

IPIECA



Water Resource Management in the Petroleum Industry

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IPIECA, the International Petroleum Industry Environmental Conservation Association, was established in 1974. It is a voluntary non-profit organization whose membership includes both petroleum companies and associations at the national, regional and international levels.

Separate working groups within IPIECA address global environmental and social issues related to the petroleum industry: oil spill preparedness and response, global climate change, biodiversity, social responsibility, fuel quality and vehicle emissions, and human health. IPIECA also helps members identify new global issues and assesses their potential impact on the oil industry.

IPIECA holds formal United Nations status, which allows it access as a Non-Governmental Organization (NGO) to all UN negotiations. The Association represents the views of its members in public fora and provides an interface between the petroleum industry and the United Nations Agencies.

IPIECA's goals are to promote good practices and industry consensus through:

- Arranging international workshops
- Publishing authoritative reports
- Providing a channel of communication with the UN
- Providing a forum for open dialogue
- Facilitating stakeholder engagement
- Promoting partnerships



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TABLE OF CONTENTS

Water – a key resource	3
Water and oil	3
IPIECA Water management good practice guidelines	4
Good practice examples	
PETRONAS water treatment plant benefits both business and community	5
Nexen brings water to the desert	5
Hydro strikes water in Angola	6
EnCana says hats off to simple solutions	6
BP’s Kwinana refinery values water	7
Shell manages water more effectively	7
BP delivers a clean water project in Algeria	8
ChevronTexaco is good for the neighbourhood	9
ExxonMobil’s water management practices in Western Canada	9
Reclaimed water for ChevronTexaco in California	10
KPO is operating responsibly in a new environment	11
TOTAL researches the use of produced water for irrigation	11
Imperial Oil recycles water at Cold Lake	12

WATER – A KEY RESOURCE

Water is one of Earth's most critical resources. Essential to every ecosystem, water sustains all life, and helps maintain the environmental balance of our planet too. Water is essential in human development – from the personal water needs of every individual to the demands of agriculture and industry.

The world's water resources consist of fresh water found on and under the Earth's surface, and the immense salt-water reserves of the oceans. Since fresh water is used to meet most of our current needs it has become the focus of immediate concern. With population growth and industrial development on the increase, demand on limited supplies is likely to intensify still further.

Both the Millennium Development Goals and the Johannesburg Summit on Sustainable Development recognise the need to provide greater access to clean fresh water, to improve sanitation, and to produce integrated plans for the development of this universal resource.



WATER AND OIL

Water is almost as important to the oil industry as oil itself. We actually handle more water than we do oil. That's because large volumes of water are vital to many of our core activities. Fresh water plays an integral part in many operating processes – from production and manufacturing to steam and power supply. Seawater is also widely used in cooling systems, and to maintain pressure in oil reservoirs. But we don't just discard the water we use - after cleaning, we return most of it to the environment.

There are often conflicting demands on water resources in areas where oil companies operate – access to clean fresh water may be limited, available supplies may be over-stretched and, in the worst cases, pollution may have left some natural water resources unusable. The oil industry is committed to finding a healthy balance between the water needs of agriculture, local communities and commerce.

Through careful management of its activities the oil industry can help protect both land-based water resources and the marine environment. Where water is scarce, the oil industry can use its practical expertise to help unearth and tap new sources of water. We seek ways in which the water we've used can be recycled – in agricultural irrigation, for example. Wherever possible we'll try to use reclaimed waste-water or lower grade natural water in our industrial processes – leaving more fresh water for community and agricultural use, and reducing pollution too. We also strive to reduce our impact by treating and monitoring our waste water before discharge. We also take great care over the storage, handling and transportation of all our products – to further reduce the possibility of marine or groundwater contamination.

The oil industry sees itself as having a dual role in water resource management: to reduce the impact of our operations and to contribute to the communities where we operate. These principles are brought into practice through two key oil industry good practice guidelines: Operating Responsibly and Building Capacity.

IPIECA WATER MANAGEMENT GOOD PRACTICE GUIDELINES

Guideline 1: Operating Responsibly

Sound water management is integral to Operating Responsibly. Consideration for the needs of other water-users, and adopting a life cycle approach to our water use and discharges are key to best practices that include:

- Assessing and managing water use and discharges to water as part of our environmental management systems
- Designing sustainable water systems that benefit our business, the community and the environment
- Sharing innovative new ways of managing water

Guideline 2: Building Capacity

With its business and technical skills the oil industry is ideally placed to help build capacity in water management. Key best practice here includes:

- Active membership of water resource stakeholder organisations at all levels
- Contributing to local initiatives that increase access to clean fresh water and improve basic sanitation
- Developing tools, technologies, and practices that make water use more efficient and reduce costs

Such guidelines are obviously commendable – but how do they work in practice? The following company case studies illustrate good water management practice in the petroleum industry, and how companies are operating responsibly and building capacity in the regions and communities where they operate.



PETRONAS WATER TREATMENT PLANT BENEFITS BOTH BUSINESS AND COMMUNITY

Guidelines in action:

Best practice in action:

**Operating Responsibly
Building Capacity**

**Assessing and managing environmental impacts
Contributing to local initiatives**

The PETRONAS Petroleum Industrial Complex (PPIC) is a group of petroleum-based manufacturing plants and facilities on the east coast of the Malaysian Peninsula. For PETRONAS to contribute to responsible, sustainable development, a new water treatment plant was needed to reduce demand on local water resources.

Following a detailed environmental impact assessment and a flora and fauna inventory, PETRONAS worked closely with the local population of Kerteh, a mainly fishing community, recruiting and training local people to work on various stages of the project.

The resulting plant reduced demand on natural resources and now also supplies the local community. The plant proved its worth during the 2002 drought, supplying local people with 30 million litres a day of World Health Organisation standard potable water.

Throughout the project, the PETRONAS team was committed to working closely with the local community to ensure their continuing access to clean water. Local people were involved not only in the development of the project but continue to play an integral role in the plant's future through their operational and maintenance roles.



NEXEN BRINGS WATER TO THE DESERT

Guidelines in action:

Best practice in action:

Building Capacity

Contributing to local initiatives

Nexen Inc. works with local communities to distribute the potable drinking water they find while drilling for oil and gas in the desert. So far, twenty villages have been helped in this programme where local communities provide labour and locally available building materials, while Nexen Inc. provides the new water wells along with the pumps, generators, reservoirs and distribution systems needed by a community to create a sustainable water management system.



Nexen is now working in partnership with the Yemen Government, the United Nations Development Programme and the Canadian International Development Agency in Yemen to develop self help water resource management systems, infrastructure and capabilities in the local communities to sustain water and sanitation systems into the future.

HYDRO STRIKES WATER IN ANGOLA

Guidelines in action:

Best practice in action:

Building Capacity	Active membership of stakeholder groups Contributing to local initiatives Developing more efficient production
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In Angola, Hydro seized an opportunity to help develop a sustainable way of life for several thousand people displaced to rural areas during the civil war. A community development project focused on striking water to produce an affordable water supply.



Working with the state oil company Sonangol, Hydro's partners in oil exploration and production, the teams used old exploration data to identify water resources 200 metres below the surface. The resulting Quengela Water System and Agricultural Programme has built 7 water wells and has reactivated 2 old water well sites since 1999. These wells now produce enough water for 6000 farmers and 350 farms. In a country where one cubic metre of water costs up to US \$7, these wells are of vital importance. Farmers access the well water through a 17 km system of water lines, water filling stations and fountains.

The programme also includes a plant to process the manioc that can now be produced locally, and includes water bottling and egg production plants along with schools, washhouses and other valuable infrastructure improvements.



ENCANA SAYS HATS OFF TO SIMPLE SOLUTIONS

Guidelines in action:

Best practice in action:

Operating Responsibility	Sharing innovative ways of managing water
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In all operations, EnCana strives to make efficient use of resources. For instance, around Medicine Hat, Canada EnCana is employing centrifuges in an ongoing effort to reduce the volume of fresh water used for an oil well. In 2004 EnCana drilled 90 oil wells in the Suffield area using this technique and realized a 31,000 m³ reduction in water consumption.

Another example of EnCana's water recycling efforts in the same area is demonstrated in shallow gas drilling operations. Centrifuges require a few days to effectively separate the liquids from the solids and as such they do not work on shallow gas wells because of the extremely short drilling time.

To address this challenge, EnCana field staff reduced fresh water consumption by modifying the design of the liquids and solids separation system. The system was designed with a series of dividers so that the used drilling fluid moves from one cell to the next to slowly settle out the solids leaving clear water in the last cell. This clear water is then transported to drilling operations for reuse. This method of recycling reduced the amount of fresh water used for a shallow gas well by 35% for a total 20,000 m³ reduction in 2004.

BP'S KWINANA REFINERY VALUES WATER

Guidelines in action:

Best practice in action:

<p>Operating Responsibly Building Capacity</p>	<p>Designing sustainable water systems Active membership of stakeholder groups Contributing to local initiatives Developing more efficient production</p>
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If you're the largest user of drinking water in an extremely arid region and you're also on the edge of a popular fishing and recreation area, you face a double challenge – fresh water restrictions and low tolerance for wastewater emissions.

Kwinana Refinery – built on the sensitive Cockburn Sound in Western Australia – tackled both issues in 1997 with a three-pronged strategy. To minimise water use and to re-use it where possible; to use lower quality ground water where suitable for industrial processes; and to eliminate all process wastewater discharges into the Sound.



By 2004 the new approach was delivering. The refinery used 40% less fresh water and 70% less drinking water and reduced wastewater flows by 40%. It wasn't just the environment that benefited - the refinery's water management strategy is saving over US \$1 million a year.

The refinery has also worked with the local Water Corporation to build a new filtration plant that converts over five million cubic metres of treated municipal wastewater every year into water for local industries' use.

With the plant going online at the end of 2004, not only will less municipal wastewater be discharged to the environment but more fresh water is now retained for the local population.



SHELL MANAGES WATER MORE EFFECTIVELY

Guidelines in action:

Best practice in action:

<p>Operating Responsibly Building Capacity</p>	<p>Designing sustainable water systems Developing more efficient production</p>
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In Oman, the expected growth in oil production and associated water production over the next 5 years has seen Shell develop different technologies to reduce costs and convert wastewater to a sustainable resource.

Shell and PDO have introduced several innovative technologies and are working on minimising water produced, maximising production water re-use and finding more efficient water disposal methods.

Seismic imaging techniques at wells and reservoirs have helped reduce water production and see that all water pumped back down is successfully used to enhance oil production.

Cyclone based technology allows Shell to separate reservoir water whilst still in the well bore or at the wellhead, reducing costs and energy intensity of separation. At the surface a new pilot project sees water purified through reed beds before being used to irrigate salt tolerant crops.

Previously, surplus production was discharged into shallow aquifers, which had the potential to pollute groundwater – this practice is now being phased out.

Analysis of over 800 water supply wells which supply water from the shallow aquifers for human and industrial purposes suggest that the necessary water supply can now be maintained for the foreseeable future.



BP DELIVERS A CLEAN WATER PROJECT IN ALGERIA

Guidelines in action:

Best practice in action:

Building Capacity

Active membership of stakeholder groups
Contributing to local initiatives
Developing tools and technologies

The need for clean water in the In Salah region of Algeria was clearly evident. BP developed a clean water project to provide cheaper, healthier water for the community. The project employed local management and has proven so successful it now competes with international companies for water provision tenders.

When the BP team discovered that poor water quality was contributing to a number of health complaints amongst the local community, a partnership was formed with a French company that had already tackled similar problems in Uzbekistan.



The BP team clearly understood that the clean water project should be locally managed to be most effective, and they set about employing and training a local team to develop and manage the four new desalination plants. They introduced desalination technology new to Algeria and transformed the project from a social investment to a sustainable commercial venture that has the potential to outlast BP's petrochemical involvement in the area.

The impact of the project is measurable not only in terms of affordable water deliveries, but also in terms of cheaper bottled water and a free water supply for the poorest households. The local hospital, which recommends the water supply to its patients, will monitor the long-term impact on the health of the community.

CHEVRONTEXACO IS GOOD FOR THE NEIGHBOURHOOD

Guidelines in action:

Best practice in action:

<p>Operating Responsibly Building Capacity</p>	<p>Designing sustainable water systems Active membership of stakeholder groups Contributing to local initiatives Developing more efficient production</p>
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In an award winning water conservation and re-use programme, ChevronTexaco is helping supply its neighbours in California’s Central Valley with the supplemental irrigation water they need. The water is a by-product of oil drilling operations in the giant Kern River oil field in the San Joaquin Valley - surrounded by 45,000 acres of grape, citrus and almond farms along the Central Valley.

Unlike the salty water produced from most Central Valley oil fields, water from Kern River is fresh, making it ideal for local growers. About half the 40 million gallons of water produced from the oil field each day is supplied to local farmers via pipeline or canal and their local water authorities.

The remaining 20 million gallons per day are used by ChevronTexaco in its operations – injected as steam to coax more oil from the field, or used for field maintenance projects.

ChevronTexaco treats and monitors water before it leaves the oil field to ensure it is suitable for agricultural use. Water passes through specialized equipment that removes all but trace amounts of oil and solids.

The entire operation is approved and administered by the Regional Water Quality Control Board through a federal pollution discharge permit. In 1996 ChevronTexaco and the Cawelo Water District received an Award for Distinguished Service in Environmental Planning from the State Water Resources Control Board.



EXXONMOBIL’S WATER MANAGEMENT PRACTICES IN WESTERN CANADA

Guidelines in action:

Best practice in action:

<p>Operating Responsibly Building Capacity</p>	<p>Assessing and managing environmental impacts Developing more efficient production</p>
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ExxonMobil aims to conduct business in a way that’s compatible with the balanced environmental and economic needs of the communities in which it operates. This means using alternative sources of water (saline groundwater, produced water, etc.), rather than freshwater whenever economically feasible. It also means recycling the majority of produced water in waterflood projects, and using contaminated water for waterflood injection, rather than injecting it into disposal wells.

ExxonMobil has developed Water Management Plans for all field areas in Western Canada. These assess how each facility uses water, identify potential opportunities for conservation, and put in place processes to protect surface and groundwater quality.

As part of its drive to reduce freshwater use, ExxonMobil used produced water from the Husky Ram River Wastewater Pond to plug and abandon two gas wells in the Foothills rather than using fresh water from the nearby Clearwater River. Measures to protect surface and groundwater quality include berms for many new leases – these allow surface runoff water to be collected and tested before release. Water quality in discharge and in groundwater wells is also carefully measured, and ExxonMobil annually completes a due diligence groundwater monitoring programme at all facilities to ensure the protection of surrounding groundwater resources.



RECLAIMED WATER FOR CHEVRONTEXACO IN CALIFORNIA

Guidelines in action:

**Operating Responsibly
Building Capacity**

Best practice in action:

**Designing sustainable water systems
Active membership of stakeholder groups
Developing more efficient production**

ChevronTexaco has a number of refineries in areas of the US where conflicting demands on water resources are acute. ChevronTexaco has responded to these pressures by seeking new ways to both manage and conserve water. In El Segundo, California, for instance, a severe drought in the 1980s saw the local Water District develop from simply a fresh water wholesaler to an authority that also supplied specially produced reclaimed water.

ChevronTexaco's El Segundo refinery now takes eight million gallons a day of this reclaimed water – with four million gallons going to cooling tower makeup water, and four million gallons a day to boiler feed water. Reclaimed water now accounts for some 80% of the refinery's overall water consumption.

Further north in California the drought also prompted the East Bay Water District to find ways of supplying more reclaimed water, to relieve the pressure on fresh water demand. ChevronTexaco's Richmond refinery currently uses three million gallons a day of reclaimed water in its cooling towers. The refinery is also exploring the possibility of using another three million gallons a day as boiler feed water – which would see its overall consumption of reclaimed water account for more than 50% of daily usage.



KPO IS OPERATING RESPONSIBLY IN A NEW ENVIRONMENT

Guidelines in action:

Best practice in action:

Operating Responsibly
Building Capacity

Designing sustainable water systems
Active membership of stakeholder groups
Contributing to local initiatives
Developing more efficient production

The Karachaganak Field is one of the world's largest, with initial exploration and production placing considerable demands on the local public water supply. Additional capacity to treat wastewater was needed, as was improved storage of run-off to reduce the chances of contaminating nearby groundwater. The Field wanted to develop measures that would prevent wastewater being discharged into local water sources and provide for water reuse.

Initial analysis showed that the local rivers and aquifers formed an effective but fragile ecosystem, with little water to spare for the demands of the field. A new pumping station was therefore built to bring water in from the Konchubai Gulley – and now over 150,000m³ a year no longer needs to be taken from the public supply. Water treatment and water disposal facilities were also upgraded, with wastewater now used for dust control and fire fighting. The extent and complexity of the new water management programme shows just how seriously KPO takes its responsibilities to the environment and the local community.



TOTAL RESEARCHES THE USE OF PRODUCED WATER FOR IRRIGATION

Guidelines in action:

Best practice in action:

Operating Responsibly

Assessing and managing environmental impacts
Designing sustainable water systems
Sharing new ways of managing water

TOTAL's Research Department is hard at work seeing whether some of the water produced in its operations can be used for irrigation, and so contribute to sustainable development in arid regions, by augmenting local water resources.

TOTAL's researchers have planted a series of greenhouse crops, and are experimenting by irrigating them with produced water which has low levels of salt. Before the produced water arrives at the crops it has been filtered several times through artificial wetland biofilters (made up of reedbeds and halophytic plants growing on sand and gravel layers). These have been proven to remove most of the hydrocarbons from produced water – and once the water is free of hydrocarbons, the focus of the experiment moves to seeing how well the plants can tolerate its salinity. Early results suggest that cotton can thrive in a low saline environment, whereas hemp is not so well adapted.

Now that promising results have been obtained in the greenhouse, TOTAL plan to scale up its de-oiling operations to the field. TOTAL also plans further studies of the salinity tolerance of other commercial crops, in order to develop a range of plants that can be grown in these conditions.

IMPERIAL OIL RECYCLES WATER AT COLD LAKE

Guidelines in action:

Best practice in action:

Operating Responsibly

Efficient use of scarce water resources

Imperial Oil's Cold Lake facility in Canada is one of the largest oil sands operations in the world. Recovering bitumen from oil sands takes a lot of water – it is used to create the steam that heats the bitumen to the point where it may be recovered. Wherever possible, Imperial always seeks to reuse as much of this injected water as possible – currently recycling around 95%. Imperial was also the first operation in the area to use brackish water from deep saline aquifers, so reducing its demand on local fresh water resources.

Although bitumen production has climbed steadily since commercial operation began in 1985, fresh water use over the period has actually declined. This is thanks to Imperial's "water management hierarchy" and efficient use of scarce water resources at Cold Lake. Some fresh water is still required, and this is drawn either from Cold Lake or, when monitoring shows the lake level is low, from alternative groundwater sources. As operations continue to expand at Cold Lake, water management programmes will intensify too. Plans including an expansion of the brackish water system, and a treated water transfer line to enable greater use of recycled water across the operation result in no appreciable increase in fresh water use.





The oil industry acknowledges its responsibility and role in effective water management in the communities where it operates. Many oil companies have proactive and successful programmes designed to reduce the impact of their operations and to contribute to building water capacity in local communities.

But the oil industry is not complacent about its response to water issues – only by constantly monitoring the effect of our activities, and continuing to manage water resources in an environmentally and socially sensitive way, can we play our part in helping to ensure healthy water resources are available for all.



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