply and the low recycle ratio required from the biological process. In this process, in a continuously fed reactor, aerobic and anoxic cycles are performed alternately, allowing for an effective nitrogen removal. The length of the cycles is automatically determined on the basis of the oxidation-reduction potential (ORP) and dissolved oxygen (DO) signals. These reveal the end of the nitrification and denitrification processes. In particular, the ammonia disappearing during the aerobic cycle, identified by a flex-point in the DO profile with time, at the end of ammonia nitrification, and the nitrates disappearing (breakpoint) in the anoxic cycle, identified by a flex-point in the ORP profile with time, at the end of nitrate denitrification process, are the main evident observations. The alternate cycle basin was managed by using a patented control device (Battistoni and Chemitec, 1999). This works by means of the differential analysis of the signals of DO and ORP coming from each CSTR of the bioreactor. These are continuously on-line stored and processed. The ACP is continuously tested in a pilot plant located in Treviso's WWTP (fig. 3a). This process has been applied also for the upgrading of the Viareggio's WWTP (20.000 PE) (fig. 3b). At the moment, in Italy, more than 80 plants are working with this process.
On energy consumption, it is interesting to underline the way the gradient diffusers distribution in the biological reactor, together with the blowers management based on the OD-ORP on line signals, can limit the sludge over aeration and optimize the air supply with remarkable energy savings.

The Alternate Cycles Process (ACP) applied to the sludge treatment

The application of ACP for the treatment of the sludge coming from WWTP is studied at pilot scale (situated in Ancona, Polytechnic University of Marche) and also in full scale in order to understand what are the best conditions for the process behaviour.

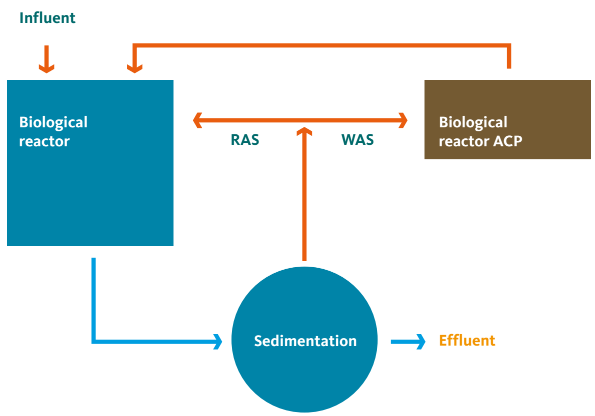

Figure 4 Flow scheme of the ACP process applied to sludge treatment.

References

Battistoni P. and Chemitec (1999). "*Metodo e dispositivo di controllo di un processo di trattamento biologico, a cicli alternati, di acque reflue.*" Italian Patent N° NR99A00.
Battistoni P, De Angelis A, Prisciandaro M, Boccadoro R, Bolzonella D (2002). P removal from anaerobic supernatants by struvite crystallization: long term validation and process modelling, Water Research, 36 (8), 1927-1938 APR 2002
De Baere L. (2004). The role of anaerobic digestion in the treatment of MSW: state of the art. In proceedings of IWA Conference Anaerobic Digestion 2004, AD 10th, Montreal, Canada, August 29 - September 2, 2004, 395-400.
Pavan P, Battistoni P, Mata-Alvarez J, Cecchi F (2000). Performance of thermophilic semi-dry anaerobic digestion process changing the feed biodegradability, Wat. Sci. & Tech., 41 (3) : 75-81
Bolzonella D., Battistoni P., Susini C., Cecchi F. (2005b). Anaerobic Codigestion of Waste Activated Sludge and the Of-MSW: The experiences of Viareggio and Treviso Plants (Italy). Proceedings ISAD-SW IV, Copenhagen, Denmark, 29 August-3 September 2005.
Pavan P., Bolzonella D., Innocenti L., Cecchi F. (2004). The AF-BNR-SCP process: focusing on the anaerobic codigestion step of sewage sludge and OFMSW in the full scale experience of an OFMSW/wastewater integrate treatment. Proceedings of the ISWA Congress, Rome, Italy, October 2004

Water Environmental Situation and Pollution Control in China

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Introduction

Since the 1980's, with China's rapid economic development, the demand for water resources has increased, while water environmental quality has deteriorated seriously. China is a country with poor water resources; the per capita amount of water is limited and its spatial distribution is extremely uneven. As a result, many cities and regions are facing serious problems of water shortage. At the same time, water pollution is not been controlled effectively increasing the water shortage problem. Rivers, lakes and oceans in a wide range are polluted, which results in the destruction of natural aquatic ecosystems and landscapes. Water pollution, quantity shortage, aquatic ecosystem degradation and landscape destruction are the main water environmental problems in China. Water resources and aquatic environment have become key factors affecting China's sustainable development.

Water environmental situation in China

Rivers' water environmental situation

There are seven main rivers in China: the Changjiang River, the Yellow River, the Pearl River, the Songhua River, the Huai River, the Hai River and the Liao River (Fig. 1). The State of the Environment in China 2006 shows that water quality of the seven main rivers in 2006 was similar to that in 2005 and has not improved significantly[1].

Environmental Quality Standards for Surface Water (GB 3838-2002) defines five water quality classes for different environmental functions: Class I for headwaters and natural reserves; Class II for 1st class drinking water sources and habitats of rare aquatic organisms; Class III for 2nd class drinking water sources, aquiculture and human contact; Class IV for industrial water sources and recreation areas for indirect human contact; Class V for agriculture water sources and landscaping requirements. Among the 408 monitored sections, those in Class I-III, Class IV-V and below Class V were 46%, 28% and 26% respectively [1]. The main pollutants were Oxygen Consumed (CODMn), oils and ammonium.

Fig.1 China's seven main rivers

Water quality classification of the seven main rivers' monitored sections is shown in Fig. 2. The Changjiang River and the Pearl River, which are located in the south of China, have a better water quality because of their high dilution capability. The percentage of monitored sections suitable for drinking water and human contact (Class I-III) was 76% and 82% respectively for the Changjiang River and the Pearl River. The five other rivers, located in the north of China, showed a poorer water quality, and the monitored sections in Class I-III were below 35% except for the Yellow River. The Hai River is the most polluted river; the sections in Class I-III and below Class V were 22% and 57% respectively among the 63 monitored sections of the river.

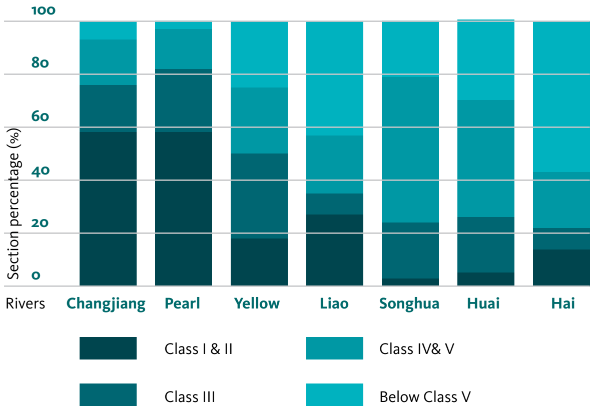


Fig.2 Water quality classification of monitored sections in the seven main rivers in 2006 [1]

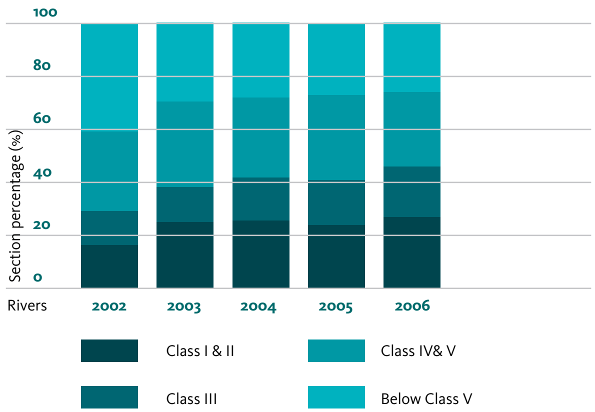


Fig. 3 Water quality classification of the seven main rivers (2002~2006) [1]

Table 1 Water quality classification of key lakes and reservoirs in China in 2006[1]

Lakes	Number	Class I	Class II	Class III	Class IV	Class V	Below Class V
Three lakes[a]	3	0	0	0	0	1	2
Big fresh-water lakes[b]	9	0	1	1	1	2	4
Municipal lakes [c]	5	0	0	1	0	0	4
Reservoirs [d]	10	0	1	4	0	2	3
Sum	27	0	2	6	1	5	13
Percentage (%)		**0**	**7**	**22**	**4**	**19**	**48**

Note:
a. Dianchi, Taihu and Chaohu
b. Xingkaihu, Erhai, Jingbohu, Poyanghu, Dongtinghu, Nansihu, Baiyangdian, Dalaihu and Hongzehu
c. Kunminghu (Beijing), Xuanwuhu (Nanjing), West Lake (Hangzhou), East Lake (Wuhan) and Daminghu (Ji'nan)
d. Shimen, Qiandaohu, Danjiangkou, Miyun, Dongpu, Yuqiao, Songhuahu, Dahuofang, Menlou and Laoshan

Fig. 3 shows the water quality classification of monitored sections in the seven main rivers since 2002. From 2002 to 2006, the overall river water quality has slightly improved: the section percentage of Class I-III has increased, while the section percentage below Class V has decreased. However, the overall river pollution situation has not improved significantly in the recent years.

Lakes and reservoirs' water environmental situation

According to the *State of the Environment in China 2006*, 48% of the key lakes and reservoirs have water quality below Class V and only 29% belong to Class I-III which is suitable for drinking water and human contact. The main pollutants of these lakes and reservoirs are total nitrogen (TN) and total phosphorous (TP), indicating that the lakes in China are facing serious eutrophication problems.

Taihu Lake is located downstream of the Changjiang River. Its adjacent regions are the most developed in China but the lake has been seriously polluted. Water quality in the period 1994-2006 is shown in Fig.4. Although great efforts have been made on water pollution control in the last decades, water quality of the Taihu Lake has not improved significantly and was still below Class V in 2006. Serious water bloom occurred in the Taihu Lake in May of this year. The water bloom deteriorated water quality and affected water supply around the lake greatly.

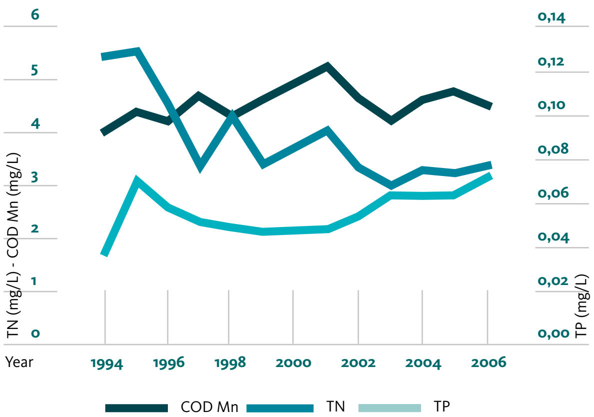


Fig.4 Water quality in Taihu Lake (1994-2006) [1, 2]

Fig.5 Water quality of the near-coast China Sea in 2006 [3]

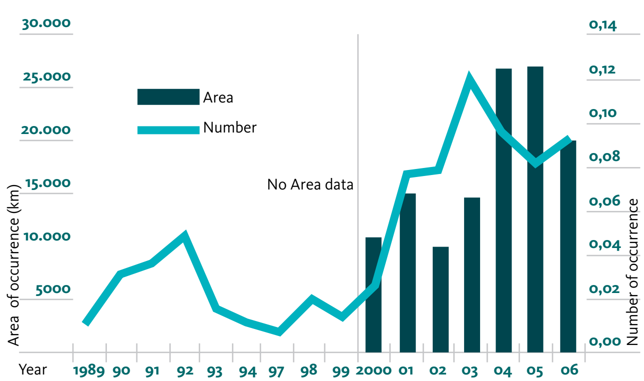
Groundwater environmental situation

Up to 2006, shallow groundwater quality has been monitored in 125 cities. Shallow groundwater quality has deteriorated in 21 cities mainly located in the northeast, northwest, east and south central China, and has improved in 9 cities. Deep groundwater quality has been monitored in 75 cities showing a quality deterioration of deep groundwater in 12 cities located in the eastern coastal regions, and an improvement in 5 cities. Because of groundwater overexploitation, 216 groundwater descent funnels were formed and located mainly in north, northeast and east China. The areas of the descent funnels ranged from tens to thousands of square kilometers. Of 171 groundwater descent funnels, 65 of them had an expanding area (6736 km^2 in all), while the area of 57 funnels decreased (2175 km^2 in all) and the rest remained stable. [1]

Sea water environmental situation

The water in the near-coast China Sea is also polluted and some areas are still seriously polluted. *Sea Water Quality Standards* (GB 3097-1997) defines four seawater quality classes for different environmental functions: Class I for marine fishery and marine natural reserves; Class II for aquiculture and human contact; Class III for areas of industrial use and seashore scenic and tourist areas; Class IV for coastal harbors and ocean development. In 2006, the sea area with water quality below Class I was 1.49×10^5 km^2, which was 1×10^4 km^2 more than that in 2005. The heavily-polluted sea area with water quality below Class IV, was 2.9×10^4 km^2 and mainly located at Liaodong Bay, Bohai Bay, the mouth of the Changjiang River, Hangzhou Bay, the mouth of the Pearl River, nearshore sea areas of Jiangsu Province and some cities. (Fig 5) [3] The Bohai Sea and East China Sea were the most seriously polluted.
The main pollutants in seawater are inorganic nitrogen, phosphorous and oils. The China Sea is facing serious problem of eutrophication. Ninety-three red tides occurred in 2006, 13% more than in 2005. The total area of red tide was about 19840 km^2, 27% less than in 2005. The area of 32 red tides exceeded 100 km^2 and seven of them exceeded 1000 km^2. Most red tides occurred in the East China Sea: their number and surface accounted for 68% and 76% respectively. The occurrence of red tides from 1989 to 2006 is shown in Fig. 6. Both the surface and quantity show an increasing trend in recent years therefore, major attention should be given to this phenomenon.

Fig.6 Occurrence of red tides in China Sea in 1989-2006



Water pollution control in China

The annual production of industrial and domestic wastewater in China is shown in Fig. 7. The annual production of industrial wastewater decreased from 1989 to 2000 and then increased from 2000 to 2006. In the period 1989-2006, domestic wastewater augmented gradually along with urbanization. Domestic wastewater production in 2006 was nearly 3 times the one in 1989. In recent years, China has made great efforts on water pollution control and wastewater treatment rate increased quickly. The treatment rate of municipal domestic wastewater doubled in the period 2001-2005 (Fig. 8). However, the treatment rate of the total municipal wastewater and municipal domestic wastewater was only 52% and 37.4% respectively up to 2005[4]. Large quantities of wastewater were discharged into water environment without any treatment, and this is one of the most important reasons for the deterioration of water environment in China.
The non-point pollution source is another important reason for water environmental pollution. The effect of non-point pollution source on water pollution in China is being recognized in recent years however unnecessary measures have been proposed or carried out.

Summary

China is making great efforts to improve water environmental quality, but the improving trends have not been so significant yet since water pollution control can't be completed in such a short time. As for water pollution sources, both the point and non-point source are effectively controlled. China's water environment will improve greatly and become an important basis for the nation's sustainable development.

References

1 State Environmental Protection Administration of China. *State of the Environment in China* (1989-2006)
2 State Environmental Protection Administration of China. *China Environment Yearbook 2000*
3 State Oceanic Administration of China. *Marine Environmental Quality Bulletin of China* (1990-2006)
4 State Environmental Protection Administration of China. *China Environmental Statistic Bulletin* (1995-2005)

Fig. 7
Annual production of industrial and domestic wastewater in China (1989-2006) [1, 4]

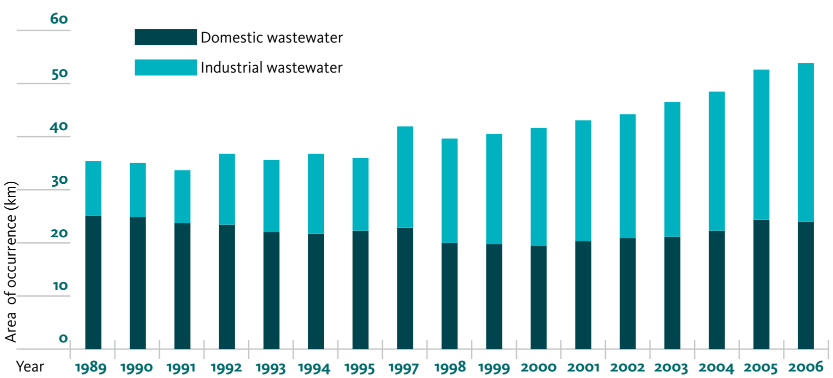
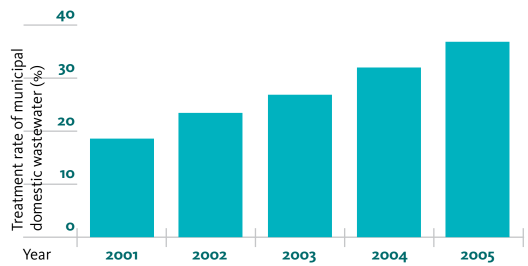


Fig.8
Treatment rate of municipal domestic wastewater in China (2001-2005) [4]



Water Pollution Control and Management

Augusto Pretner, Nicolò Moschini, Luz Sainz DFS Engineering

DFS is currently implementing two major projects focused on water pollution management under the Sino-Italian Cooperation Program. Both projects are located in the City of Beijing, and show the significance of water pollution in China and the pressing need for sustainable management of water resources.
The first project concerns the restoration of the Shichahai Lakes located north west of the Forbidden City. The lakes and their surrounding area form a historical landscape known for its ancient temples, hutongs and residential areas. The place is a lung for the city due to its vegetation and the 35 hectares of water area. However, stagnation and polluted discharges into the lakes have progressively deteriorated water quality and eutrophication is under way. Our project started in 2005 with a preliminary analysis of the lakes' quality status, and is currently developing a pilot treatment plant to establish the most appropriate solutions for pollution control.
Our second project deals with the quality enhancement of the Ju River, a tributary of the Jiyun River that sources in the Hebei province and stretches along the capital's eastern districts of Pinggu and Shunyi. The Ju River collects the wastewater produced by nearly 400.000 people and the load generated by other activities in the basin, predominantly farming. Many pig farms exist in the Ju basin that discharge with insufficient or no treatment into the river. As a result, the pollution load into the Ju is estimated to be between 500,000 and one million population equivalent. Pollution is aggravated by the fact that upstream of Pinggu and Shunyi districts, the river runs dry for nine months a year, conveying only the sewage from the catchment's municipal, agricultural and industrial activities.
The following paragraphs provide further insights into these projects, describing the methodologies used and how the problems encountered are being tackled.

The restoration of the Shichahai Lakes

The Shichahai Lakes system includes the Houhai, Xihai and Qianhai lakes and is part of a larger water system anciently known as "the imperial water network", which was the main source of supply for Beijing in the past. Over the last decades the original water system has been modified with the erection of concrete enforced banks and vast urban development. The ecological equilibrium of the lakes has been impinged by the significant reduction of inflow, the spill of polluted discharges and the closure of the system's outflow. The lakes have become an artificial system that is presently fed with short pulse inflows of polluted external waters aimed at maintaining water levels within an established interval, but neglecting the consequences for the water's eutrophic status.
The Sino-Italian Cooperation Program, supported by the Italian Ministry of Environment, Land and Sea and Beijing Environmental Protection Bureau financed a study in 2005 to identify the causes of the current degradation of the lakes and define cost-effective solutions. A numerical model was constructed to understand the hydrodynamic and chemical processes in the system, and analyses were conducted to assess pollution in the lakes and the composition of bottom sediments. The conclusions drawn are summarised as follows:
_ an almost null water circulation reduces the re-oxidation and exchanges between various parts of the lakes, thus favouring the degradation of some sub-areas;
_ the "pulse feeding" of the lakes with polluted waters causes the progressive accumulation of organic sediments particularly rich in nutrients (N and P) and a varying composition of the lake water pollutants;
_ Significant loads of nutrients are held responsible for the water's eutrophic status, with the risk of excess algae growth that leads to de-oxygenation of waters with

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consequent turbidity, loss of fish, periodic algal blooms, green coloured waters, mucilage development, etc.
Most water quality parameters in Shichahai are classified between grades III and IV of the Chinese environmental quality standards for surface waters, which range from excellent I to poor V grades. Exception is made for ammonia and total N that do not even comply with the worst V grade.
The first part of our project concluded that the construction of seven small treatment plants was needed to restore water quality to the lakes. This was a preliminary study based on the existing data and an initial monitoring campaign. The second phase of the project is currently on-going with the implementation of a pilot treatment plant in the Houhai Lake and a detailed monitoring campaign to assess the plant's impact on the lake's water quality.
The overall aim of the second phase is to optimise the operation of the new works and to extend the results to the whole lake system. In particular, the project will help to define the schemes for future treatment plants in the lakes. Hence, the areas that are worst affected by eutrophication will be identified in order to define potential locations for the inflows and outflows of future plants.
In March 2007 the detailed design of the pilot treatment plant was approved by the Commission formed by the Italian Ministry of Environment, Beijing Environmental Protection Bureau and Xicheng Environmental Protection Bureau. The pilot plant is designed to abate phosphorus based on contact filtration and reverse osmosis technologies. It comprises several stages of treatment that can operate together, serially, or individually, and their final configuration will be based on the project's results. The works will be located on the lake bank and connected with electricity and sewer facilities. The plant is very compact and will be protected by a special box in compliance with the specifications provided by the Chinese Authorities for the upcoming 2008 Olympics Games.
Following the construction of the plant, an exhaustive task of operational testing and tuning of the processes will be carried out along with the training of Chinese staff on the system's operation and maintenance.
The pilot plant has been designed to minimise maintenance and is completely automated. All the ordinary operations except for membranes cleaning and chemicals dosage can be programmed to occur automatically when needed.
The new works' testing is conducted in parallel with the monitoring campaign and mathematical modelling of the lake system which all together will help to optimise the operation of the works and make knowledge based decisions to proceed with the restoration program.
The data obtained from the quality and bottom sediment monitoring survey will be fed into the mathematical model to enhance the simulation of the quality processes in the lakes. This model will be used for assessing the solutions to restore water quality and will help determine the number of plants required for the process' optimization and whether the oxygen saturation of treated water released at specific locations will be an effective alternative to the more traditional hypo-limnetic aeration by bubbling.
A number of alternatives will be evaluated in order to identify the scheme that attains the established quality objectives at the lowest cost and environmental impact. Many factors will be considered in the evaluation of the solutions such as technical and financial viability, costs, reliability, environmental impacts and administrative requirements. Technical support will be provided to Chinese experts for selecting the solution that best meets their needs.

Enhancement of water quality in the Ju River

The water from Chinese rivers is generally in very poor state because of the reduction of natural flows and the substantial discharges of wastewater dumped into them. With the Olympics just around the corner, the Chinese Government has decided that pollutants into Beijing's rivers should be reduced by 50% in 2008.
The Ju River is one of Beijing's three rivers. It crosses the eastern districts of Pinggu and Shunyi, collecting wastewater generated by 400,000 inhabitants, and the industrial, farming and agricultural discharges. The predominant activity in the area is pig husbandry. It is estimated that significant amounts of wastewater are discharged from the pig farms into the Ju with insufficient or no treatment. The area also has a beer brewery and some chemical factories. For three quarters of the year, the Ju River flows dry upstream of Beijing city, transporting only the city's municipal, industrial and agricultural spills.
The main indicator of organic pollution in the Ju River is COD (Chemical Oxygen Demand) which has values as high as 385mg/l. The City's mayor has given key priority to the reduction of COD in the Ju, aiming at bringing it down to 100 mg/l by 2008 and 70 mg/l by 2010.
The quality objectives demand that the Ju River just

upstream of Beijing should reach class V standard of surface water with COD concentration of 40 mg/l. The main goals of our project are to abate pollution of the Ju River by characterising pollution sources, and to provide relevant authorities with technological solutions to reduce pollution. Pilot projects will be implemented to demonstrate the effectiveness of measures to control pollution at their source. For instance, technologies will be proposed for treating sewage rich in organic nutrients and reusing sludge to produce biogas.

DFS has developed a sound expertise in pollution abatement at river basin scale through the implementation of projects financed by the European Commission and other international funding institutions. Based on this experience, DFS has set up a toolkit called ECOPLAN-Kit© which gathers a suite of technologies and procedures for characterising pollution sources and controlling their impacts on the receiving bodies. This toolkit includes geographic information systems, equipment for Supervisory Control and Data Acquisition (SCADA), flow and quality monitoring systems for wastewater facilities and rivers, and mathematical models to simulate processes in sewers and receiving bodies. In our project, we endeavour to adapt the ECOPLAN Kit© to meet the needs of the Chinese authorities in the strategic planning of pollution abatement measures.

We emphasise the need for technology adaptation and assimilation by the Chinese counterparts and strongly believe that training of local staff is crucial for ensuring the project's sustainability in the long term. Through our projects we expect to contribute in making a better water environment in China.

Remote Sensing Applications for Water Quality Control and Management

Marco G. Cremonini, Luigi Torriano, Federico Breda, Patrizia Scalas, DFS Engineering

Water quality is a critical issue in China due to an increased population demand, industrial development, intensive agriculture, lack of erosion control practices, pollution and water scarcity.
Although industrial point source pollution was the primary concern in the 1990's, in recent years non-point source pollution from both agricultural and urban runoff has received considerable attention. Many of China's freshwater lakes are in a state of eutrophication due to high nutrient loads from phosphorus and nitrogen fertilizers. Coastal waters are moderately to highly polluted and are often affected by phenomena like "red tides". Increased turbidity in water courses due to upstream erosion is a common occurrence which is added to water scarcity. Excessive suspended solids have numerous ecological impacts by reducing light penetration, lowering the rate of photosynthesis, and, thus lowering the rate of oxygen production in the water column.
Major lakes including reservoirs and urban lakes in China suffer algal blooms, eutrophication and lack of dissolved oxygen. Water quality plays also a role in connection to the production of Green House Gases, in particular Methane, with an overwhelming role of water bodies as a source in China.
Standard techniques for measuring water quality involve *in situ* measurements and/or the collection of water samples for subsequent laboratory analyses. While these technologies provide accurate measurements for a point in time and space, they have limited potential to provide the spatial or temporal view for water quality monitoring, assessment and management of wide or multiple water bodies. Remote sensing techniques based on satellite images offer the potential for cost effective and synoptic measurement of water quality indicators of wide areas.
Remote sensing techniques were applied in China to assess and monitor water quality parameters in some projects developed in the framework of the Sino-Italian Cooperation Program (SICP) promoted by the Italian Ministry for the Environment Land and Sea.

Basics on Remote Sensing

Remote Sensing (RS) is broadly defined as any data collection activity carried out without contact with the investigated object or area. RS is now commonly intended as the technologies, tools and methodologies based on aerial and satellite data used to study and monitor large-scale trends and processes on the earth's surface at different geographic scales, from local to global. In the last decades, RS has been successfully applied to natural resource management, land planning and environmental monitoring. Satellite RS analysis can provide cost-effective alternatives to labor-intensive ground surveys, as satellite images can cover very large areas. This approach is especially cost and time effective in China given the large surface of the country and the lacking of updated territorial information.
Methodologies based on RS provide a number of advantages when compared to traditional survey techniques:
_ continuous acquisition of data;
_ regular available updates (resulting in up-to-date information) ;
_ broad regional coverage;
_ good spectral and spatial resolution;
_ ability to manipulate/enhance digital data;
_ cost-effectiveness of data;
_ large archive of historical data available to perform trend analyses.

RS Based Techniques for Water Quality Monitoring

In the last years, RS techniques were used by D'Appolonia to monitor water quality in China in projects developed in the framework of the Sino-Italian Cooperation Program. Water quality assessment and monitoring was carried out using advanced software capable to provide a synoptic view of the status of water bodies (sea water, rivers, lakes and reservoirs) based on the analysis of satellite images. Different scalar parameters can be simultaneously retrieved, on a per pixel basis:

_ concentrations of suspended chlorophyll (chl)
_ suspended minerals,
_ colored dissolved organic carbon (CDOC)
_ turbidity

The use of these parameters is based on the consideration that they can be correlated to water quality conditions and they are optically significant for water suspended and dissolved constituents.

For most waters, the optically dominant suspended organic component is chlorophyll (chl) which is present in most photosynthetic organisms and provides an indirect measure of algal biomass and an indication of the trophic state of a water body. Chlorophyll is usually included in water quality monitoring programs for lakes, rivers, reservoirs, coastal and open ocean, since excessive algal growth results in water with an unpleasant taste, odor and appearance, and may cause water eutrophication, negatively affecting water quality, diminishing the recreational utility of water bodies and impacting the ecosystem. Monitoring algae populations and distribution in water bodies is thus vital for resource preservation, public health and safety, and overall economy.

The optically dominant suspended inorganic component is typically in the form of suspended minerals. Increased turbidity is unsightly and the high suspended minerals load associated with it has severe impacts on ecosystems, as it disrupts fish reproduction, smothers habitats, and prevents light penetration required for aquatic plant growth. Nutrients, bacteria, heavy metals, and pesticides are also commonly found adhered to suspended minerals.

Dissolved Organic Carbon (DOC) is used to describe the myriad dissolved compounds found in water that are derived from organic materials such as decomposed plants or animal matter. The most recognizable forms of DOC such as soluble fats, proteins, and carbohydrates are often found within the stream or lake from animal feces or decomposition of fish and insects. This form of DOC is not pigmented and does *not* alter the water color, whereas DOC brought in from outside a lake or stream created by the decomposition of leaves and woody debris is. The plant material is broken down by organisms into very small particles that are yellow to black and that can have a great influence on water color. In this case, it is possible to distinguish the Colored Dissolved Organic Carbon (CDOC). The effects of excess CDOC are comparable to those of total DOC and can be a useful indicator of the degree of pollution.

Water turbidity (also correlated with the “Secchi depth” in lakes) is the measure of water light scattering properties and is determined by the amount, size and composition of suspended matter such as clay, silt, colloidal particles, plankton and other microscopic organisms. Turbidity can vary seasonally according to biological activity in the water column and surface run-off carrying soil particles.

Presence of historical data or *in situ* measurement of these parameters, particularly if coincident with the acquisition of remote sensed data can help in the calibration of results deriving from satellite images analysis.

Pilot Applications of Water Quality Monitoring in China

This methodology was applied in selected water bodies in China in the context of environmental studies carried out in the framework of the Sino-Italian Cooperation Program. The projects were carried out by D’Appolonia and the China Research Academy of Environmental Science (CRAES) of the State Environmental Protection Administration (SEPA) starting from 2002. These pilot applications demonstrated the capabilities of advanced RS techniques (i.e. Landsat data) to perform water quality analysis in several water environments in China. The applications focused on different pilot areas that presented various types of water quality features and concerns. Following are some examples of applications in China.

Haihe River Basin and Bohai Bay

To face the problem of water scarcity, several hydraulic projects are being considered in the Haihe River Basin. The study focused on the Haihe River Basin and the Bohai Bay which has been particularly vulnerable to red tides due to its shallow depth, low tidal exchange, and high nutrient load from nearby agriculture and aquaculture production. In Bohai Bay, CDOC was present in the littoral zone in highly elevated concentrations, exceeding 55.5 g/m^3, and chl in the limnetic zone. Chlorophyll concentrations are the highest in the northern half of the Bay with values sometimes exceeding 40 mg/m^3. The figure shows the chlorophyll in the Bohai Bay in October 2002.

Jianghan Plain

Jianghan Plain, located in Hubei Province, is the primary floodplain of the Yangtze River and is one of the richest areas of shallow lakes in China. Water quality analyses were performed on the eastern half of the Jianghan Plain focusing on the Yangtze River and Honghu and Liangzi Lakes. The Yangtze River showed extremely elevated values of suspended minerals uniformly distributed through-out this section of its floodplain. Concentrations of suspended minerals often exceeded 50 g/m^3, and sometimes 90 g/m^3. An example of turbidity result is presented below (section of the Yangtze River in July 2002).

Dalai Nur, Miyun and Hongze lakes

The monitoring of water quality parameters with RS techniques can be used for further application. For three selected water bodies (Dalai Nur in Inner Mongolia, Miyun in Beijing and Hongze in Jangsu) a SICP project was carried out in order to design a preliminary model for predicting Methane emissions from water bodies, using water quality parameters measured from the satellite. The above mentioned parameters can be considered as direct precursors or indicators or products of methanogenesis. Euthrofic conditions, for example, which indicate a lack of oxygen and potential triggers of anaerobic reactions in water, like methanogenesis, can be assessed using chl measurements as indicators.

For the model's quantitative assessment and for the validation of the RS analysis results, historical water quality data and field analysis of water samples were used. Field and historical data were correlated with parameters measured by satellite in order to assess their capability to predict the production of methane in water bodies. The model design is currently ongoing and preliminary results will soon be available. Preliminary results for suspended minerals in the Hongze Lake are presented below (from top to bottom: 20 April 2004, 9 July 2004, and 31 July 2006).

These techniques, successfully applied in the SICP projects to some case studies, provide a new and state-of-the-art approach to develop a comprehensive water quality monitoring program of water bodies in China while reducing time and costs with respect to programs conducted with traditional methods. The support provided by these techniques is considerable also considering the importance of water resource and the current growing level of pollution in China.

This section is written by the Chinese participants in the trainings in Italy. We hope hereby to provide the Newsletter readers with an authentic flavour of the training experience.

State Environmental Protection Administration of China

Water Prevention and Pollution Control
Italy, June 9-23 2007
22 participants

Within the framework of the Sino-Italian cooperation of Environmental Management and Sustainable Development Training Program "Water Pollution Prevention and Control", 22 trainees from the national environmental protection system of China attended the first training seminar in Italy from March 17 to 31 2007, under the leadership of Li Xinmin, Vice Director General of the Department of Pollution Control of the State Environmental Protection Administration (SEPA).
Through the attentive organization of the Italian Ministry for Environment, Land and Sea (IMELS) and Venice International University (VIU), the trainees had fruitful experiences successively in Rome, Siena, Venice and Turin. They were introduced to Italian and EU organizational systems, legal frameworks, management theories and management practices in terms of water pollution prevention and control. They visited IMELS, THETIS (technical support agency for Venice Water Affairs Bureau) laboratory, and conducted on-site visits to the Venice lagoon, the Treviso Wastewater Treatment Plant, the Fusina Wastewater Treatment Plant in Venice and the Castiglione Torinese Water Works in Turin. In the process, the trainees learned a lot, especially about the following points.
1. Comprehensive and systematic management of the drainage area. From the perspective of drainage and the whole system, to plan targets for water environmental protection, to coordinate the water-related affairs and to survey the quality change of basin water; organizationally to establish an observation group that incorporates the governmental and nongovernmental organizations and to form a whole package of practical administration models of drainage areas, and finally to promote the improvement of the overall water environment of the drainage area.
2. Changing from large-scale centralized treatment systems to small-scale and scattered ones of the EU countries to avoid the negative impact and even serious damage to the ecological functions of downstream water bodies.
3. Management models, in which governments provide the construction of pipelines and the industry is responsible for the establishment of wastewater treatment plants, that clarify the responsibilities of governments and the industry and help the urban wastewater treatment plants to meet their corresponding standards.
4. Sound chemically and biologically combined monitoring methods to gauge the environmental quality of the water, that can efficiently avoid the defects of the purely

chemical methods, e.g.: incapacity of monitoring the toxicity of each chemical substances, inability of measuring the biological effectiveness, biodegradation and bioaccumulation of organic matter in water, higher monitoring costs, etc..
Thanks to the productive work of the trainers and the interaction between the trainers and the trainees, the program achieved very good results. The trainees also gave some feedback:
1. The outcome of this experience would be greatly improved if the training material and related background information, both in Chinese and English, would be provided in advance, especially the organizational framework of environment management in the EU and Italy, the content of water-related laws and regulations, major policies and executive means of environmental management, penalties for regulations and environmental law breaking.
2. Due to the tight schedule, the training should focus on macroscopic topics rather than microscopic ones.

Besides the intense training, the trainees were toured to many historical sites and beautiful scenery which are frequently shown on TV and movies. They were greatly impressed by what they saw and experienced. And above all, the trainees were all touched by the Italian people, who are kind, keen, and always ready to help out. The trainees believe they now gained a much better understanding of Italy, including its culture, its history, and its people during this period. They believe their short stay in Italy will bind the two peoples together and will promote the cooperation between the two great countries.

The trainees would like to take this opportunity to express their great appreciation for the passionate work of the trainers, organizers, interpreters and tour guides, especially VIU staff who contributed a lot to the success of the training program.

Chinese Ministry of Science and Technology

Capacity Building on Clean Development Mechanism
Beijing, April 9-13 2007
Italy, April 14-28 2007
26 Participants

The 2007 Sino-Italian Capacity Building Training Workshop on Clean Development Mechanism was held successfully. It was jointly organized by the Administrative Centre for China's Agenda 21 and Venice International University. It consisted of two stages: the first one was held in Beijing from April 9 to 13 2007. The second one was carried out in Italy from April 14 to 28. Twenty-six Chinese participants, from provincial governments and universities joined the workshop. The workshop promoted Chinese participants' awareness on CDM and climate change, and strengthened the cooperation and exchange between China and Italy in CDM projects.

The participants took part in fieldtrips and attended for three weeks scores of presentations about CDM projects both in China and Italy. In class, they learned about CDM funds, CDM cases, climate change, and renewable energy such as hydrogen, solar and geothermal energy. The lectures impressed the participants and increased their awareness in the area of climate change and sustainable development. Professor Dong Tieyou, from Henan University of Science and Technology, said: "After taking these lectures, I now understand how the CDM Fund works for us to develop PIN and PDD, and what will be going on in the CDM market all over the world for the next couple of years. We learned the process of CDM projects application that will help us evaluate risks when we are dealing with CDM projects. The workshop is really helpful". A delegate of Kexin Technique Services Center of CDM, in Jilin Province, Professor Dailei told us: "When I look around the VESTA, I learn the way to recycle and use waste to achieve the goals of energy conservation and environmental protection in Italy". Mr. Li Xin, Director of Department of Gansu Province explained: "Nowadays, Chinese people's living standards and consumption patterns develop quickly. During the 90s, waste flows grew more rapidly than the available space to stock them. At the same time, people were concerned about the environment and health which have been potentially polluted by waste. In Italy, there are ways to tackle the issue which use a range of different treatment options to deal with the entire solid waste stream, waste collection, waste treatment, and then burning the waste to generate energy in the plant. As a result, the treatments significantly reduce the waste deposit and energy consumption. It's a global approach, and it contributes to cleaner production, environmental sustainability and green economical development. It's a good model for China".

The training themes were closely related with CDM projects, climate change and advanced technology of environmental protection in Italy and EU. The workshop is a good opportunity for participants to gain experience and explore the different techniques. It is a significant basis for the participants to do a better job with CDM projects in the future.

Chinese Academy of Social Sciences

E-learning spreads Italian environmental protection experiences to every corner of China

Environmental Management
e-learning session
China, March 5-9 2007
60 participants
study tour
Italy, May 24-June 2007
15 participants

The Sino-Italian Pilot Project E-learning for Sustainable Development was held simultaneously in Beijing, Changsha and Xining from March 5 to 9 2007. The E-learning Program was sponsored by IMELS and CASS, and jointly implemented by Venice International University, the Italian Monserrate Association and the Institute of Industrial Economics of CASS.
Beijing, in the eastern part of China and as the capital city, is one of the most developed areas and has a vigorous economic growth and a higher standard of living. Beijing's per capita GDP reached 6,000 dollars in 2006. Changsha, the provincial capital of Hunan in the central part of China, has an average level economic growth. As for Xining, it is the provincial capital of Qinghai in western China. Most of Qinghai is a poverty-stricken area with a bleak environmental status. These three cities represented an array of China's regions.
The trainees in Xining and Changsha were local government officials and scholars. Since governing officials and scholars in Beijing have easy access to various trainings, the Beijing candidates were mainly selected from environmental protection NGOs. A proportion of 94% of participants were satisfied or very satisfied of the overall outcome of the E-learning experience. The trainees in the Study Tour were quite pleased with VIU's organization in Italy.
Italy is an ancient country with long history, just as China. Located in the center of the Mediterranean, Italy not only gave birth to the Renaissance, the splendid era of European culture, but has also become a bridge for all Mediterranean cultures in modern times.

Italy has always been famous for its beautiful scenery, delicious food, elegant architecture, famous music, stylish design and fashionable chic all over the world. The participants were also impressed by the hospitality of Italians. Ever more people take interest in exchanging and sharing ancient and modern achievements with Italy.
The trainees of E-learning mainly appreciated the two following points:

1. Italian and Chinese experts delivering lectures to the trainees with fairly advanced theory and perspective in sustainable development, which is helpful to China's sustainable development.
2. E-learning is an innovative learning method for the trainees. They can participate in local areas. Therefore, it is beneficial for them to save time and other costs.

Meanwhile, as a pilot project, E-learning should be improved in some aspects.
For instance since there are different operators providing network connections in China, interconnections are often problematic. Internet access is sometimes overcrowded and connections are often jammed due to lack of bandwidth. The technical support for E-learning should provide a better solution.
Another problem is the difficulty to satisfy the trainees' peculiar needs with each course. For example, the trainees in Beijing preferred lectures on urban environmental management; the participants in Xining were especially interested in desert or grassland managing skills; while those in Changsha tended to want more information on sustainable agriculture. This confirms that, as E-learning expands, we should be aware of the need to diversify our courses.

Venice International University and Tsinghua University Joint Workshop: Sino-Italian Comparative Studies on Sustainable Development
VIU, April 16-17 2007

On the basis of the Sustainable Development Exchange Project between Tsinghua University and Venice International University under the framework of the *Agreement on Scientific and Technological Cooperation for Environment*, Tsinghua University has become a member university of Venice International University consortium. In order to improve the academic cooperation, TU and VIU co-organized a Joint Workshop to exchange information, experiences and academic achievements, and to search for further cooperation.
The workshop was held on April 16-17 at VIU premises and supported by the Italian Ministry for the Environment, Land and Sea.
The workshop offered nine Italian and four Chinese professors and young researchers the opportunity to confront their views on issues such as Sustainable Development, Environmental economy, policy, management, Energy and climate change, Water management and waste water treatment, Solid waste management, Environmental Risk Assessment in China and Italy. In particular they were able to expose and discuss their own researches in these fields, pointing out "convergences and divergences" of research approaches and results, to find opportunities for research cooperation.

Water Pollution Prevention and Control, CASS
Italy, May 12-26 2007
39 participants

China is nowadays facing serious water resource management issues: among these are the worsening of water quality pollution, quantity shortage and aquatic ecosystem degradation. In particular, over 400 Chinese cities are fac ing water shortages; 90% of the nation's cities suffer from groundwater contamination; only 29% of rural population has access to improved sanitary measures; waste water treatment plants are inadequate; coastal water is polluted from waste water discharged directly into the sea, negatively affecting biodiversity.
China's impressive economic growth is dragging the country in a worrying situation regarding environmental deterioration; at the same time, China necessitates water to satisfy its population needs as well as to support its economic activities and, thus, its development.
For these reasons, water management in terms of pollution and floods and droughts control has become a crucial issue for the Country.

In this context, experts from CASS attended *Water Pollution Prevention and Control* training course organized by VIU, in order to acquire management tools from the Italian experience. The training course deeply explored water issues from many points of view investigating legislation, financial aspects and policy of water management, water pollution effects on human health, waste water treatment and monitoring tools.

Environmental Management, SEPB
May 26-June 9 2007
26 participants

According to the needs of the Shanghai Environmental Protection Bureau, the course agenda was designed to develop all the main topics of sustainable development, by presenting the methods of addressing each different aspect in Italy and Europe.
During the days spent in Rome and Siena, the delegation was provided with a general introduction on the EU law and policy, together with examples of implementation in the national legislation.
In Venice and Turin, lectures on specific subjects were organized. Particular emphasis was given to urban sustainability, starting from the example of Venice and its Lagoon, to the projects for the new development of Chongming Island in Shanghai. Experiences from other European cities were introduced as case studies to inform the participants on the most useful tools currently available to improve the liveability of modern towns.
Other aspects related to urban sustainability were investigated as well. The necessity of using renewable energies and applying the most recent technologies to obtain high energy efficiency in dwellings gave rise to discussions between the participants and the lecturers.
Topics like waste management and air pollution control were tackled during site visits, that gave the delegates the opportunity to meet the representatives of firms and institutions which apply “green” technologies or develop new sustainability projects.

Air Pollution Control, MOST
Italy, June 23-July 7 2007
30 participants

Air pollution is nowadays a problem of great interest, not only for China but also for industrialized countries, in which most of the population lives in towns and where traffic is one of the main sources of pollutants.
The Chinese Ministry of Science and Technology requested to have an entire course dedicated to this issue; therefore the agenda was designed in order to present the Italian experience in the control of air pollution and some outstanding projects of planning and monitoring.
In Rome, the delegation visited the National Research Council that presented its most recent research projects and the various techniques adopted.
During the day spent in Siena, the attention was focused on the political aspect of atmospheric pollution. A general introduction to the principles and to the European legislation was given, and then the legislative framework in the field of air pollution was presented.
The role of the Regional Environment Protection Agencies (ARPA) was underlined, and their activity and action range discussed through lectures and visits. A very special opportunity to see an example of their work was given by the visit to the newly inaugurated Integrated System for Environmental Monitoring and Emergencies Management carried out by ARPA Veneto and realized in the industrial area of Venice. The

system is the first of its type in Europe and will allow the early detection of any polluting emission coming from the industrial area and the warning of institutions and population. Also, the possibility of reducing air pollution in cities by cutting the emissions coming from traffic was presented through Intelligent Transport Systems (ITS) projects. Several Italian cities have already implemented this kind of systems and Chinese cities are following this example as well, benefiting also from the support of Italian companies that are leaders in this field.

Sustainable Urban Development in Coastal Areas, TSTC

Italy, June 16-30 2007
26 participants

The first training organized in Italy and addressing a delegation of the Science and Technology Commission of Tianjin follows the opening session held in China last March. The aim of the training, focused on *Sustainable Urban Development in Coastal Areas* is to propose different aspects to be included in the management and development of coastal areas, as they present some peculiarities not to be undervalued. The city of Tianjin in particular is situated in an area that has faced a very dramatic growth of industries during the past years. At the same time, the Municipality of Tianjin wants to protect environmental and cultural aspects.
Based on the Italian experience in the field of cultural heritage protection, the first lectures in Rome and Venice were more focused on showing how to preserve the historical areas of cities, while creating technological and industrial parks, as well as boosting the expansion of the port.
As for the latter point, the delegation had the opportunity to visit the Port of Venice, to see how boat traffic is sorted out in different areas of the lagoon in order to facilitate both tourism and industries.
A whole day was also devoted to land remediation and redevelopment, with the case study of the industrial area of Venice.
Moreover, as the coast management must also take in consideration the sustainable development of aquatic environment, some specific lectures were organized on water pollution as well as on contaminated sediment monitoring.
As concerns of common issues for sustainable urban development, some examples regarding the traffic and waste management were discussed.

Sustainable Programme for Rehabilitation of the Shichahai Lakes in Beijing Urban Area

The Shichahai Project, undertaken under the Sino-Italian Collaboration Program for Environmental Protection, aims at enhancing water quality of the Shichahai lakes system in Beijing's urban area.
The first phase of the project, completed in December 2005, provided an insight into pollution problems of the lakes and identified the most appropriate measures to restore water quality in view of the 2008 Olympic Games. The project concluded that it is necessary to implement small treatment plants (5 l/s capacity each) along the lakes in order to restore the system's water quality. In January 2006 the Italian Ministry of Environment, Land and Sea (IMELS) and the Beijing Environmental Protection Bureau (EPB) agreed to proceed with the implementation of the solutions identified in Phase 1 and to start a pilot project consisting of the detailed design and construction of a water treatment plant and fountains system in the Qianhai and Xianhai lakes respectively.
The construction of the works will be supported by a monitoring campaign that will consent to evaluate the physical and chemical processes in the lakes throughout the year and provide the basis for the optimization of the newly installed treatment works.
Monitored data will be used to enhance the mathematical model developed under Phase 1 so that it becomes a valid tool for

the planning and management of the lakes. The enhanced model will be used to further evaluate the environmental restoration solutions identified in Phase 1 and explore them in more detail considering the dataset supplied by the survey campaign. The tools developed throughout the project, database and monitoring network, will be supplied to Beijing EPB and training courses will be held with the relevant local experts to make sure these instruments will be replicated following the project's completion.

Sustainable Water Integrated Management of the East Route Project

After 50 years of investigations and research, in November 2002 the Chinese Government commenced the ambitious South-to-North water diversion project to balance the nation's water supply. The South North Water Diversion Project (SNWDP) is the biggest hydraulic project ever designed worldwide. It raises scientific, social and environmental concerns related to land use change, possible regional climatic variations and agricultural productivity.
The SNWDP aims at transferring 59 billion cubic meters of water per year by means of three links from the southern subtropical basin of the Blue River to the northern semi-arid basin of the Yellow

river. The eastern connection, called the East Route, is the most advanced part of the project: a complex hydraulic system of interconnected channels, rivers, lakes and reservoirs will be used to transfer, at the final stage, an average discharge of 1000 m^3/s to the Beijing district 1200 km north.

The scheme crosses a highly populated area affected by water scarcity and heavy water pollution, which prevent the sustainable socio-economic growth.
The SWIM project, "Sustainable Water Integrated Management", is one of the on-going initiatives in the framework of the Sino-Italian Collaboration Program for Environmental Protection (SICP). SWIM focuses on the optimization of water management along the East and Middle Routes of the South to North Water Diversion Project (SNWDP), a major inter-basin transfer project consisting of three links or "routes" to supply the dry Northern and Western regions with 40 billion m^3 per year from the Yangtze River.
SWIMER (Sustainable Water Integrated Management of the East Route of South-North Water Diversion Project of China) established an integrated water resource management approach to the most advanced "East Route" of the SNWDP, whereby the water engineering scheme was analyzed in combination with socio-economic, environmental and climate change factors. The mathematical models developed under SWIMER can help to optimize the sectoral and geographical allocation of water resource along the East Route, thus promoting the implementation of a sustainable development policy that balances socio-economic interests with environmental needs.
Chinese Authorities expressed their wish to extend the project to the Middle Route as well as to make the models an operative Decision Support System (DSS) for helping the managers of the SNWDP in the long and short term management of the diversion. SWIM was formulated to meet this major aim along with the following objectives:
_ The design of a system for Real Time Control of the water supply system serving Beijing City;
_ Institutional capacity building to strengthen the SNWDP Bureau who will take over the responsibility for the management of the diversion once the construction is finalized;
_ A water education program in collaboration with UNESCO;
_ The set-up of an environmental project to be financed by the Global Environmental Fund (GEF) focused on fostering the sustainable exploitation of North China Plain Aquifer.

The Hai He River Basin Project

The Project, undertaken under the Sino-Italian Collaboration Program for Environmental Protection, aims at enhancing water quality of the Hai He River Basin in Tianjin's urban area. The Hai He River plays a crucial role in the Tianjin Municipality's navigation, flood discharge, water storage and urban environment operations.
The river results to be highly polluted by sewage effluent, storm water runoff and waters discharged by industrial sites; actually two major problems are putting under threat Tianjin area: water scarcity and algae floating and greatly damaging the city's ecological environment.
Due to the untreated wastewater discharged into the river, the surface water is heavily polluted. Water quality does not meet water quality standards for even agricultural water sources and general amenity purposes.
The overall objective of the project is to propose strategies and actions aimed at the control and abatement of pollutant loads in the study area within the Hai He River.
The following typologies have been considered:
_ Long term strategies: within this phase of the study the main parameters playing an active role in the pollution of the Hai He river trunk study area will be identified and characterized. The study will outline at large scale long term water quality preservation and sustainable strategies to be applied. A basic water quality model relying on existing gathered data will be built, and will provide an overview of the current situation and indication for long term strategies.
_ Short term local interventions: once the dynamic of the system will be investigated through the general overview of the current status, the large scale study and the long term strategies, the project will investigate immediate actions to be focused in CSD area. Short Term Local Interventions will be investigated with the aim of obtaining tangible results in terms of water quality improvement in the short period.

Miyun Reservoir Protection Plan

Beijing is an area with stringent water

resources. The water resource is only about 227 cubic meters per capita, far lower than international water shortage lines (1000 cubic meters) and international water resource cordons (1700 cubic meters). As the city size has been expanding in recent years, the problem of water source short supply is outstanding day by day. The water shortage crisis is threatening the survival and the socio-economic development of urban activities including the Olympic Games 2008.

In order to protect the water source of the Miyun Reservoir, the only surface drinking water source in Beijing, the Miyun County government has implemented the migration project of first class protection zone of the Reservoir; set up measures for first class protection zone; banned breeding fish; established a law enforcement team to protect the water source. All the above measures ensure that water quality of the Reservoir meets the standards.

However due to the impact from regional environment and economic development and the lack of a comprehensive plan on prevention and control for water pollution for the Reservoir, its quality and surrounding environment have shown a declining trend.

The project aims at developing a comprehensive plan for water pollution control and prevention in the Miyun Reservoir and at suggesting general guidelines for the sustainable development of the watershed area.

The project was divided into two phases: a first one, completed in 2006, of environmental and socio-economic characterization of the Reservoir and its watershed area, and a second one of finalization of the overall objectives which is at the moment under construction.

VIU Training Activities 2008

Thanks to the renewed support of the Italian Ministry for the Environment, Land and Sea, we are proud to present the 2008 Advanced Training Program.

All Chinese institutions have confirmed their will to participate in the training activity and are asking for new topics due to their always increasing environmental awareness.
Moreover, the big challenge of the Olympic Games is demanding an greater effort to face local environmental issues common to big cities like Beijing.

27 Training sessions will be organized by the TEN Center of the Venice International University, with almost 1000 Chinese trainees to attend the 2008 Training Program. This year, 8 Chinese cities will be reached by the distance learning activity carried out within the E-Learning Program as a positive result of last year's pilot project.

The following Chinese institutions will take part in the Advanced Training Program, as follow:
_ The Chinese Academy of Social Sciences (CASS):
4 Trainings in Italy + 1 in Beijing
Waste Management, Water Pollution: Prevention and Control, Capacity Building on Sustainable Development, Energy Efficiency and Renewable, Sustainable Urban Development and Eco-Building
_ The Chinese Ministry of Sciences and Technology (MOST):
4 Trainings in Italy + 2 in Beijing
New and Renewable Energies, Clean Development Mechanism Capacity Building: Introductory Session, Clean Development Mechanism and Capacity Building, Energy Conservation and Efficiency, Capacity Building on Sustainable Development: Introductory Session, Capacity Building on Sustainable Development
_ The State Environment Administration of China (SEPA):
4 Trainings in Italy
Air Quality Monitoring (3 courses), Multilateral Environmental Agreements
_ The Beijing Municipal Environmental Protection Bureau (BMEPB):
3 Trainings in Italy
Electromagnetic and Radiomagnetic Pollution, Water Pollution Control, Brownfield Pollution Evaluation and Treatment
_ The Shanghai Municipal Environmental Protection Bureau (SEPB):
2 Trainings in Italy + 1 in Shanghai
Environmental Friendly City, Environmental Management (2 courses)
_ The Science and Technology Commission of the Municipality of Tianjin (TSTC):
2 Trainings in Italy + 1 in Tianjin
Sustainable Development for "Eco-city": Overview and General Principles, Sustainable Development for "Eco-city": Application and Case Studies (2 courses)
_ The E-Learning Program (in cooperation with CASS):
1 Training in China + 2 Study Tours in Italy
Environmental Management and Sustainable Development in Practice, Environmental Management and Sustainable Development in Practice: Study Tour (2)