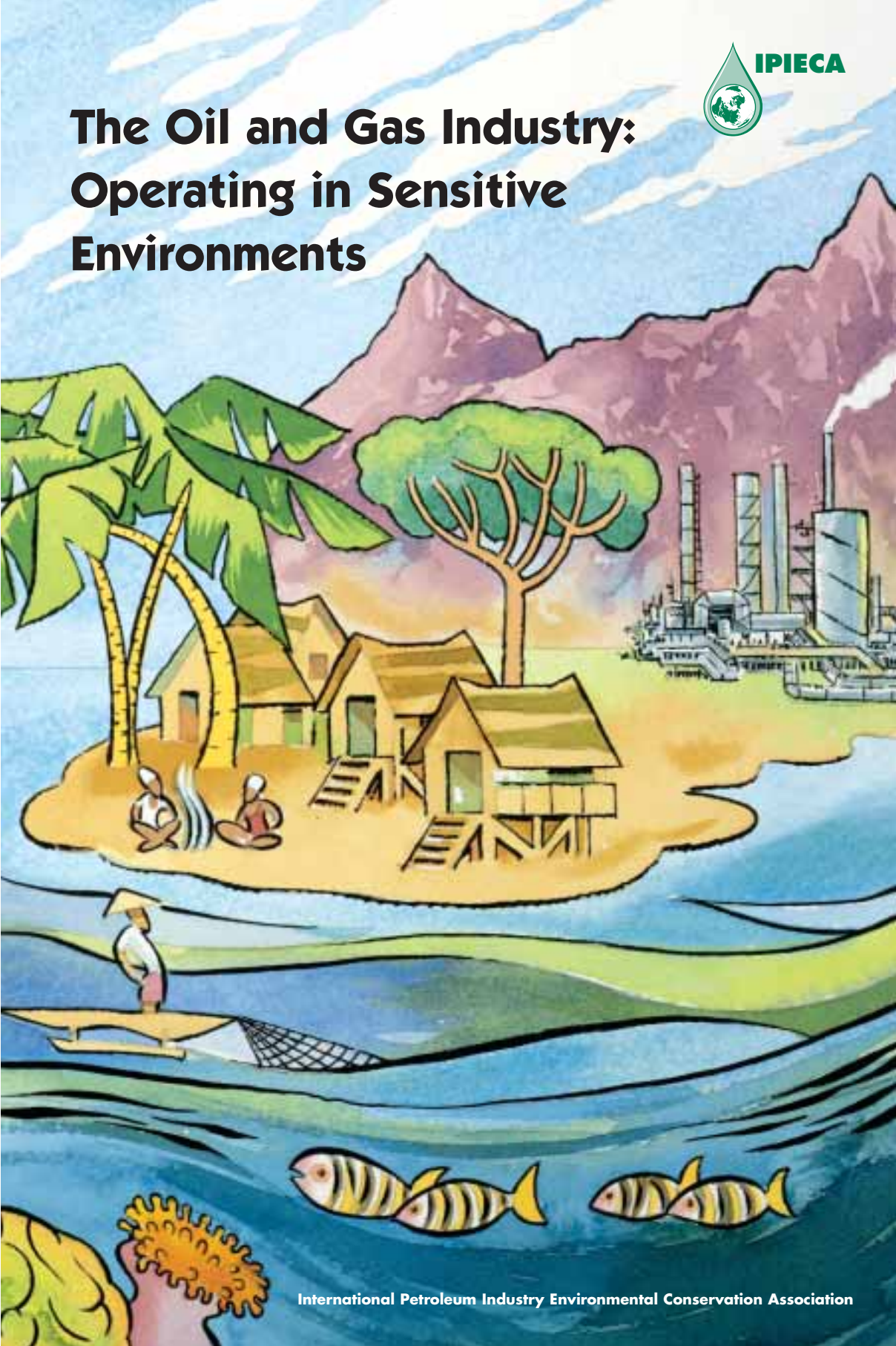
IPIECA

The Oil and Gas Industry: Operating in Sensitive Environments



International Petroleum Industry Environmental Conservation Association

The Oil and Gas Industry: Operating in Sensitive Environments

The oil and gas industry has been operating in some of the world's most sensitive environments for more than 100 years. These range from deserts, mangroves, wetlands, coral reefs, tropical rainforests to frozen tundra, and from rural areas inhabited by indigenous communities to heavily populated urban environments.

Although the industry's record has not been perfect, it has been a pioneer in developing and using new technologies and in implementing management systems to minimize the environmental impact of its operations. It has also expanded its use of assessments and other activities to further address environmental, social and economic impacts and to enhance benefits delivered to local communities.

The industry's continual efforts to improve its environmental and social record have intensified in recent years, reflecting heightened awareness and interest regarding the way that industry manages its interface with the environment, local communities and the public at large.

INTRODUCTION

Developed by the International Petroleum Industry Environmental Conservation Association (IPIECA), this publication has three key objectives. These are to:

1. demonstrate that minimal impact operations are achievable in a diverse range of environmental and social settings;
2. actively encourage exchange of company experiences and best practices; and
3. provide a basis for discussion with groups outside the industry with a view to promoting ongoing improvements in industry performance.

This booklet summarizes a series of short case studies which describe some of the oil and gas industry's experience of operating responsibly in sensitive human and physical environments. (Full versions of the case studies are available on the IPIECA website or from the IPIECA Secretariat—see page vii.) The case studies cover company experiences across the full range of oil and gas industry activities. Cases cover operations near conservation sites of global importance, operations near sites of special value to local people, and activities that address concerns about social and economic impacts of operations on local communities.

A key theme that runs throughout the case studies is the need to balance environmental impacts with economic and social benefits—i.e., benefits to the countries and communities in which the industry operates, as well as benefits to the oil and gas companies that provide the majority of the worlds fuels and petroleum products used daily to improve quality of life. In achieving this balance, different technologies, management systems and operational practices are applied as appropriate to different sets of circumstances.

Key management features, which the oil and gas industry may use to work towards this balance, are outlined in the following paragraphs.

Stakeholder consultation

Community participation in the project development process is an essential practice in oil and gas industry operations. The industry recognizes that community concerns are not always satisfied by conventional risk assessment techniques, and that community dialogue is necessary to build consensus. Consultation with local communities helps industry to understand and respect their social and cultural values, needs and wishes, and to use this local knowledge.

Consultation can provide a forum for communities to debate sometimes competing priorities; for instance, the employment opportunities afforded by a new development may have to be weighed against environmental considerations.

In addition to consulting with local communities and government departments, the industry also seeks input from public interest groups. Oil and gas development projects are making more frequent use of public consultation through surveys, public meetings, community advisory committees and publicly available reports of environmental performance. These initiatives are most successful when begun at an early stage of a project development, conducted in an open and responsive manner, and continued through its life span. In many instances, important partnerships have developed with these groups to meet mutual objectives.

Environmental protection guidelines

The oil and gas industry's achievements in successful environmental management owe a great deal to learning from past experience, the use of best practices and establishing environmental guidelines. The latter have been developed and introduced voluntarily by the industry and oil and gas companies and, in many cases, go beyond compliance with mandatory legal requirements. Examples include the American Petroleum Institute's *Waste Management Practices for Petroleum Marketing Facilities*, and the United Kingdom Offshore Operators Association's *Environmental Guidelines for Exploration Operations in Near Shore and Sensitive Areas*. IPIECA, the International Association of Oil and Gas Producers (OGP) and the International Association of Geophysical Contractors (IAGC) have also produced international industry environmental guidelines. These include IPIECA's 'Biological Impacts of Oil Pollution' report series (on ecosystems such as coral reefs, mangroves, etc.), OGP's *Guidelines for the Development and Application of Health, Safety and Environmental Management Systems*, and IAGC's *Environmental Manual for Worldwide Geophysical Operations*.

The industry also seeks greater objectivity and a broad range of perspectives by encouraging and working with external organizations to develop guidelines. For example, OGP and IUCN (World Conservation Union) collaborated in the production of environmental protection guidelines for oil activities in mangrove and onshore arctic environments.

Impact assessment

Impact assessments are an integral part of project development and implementation. Many oil and gas companies carry out assessments as a routine requirement wherever they operate. Based on the sharing of best practices, the techniques of impact assessment continue to improve. Mechanisms are now available to rank potential impacts to focus resources efficiently on the highest priority issues.

Assessment typically includes such issues as: evaluation before and during development; public participation; early identification of environmental, social, economic and other issues; and risk/benefit analysis. An assessment can help identify alternative development plans as well as prevention, mitigation and control measures. Sharing expertise is a crucial phase of the process and some companies in the oil and gas industry are helping to develop enhanced local expertise to carry out impact assessments.

OGP and IPIECA have developed a set of key questions that should be considered by oil and gas companies in anticipating and managing social impacts associated with their projects.

Prevention, mitigation and control

Where it is judged that the environment or local communities may be affected by industrial activities, it is necessary to address potential impacts through the application of appropriate prevention, mitigation, control and management measures. Different technologies and approaches can be used depending on local circumstances; there is no one 'right technology or practice' that is suitable for all situations. Specific measures can be applied to prevent or limit impacts within the response and remediation capabilities of the environment. For instance, the oil and gas industry is working in partnership with governments to prevent oil spills and maximize emergency preparedness and response.

Mitigation can take the form of redesign or modification of industrial processes, or the rescheduling of operations to address seasonal or cyclic sensitivities. Additionally, in some instances, other mechanisms may be appropriate. For example, where important habitats may be impacted as a result of a development, the developer may purchase additional land with a view to enhancing it. In many cases this can result in a net environmental benefit. Mitigation and management are also often critically important aspects of processes to address potential adverse local social and economic impacts of operations.

Monitoring

Monitoring environmental, social and economic impacts at all stages in a project is key to responsible operations. This may involve surveying the health of sea-bed communities, bird and mammal populations, meteorological statistics, water table fluctuations, as well as economic, health and other changes within local human communities. Biological changes, which may be revealed by such monitoring, are often very gradual and complex. Changes such as these can be limited by careful management of the performance of equipment and processes. Carrying out preventive equipment maintenance programmes, monitoring end-of-pipe emissions levels, and identifying and learning from near-miss incidents, can help prevent undesirable impacts. Setting targets for performance in these areas has become an integral element of overall business management in many companies. In addition, environmental audits and assessments can help ensure that the management systems that underpin the achievement of these targets are working correctly. Similarly, human social and economic systems change over time. It is important to understand baseline economic and social conditions that may be affected by company operations. It is equally important to monitor how such operations, including any mitigation measures identified through impact assessments, do or do not affect baseline conditions over time.

Decommissioning and planning for closure

To minimize, wherever practicable, the impact on natural habitats the oil and gas industry seeks to restore decommissioned sites to previously agreed end uses. In many cases, sites can be restored to their natural state or to enhanced habitats.

Understanding habitat dynamics and restoration technologies has improved significantly in recent years. Not only has this provided tools for the re-creation of habitats, it has also helped in understanding how distinct 'native' habitats function. In some cases, oil and gas industry developments have been able to help host governments and communities redress the effects of an earlier introduction of non-native species and to preserve, restore or improve habitats.

Substantially reducing or ending operations in an area may also have both positive and negative social, environmental and economic impacts on local communities. Planning and action to address those impacts can help communities most effectively mitigate the loss of oil and gas activities from the area.

Contribution to science

By conducting pre-development assessments and long-term monitoring, the oil and gas industry has amassed large quantities of environmental data. In addition, the industry has developed many scientific protocols for the collection and analysis of such data. This type of information has often been made available to a wider audience, including the general public.

As an example, IPIECA has worked in partnership with the UNEP-World Conservation Monitoring Centre for more than seven years and has funded the development of an Interactive Map Service (IMapS). IMapS provides free internet access to biodiversity and environmental data, through an interactive map format (www.unep-wcmc.org). The service is used by the oil and gas industry in environmental planning and management and also in emergency preparedness and response.

Technology cooperation and capacity building

By transferring technologies, management systems and skills, the oil and gas industry is able to leave a lasting beneficial legacy with the countries and communities in which it works. The industry aims to work in mutually beneficial partnerships with governments, local communities, customers and employees. These partnerships contribute to the development of local infrastructures and services by improving communications, transport, health care and education facilities, all necessary in developing local enterprises and, ultimately, a thriving economy.

To encourage such technology cooperation and capacity building, IPIECA, in conjunction with UNEP, produced the publication entitled *The Oil Industry Experience: Technology Cooperation and Capacity Building—Contribution to Agenda 21*, which contains 12 case studies highlighting approaches undertaken by its members worldwide.

CONCLUSION

As energy producers the oil and gas industry has an important long-term role to play in contributing to the needs of society. It recognizes that it must operate safely and responsibly, protecting the natural environment and addressing concerns about its social and economic impacts on local communities. This publication is intended to be a catalyst for the ongoing improvement of oil and gas industry performance by encouraging the industry worldwide to adopt key features of impact assessment and mitigation procedures and, in the longer term, to continually improve and refine them.

The case studies will be available for use, where appropriate, to facilitate discussion between representatives of the oil and gas industry and other industries, governments, regulators, and other non-governmental organizations that may be able to add value to these environmental protection and social practices and technologies.

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CASE STUDIES

The following section contains summaries of company case studies covering operations in a wide variety of sensitive environments. The full versions of the case studies are available in PDF format on the IPIECA website at www.ipieca.org/publications/biodiversity, or on CD-ROM available from the IPIECA Secretariat:

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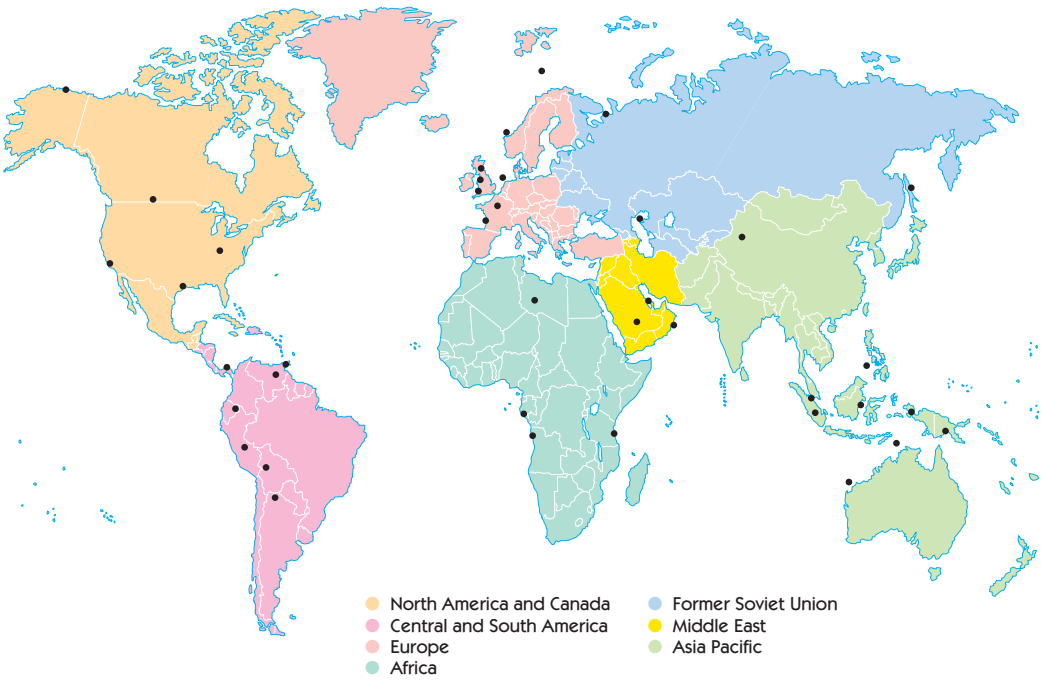
The map below shows the global distribution of member company activities reported in the accompanying case studies. A full index to the case studies appears overleaf.



CASE STUDY LISTING

* NAM: the Nederlandse Aardolie Maatschappij B.V. (NAM) was founded on 19 September 1947 and is registered in the Hague. NAM has two shareholders: Shell Nederland B.V. and Esso Holding Company Inc. Both own 50 per cent of the shares. NAM is engaged in the exploration for, and production of, oil and gas in The Netherlands and the Dutch sector of the Continental Shelf.

AFRICA

ChevronTexaco in offshore Angola

Coexisting with marine mammals in offshore operations

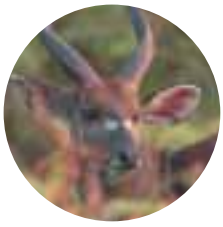
Angola has a coastline of more than 1600 kilometres and a total area of 1,245,700 square kilometres. The main factor influencing the oceanographic conditions of the area is the Benguela Current. Because of this current, the waters off the coast of Angola are some of the richest in marine life in the world. Flowing from south to north, the Benguela Current and the fertile, clean Angolan waters are home to many creatures as diverse as whales and manta rays.

While the marine ecosystem within the ChevronTexaco offshore field known as Block 2 is essentially devoid of flora, the steel columns of the producing platforms act as artificial reefs. Several species of whales and dolphins are known to inhabit or migrate through the vicinity. Little is known on the current size or trend of local southern humpback whale populations, and ChevronTexaco has supported a pilot project, with the University of Pretoria Whale Unit of the Mammal Research Institute, to undertake photo-identification, acoustic recordings and skin biopsies. The results obtained provided an invaluable nucleus for future studies of this important species.

Shell in the Gamba Complex, Gabon

The Gamba Complex Biodiversity Project

Shell is continually exploring and implementing ways to minimize its 'operational footprint' on the environment. As part of these efforts, the Smithsonian Institution's Monitoring and Assessment of Biodiversity (SI/MAB) Program, of the Conservation and Research Center of the National Zoological Park, and Shell are working together to understand and reduce the impacts of energy resource development on biodiversity, and so contribute towards its long-term management and protection. The Gamba Complex in south-west Gabon was selected as the first site to be studied under the partnership agreement. As well as its productive oil reserves the complex is known for its biological diversity and its international conservation value. Gaining scientific information on the biodiversity value of the Gamba Complex is essential to devise better long-term conservation and development strategies. The SI/MAB Program and Shell Gabon convened a workshop in November 2000 that brought together 35 participants representing 19 of the key agencies and organizations with an interest in the Complex. The results of the initial consultations, workshop and follow-up meetings led to the formation of the Gamba Complex Biodiversity Project.



BP in Tanzania

Working to address environmental concerns

As part of its commitment to the BP Conservation Programme, BP Tanzania are working on a variety of conservation projects in East Africa. Working in partnership with African groups such as Wildlife Conservation and the National Environmental Management Council, BP Tanzania is supporting the African black rhino *(Diceros bicornis)* programme in the Mkomazi region of northern Tanzania.

Since 1995, BP Tanzania has also supported the efforts of Frontier-Tanzania working with Shirikisho, a Tanzanian NGO, to raise awareness among local communities of the harmful effects of dynamite fishing and to promote more traditional and sustainable methods of fishing. Other work with Frontier-Tanzania includes marine and intertidal surveys around Pemba to provide a comprehensive analysis of the marine animals and habitats in this region. BP Tanzania has also worked on African Blackwood projects, locally known as the Mpingo, to provide much-needed basic data on the distribution, ecology, and exploitation of the tree (*Dalbergia melanoxylon*).

Total in the Murzuq Basin, Libya

Seismic acquisition in a desert environment

Total has interest in a number of concessions in the Murzuq Basin, located in the south-west of Libya. The desert landscapes in the Murzuq Basin are extremely varied and exceptionally beautiful. Biological diversity is concentrated in wadis, and includes some rare flora and fauna, and a number of rich archaeological sites have been found.

Total has carried out a seismic survey in the area. Potential impact from usual seismic acquisition include damage to archaeological sites, altering the wadi hydrological regime and visual impairment of the local landscape. To minimize these impacts, Total has undertaken a number of measures including: modification of seismic routes; prohibiting removal of any archaeological artefacts, flora and fauna; limiting access to single tracks; implementing waste management plans; and restoration of seismic line paths.

Libyan environmentalists, archaeologists and botanists played an active part in the preliminary studies. Total successfully minimized environmental impacts, and carried out an on-site assessment in 2002 to verify that EIA (environmental impact assessment) measures had been completed effectively.

ASIA/PACIFIC

Amerada Hess in central Sumatra, Indonesia

Restoring native vegetation—promoting biodiversity and environmental stewardship in the Harimau Field, Sumatra

Amerada Hess is one of a number of oil and gas companies operating in the Harimau Field in Central Sumatra. One of the challenges facing industry in the region is the threat of environmental damage that can occur after operations have ceased. Cleared areas become vulnerable to soil erosion and to the knock-on environmental and social consequences that can result.

Amerada Hess recognizes that effective environmental management at the well site, both during production activities and after they are complete, is critical to mitigating potential effects on ecosystems and local communities. In response, Amerada Hess sponsored a team of scientists from the local Environmental Research Centre at the University of Sriwijaya to oversee an extensive re-vegetation programme. The project resulted in the cultivation of more than 7000 plants at 11 locations, both safeguarding the local environment from potential impacts and providing educational and economic benefits to local communities.

Caltex Pacific Indonesia in eastern Sumatra, Indonesia

Management of oil and gas exploration and production in the Zamrud Field

Caltex Pacific Indonesia (CPI), a production sharing contractor of Pertamina on the Island of Sumatra has 141 oil fields covering an area of 35,000 square kilometres. Current company production is 640,000 barrels of oil per day.

The Zamrud Field is one of the oil fields in the Coastal Plain and Pekanbaru (CPP) Block. The Government of Indonesia has designated Zamrud as a conservation area, and CPI has been awarded the ISO 14001 Environmental Management Systems Certificate for its operations in this sensitive area. A production sharing contract between CPI and the Government of Indonesia expired in August 2002.

This case study describes how CPI managed the development of oil and gas production in the Zamrud conservation area. A number of specific measures were employed to protect this sensitive area including a 'green' seismic project, 'zero discharge' drilling, water management, preservation of nature, and regular monitoring and impact assessment. The challenges come not only from internal issues in preserving the environment during oil field operations, but also from the surrounding cultivated areas, which leads to growing pressure on the conservation area.

ChevronTexaco in the Southern Highlands Province, Papua New Guinea

Environmental conservation and sustainable development in Papua New Guinea's rain forests

Protecting people and the environment is integral to the design and operation of ChevronTexaco's Kutubu Petroleum Development Project in Papua New Guinea. The project area encompasses Lake Kutubu, a pristine lake in the Southern Highlands Province, and extends south to the Gulf of Papua. The biologically diverse environment includes more than 700 species of birds, 15,000 species of flowering plants, and more than 300 species of fishes, amphibians and reptiles. Approximately 20,000 of the country's 4 million people use the rain forest as a subsistence base for gardening and hunting, and the Kikori River Basin for transportation and food.

Chevron Niugini has been working in partnership with national and provincial governments, the World Wide Fund for Nature (WWF), local communities and others to conserve the environment, preserve cultural diversity and promote sustainable community development. For example, extensive measures have been implemented to avoid disturbance (burying project pipelines, reinjecting produced water, minimizing road construction, eliminating spills and comprehensively managing wastes etc.), and to improve the quality of life in rural communities.

ChevronTexaco in Barrow Island, Australia

Quarantine management for the Barrow Island oilfield

The ChevronTexaco operation on Barrow Island demonstrates that, with proper management and planning, development and conservation are compatible. On the island there are 14 terrestrial native mammal species, more than 110 bird species, and 54 terrestrial reptile species. In 1908 it was declared a Class A nature reserve for the protection of flora and fauna. The first seismic survey was conducted on Barrow Island in 1963 and the first well drilled in 1964. In 1967 the first tanker was loaded with Barrow Island crude. Since those early years, more than 1000 kilometres of seismic activity has been recorded, more than 880 wells have been drilled, and more than 296 million barrels of oil have been produced. Yet the island's full suite of native species remains intact and the introduction of exotic plants and animals has been prevented. This is not due to luck but a rigorous environmental management programme that has been developed and refined over 35 years.

...ASIA/PACIFIC

ExxonMobil in the Tarim Basin, China

Meeting the challenges of oil exploration in a remote location of historical and environmental significance

In December 1993, ExxonMobil became the first multinational oil company to be awarded the right to explore for, and develop, petroleum resources in China's vast Tarim Basin. Situated in Western China's Xinjiang Uygur Autonomous Region, the Basin is an area approximately equivalent to the size of France. The Taklimakan Desert, second in size only to the Sahara in Africa, is located within the Tarim Basin. Exploring for oil in this remote location presented many challenges.

Special care was necessary to prevent disturbance to the environment in an area of great historical significance located within the exploration area. To protect any relics which might be discovered in the ancient city of Qiemo, ExxonMobil contracted Chinese experts to survey the area and ensure that nothing of historical significance was disturbed during exploration activities.

As a result of the steps taken to protect the historic sites, it became apparent that one of the proposed access routes could, potentially, disturb the ancient city of Qiemo. ExxonMobil acknowledged this and cancelled all plans for this particular route; access was subsequently approved via an alternative route to avoid disturbing this cultural treasure in any way.

Nexen in the Australian Timor Sea

Managing environmental concerns associated with an infill-drilling programme on the Big Bank Shoal in the Australian Timor Sea

Nexen became owner and operator of the Buffalo field and facilities located off Australia during 2001. The development consisted of a wellhead platform located on an environmentally sensitive shoal and an associated FPSO vessel anchored two kilometres away in deep water. When Nexen discovered additional reserves that could be exploited from the existing wellhead platform it also had to meet increasingly strict new environmental regulations to receive approval. Nexen believed that its activities had minimal impact on the ecology of the shoal and set about conducting environmental assessments and audits in order to prove this. The regulators subsequently approved the plan for further extraction and the results of the audits showed that all impacts were well within the limits of the approved environmental plan.

TotalFinaElf in the Mahakam Delta, Indonesia

Environmental management in action: a sensitive mangrove ecosystem remains unharmed by 20 years of oil production

Indonesia has an abundance of mangrove forests. Mangrove forests are of considerable ecological importance, not least because of their use as spawning and feeding grounds for many varieties of fish and shrimps. Mangroves also provide protection for the coastline. In the last century, the area of mangroves forests has fallen from 13 million hectares to approximately 2.6 million hectares. Priorities for environmental conservation vary depending on location, but include the protection of breeding grounds for fisheries, the protection of shorelines from erosion, and the preservation of rare and endangered species.

Realizing the sensitivity of the mangrove area which exists in the Mahakam Delta, TotalFinaElf E&P Indonésie has implemented an Environmental Management System to ensure that its operations remain environmentally sound. Efforts have also been made at a socio-economic level to build relations, work constructively and respect the culture of local communities. Monitoring and evaluation has so far led to the conclusion that, after more than 20 years of operations, there has been no significant adverse impact on the mangrove ecosystem from exploration and production activities. In 1993 TotalFinaElf E&P Indonésie received the Environmentalist Sahwali Award in recognition of its achievements.

Shell in Malampaya, the Philippines

Malampaya Deep Water Gas-to-Power Project

In 1989, huge gas reserves were discovered in the Camago-1 well offshore Palawan in the Philippines. Delivering this gas from its source presented a major technological challenge because the reserves were located in deep water 3000 metres below the seabed and 500 kilometres away from the power stations that would supply gas to Manila. The project would also have to accommodate existing pressures on land resources and the fragility of a rich marine environment, as well as address the energy needs of the country and the expectations of communities along its route.

From the outset, Shell Philippines Exploration B.V. (SPEX) recognized the need for the ecologically sensitive and socially responsible management of field development activities. Perhaps the two most important lessons from this project are advanced planning and strategic partnerships. From the outset, SPEX was committed to contributing towards sustainable development through the integration of economic, social and environmental considerations. Making this work in practice required foresight in decision making and developing appropriate business practices, and gaining a greater understanding of how to implement these principles in practice. The involvement of respected and proven partners to work with SPEX and implement programmes has been, and will continue to be, a critical success factor.

BP in Papua Province, Western New Guinea

Developing a Biodiversity Action Plan

Indonesia's Papua Province (formerly called Irian Jaya) on the western half of the island of New Guinea is the site of BP's proposed Tangguh liquefied natural gas (LNG) facility. Papua Province also is home to around 54 per cent of Indonesia's exceptionally rich biodiversity. This area was selected for one of BP's conservation projects for 2002—it is the focus of part of BP's Biodiversity Action Plan (BAP) for Indonesia.

The Papua Province parts of the BAP aims to contribute to world-class conservation projects in partnership with external organizations such as governments, conservation groups, local communities, educational institutions and private enterprise. The plan currently includes eight elements covering a broad spectrum of programmes and publications. For example, BP is working in partnership with The Nature Conservancy (TNC) and others to develop a Conservation Training and Resource Centre and to develop a locally owned management plan for the old-growth mangrove nature reserve, located 80 kilometres east of the planned LNG facility.

EUROPE

BHP Billiton Petroleum in Liverpool Bay, United Kingdom

A major offshore development is established in an area of high environmental sensitivity

Liverpool Bay was the first significant near-shore area of the United Kingdom to show commercially exploitable oil and gas. The subsequent development by BHP Billiton Petroleum of offshore installations and an onshore gas terminal has taken place close to a highly populated area which has suffered in the past from domestic and industrial pollution. All the elements of a major offshore development, including onshore gas terminal and pipeline, are carried out in the full view of the local community.

Key to the successful protection of the area was the implementation of an Environmental Management System (EMS). The principle elements of the EMS were open communication with the community, authorities and environmental groups; implementation of rigorous environmental standards; restoration and enhancement of local habitats and the development of contingency plans in conjunction with local and national experts. BHP Billiton's success in safeguarding and enhancing this sensitive area have been acknowledged by RAMSAR, an international body which monitors fragile wetland habitats worldwide.

BP in the Forth Estuary, Scotland

A sensitive mudflat habitat continues to thrive with one of Europe's oldest petrochemical complexes at its centre

BP has been operating in Grangemouth for nearly 80 years. Today, all three of its core businesses—exploration, oil and chemicals—operate on the 700-hectare site. Located on the Forth Estuary, Grangemouth is strategically placed to take crude oil and gas products from North Sea operations. BP Grangemouth encompasses the Kinneil oil stabilization and gas separation plant which handles crude oil piped 384 kilometres through the Forties Pipeline System from the North Sea; a refinery; and a petrochemicals complex.

Although Grangemouth is a long established industrial zone it is also a particularly sensitive location which supports a wide diversity of fragile ecosystems. The area encompasses four Sites of Special Scientific Interest. Three of these embrace mudflat habitats which are protected by Special Protection Area status under the EC Birds Directive. As part of its operations, BP has carried out significant plant upgrades in conjunction with comprehensive environmental studies and advanced monitoring projects designed specifically to ensure continued protection of this important area. All of the data collected as part of the routine monitoring is made available in the public domain.

ChevronTexaco in Pembrokeshire, United Kingdom

Biodiversity Management Programme at Pembroke Plant

The ChevronTexaco-owned Pembroke refinery is a modern, large industrial site on the west coast of the United Kingdom in Pembrokeshire, West Wales. The plant is situated on the Milford Haven Waterway, and lies next to the only coastal national park in Britain. The Milford Haven Waterway and the surrounding islands are part of the Pembrokeshire Marine candidate Special Area of Conservation (cSAC), a European designation for identifying and preserving important habitats. The refinery has been in operation since 1964 and has had several upgrades and expansions. The operational area covers some 550 acres, with an additional 1200 acres given over to farmland, scrub, woodland and marsh.

As a mature industrial site, it is a major source of local employment, and is an integral part of the local community. In order to ensure that its operations are not adversely affecting the local area ChevronTexaco has implemented a Biodiversity Action Plan (BAP) at the plant. The aim of the BAP is to identify and monitor important features and then manage the environment to ensure that the features remain stable or increase in numbers/area. As part of its holistic approach, many of the initiatives that the BAP recommends attempt to include involvement and contributions from the local community.

Esso in Arcachon Bay, France

Onshore oil development in the Arcachon Bay region

A prudent and progressive approach with frequent stakeholder communications is essential in planning an industrial or resource development project in sensitive environmental areas. This approach is as critical for success as technical and operating decisions. Even with 40 years of problem-free experience as an oil and gas producer in south-west France, it has taken Esso REP, ExxonMobil's French Upstream Production Unit, and its partner (at that time Elf Aquitaine Production France), four years to obtain the Lège exploration licence covering the Arcachon Bay region.

The Arcachon Bay, located in the heart of France's south-west tourist region, is a protected natural environment for oyster farming, fishing and forestry. The Bay is surrounded by nationally protected lands including forests, a tidal sand bank and the largest dunes in Europe. Since obtaining its licence Esso REP has developed three fields in the Arcachon Bay all of which incorporate environmental standards into their project design. In addition to this, reliable prevention equipment, periodic risk reassessment, continuous employee awareness and communication with local stakeholders are key to maintaining environmental quality and ensuring the success of the Arcachon Bay development.

NAM (Shell/ExxonMobil—see page viii) in the Wadden Sea, off The Netherlands

An environmental impact assessment is key to minimizing the effects of gas exploration in a protected area

The Wadden Sea is a shallow coastal sea stretching from Den Helder in the north-west of the Netherlands through the German Bight to Esbjerg in Denmark. It is an area of biological importance and serves many ecological, economic and societal functions. Since the 1960s NAM has held two concessions for the production of oil and gas in the eastern part of the Wadden Sea and the adjacent North Sea coastal zone.

In 1993 seismic activities indicated the probable presence of important new gas reservoirs. This initiated a discussion between the Dutch government and the mining companies concerned on the conditions for exploration drilling in the Wadden Sea. In a jointly-produced report known as the 'Go-ahead Plan' (i.e. the Environmental Impact Assessment), the conditions for drilling, such as the phasing of drillings in time and space, and monitoring of potential environmental effects, were established. After a consultation process with all authorities involved this plan was finally agreed in 1995.

TotalFinaElf in Versailles, France

An exploration drilling programme is carried out in a horticultural zone of significant botanical interest

The Chèvreloup Arboretum lies in a west suburb of Paris and forms part of France's Museum of Natural History. Some of the trees are over 250 years old and more than 2000 species and varieties now grow in this 200-hectare site, of which 50 hectares are open to visitors. The Arboretum forms the centre point of study among botanists, foresters and collectors. Seismic studies carried out in 1993 revealed the possible existence of hydrocarbons beneath the Palace of Versailles. Drilling in such a site, however, presented major technical and environmental challenges.

To meet these challenges TotalFinaElf implemented new lightweight technologies especially adapted for small reservoirs. By using this latest technology, TotalFinaElf was able to significantly reduce the impact of their operations in terms of footprint size, energy consumption, noise and waste. When operations ceased TotalFinaElf worked closely with the senior staff at the arboretum and the Director of the National Museum of Natural History to restore the area. No visible trace of the drilling now remains, and the site has since reverted to its original role, namely the cultivation of rare, protected species.

Statoil in the Wadden Sea, Germany

The Europipe project—crossing the Wadden Sea

In 1994 Statoil constructed the Europipe natural gas pipeline from Norway to Germany, which had to cross through the Lower Saxony Wadden Sea National Park. The planning of the pipeline, started in 1985. Most of the Lower Saxony coastline was protected as a National Park the following year. A landfall solution, including a 2.6-kilometre long tunnel under the tidal flats, was chosen for crossing the National Park. An ecological monitoring programme documented a rapid recovery, and most of the impacts in the landfall area were found to be within natural variations.

Nature conservation legislation in Lower Saxony required Statoil to implement ecological compensation measures to compensate for the potential negative impacts. One such measure was the construction of a 17-hectare biotope with ponds and sand dunes close to Emden. This area has developed into a habitat which is home to a number of rare and threatened species of plants, insects, amphibians and birds. Establishment of the habitat was positively received by the local nature conservation authorities and environmental organizations, and has now received protection status.

...EUROPE

Statoil on the Norwegian west coast

Conserving cold water coral reef biodiversity

The petroleum industry has, over recent decades, contributed significantly to knowledge on the distribution of reef-building coldwater corals (*Lophelia pertusa*) in Norway. Since Statoil found the first coral reef at 70°N in 1982, cooperation with the Norwegian Institute of Marine Research (IMR) has identified a number of coral reefs off the Norwegian coast. Sonar and echo sounder technologies, combined with new technologies for visualization, and video recording cameras placed on ROVs (remotely operated vehicles), are useful tools for mapping coral reefs and their associated macrofauna. Studies revealed that significant damage to several reefs has been caused by trawling activities. This led to the protection of one the largest coral reefs in Norway (the Sula reef) against trawling in 1998. An inshore coral reef in the Trondheim fjord also received protection when designated the first Norwegian marine nature reserve in 2000. Statoil surveyed the area in cooperation with the IMR to identify a possible pipeline corridor. Such surveys have lead to the modification of pipeline routes, making a significant contribution to the conservation of coral reefs in the area.

NorskAgip in the Norwegian Sector of the Barents Sea

Supporting environmental studies of an important ecological area

The Barents Sea is considered an ecologically important area, in which there are many different stakeholders (oil and gas, fisheries, tourism) with different interests. To date, oil and gas activities consist of about 50 exploration drillings and the current development of the Snøhvit gas field. The Barents Sea is home to a number of important marine species including sea birds, sea mammals and fish. In addition, the ecological system adjacent to the ice perimeter is of special importance to the Arctic/Antarctic environment. When NorskAgip started drilling at the first exploration well on Goliat, the company recognized the importance of the environment in this area and has been financing/co-financing a number of environmental studies in order to increase the scientific knowledge about the Barents Sea.

FORMER SOVIET UNION

Conoco in the Russian Arctic

Preserving delicate Arctic ecology by minimizing the development footprint and environmental impact

The unique ecology of the Arctic regions requires creative solutions for the development of oil and natural gas fields. In a tundra environment, minimizing disturbance to vegetation and soil is critical to maintaining the integrity of the entire ecosystem. Minimizing the development footprint also is vital for the local indigenous people who depend on renewable resources for their established lifestyle patterns. These factors have guided many of the decisions and practices adopted by Conoco's Polar Lights joint venture with OAO Arkhangelskgeoldobycha and Rosneft in Russia.

The Polar Lights Company introduced the concept of 'padless' development of oil fields to the Timan-Pechora area of north-west Russia. This concept reduces the surface footprint by 95 per cent as compared to the traditional arctic field development and establishes a step-change improvement both environmentally and economically. The project's success has paved the way for padless development of the Ardalin satellite fields, reinforcing Conoco's standing as the leading Western partner in environmentally sound development of the Russian Arctic.

Shell in Sakhalin Island, Russian Far East

Sakhalin II—a joint venture bringing social, economic and environmental benefits to a remote location

Sakhalin is a remote island in the Russian Far East lying immediately to the north of Japan. With the downturn of the Russian Federation's economy in the 1990s, after the collapse of the Soviet Union, Sakhalin Island's infrastructure, power, water and health-care systems deteriorated because of a lack of investment. Against this backdrop, Sakhalin Energy is in the early stages of developing what is possibly the largest integrated oil and gas project in the world to date. The project will play a major role in the economic development of this remote area of the Russian Far East, but to fulfil its promise it must address some special environmental and social challenges. Comprehensive environmental, social and health impact assessments are the focus of an intensive programme of public consultation involving not only the communities of Sakhalin Island but also a range of stakeholders from Russia and beyond.

...FORMER SOVIET UNION

Agip KCO in the North Caspian Sea

Meeting the challenges of operating in a unique land-locked marine environment

Agip KCO, an Eni Company operating on behalf of seven international partners, is exploring and developing offshore concessions in the North Caspian Sea. The project focuses mainly on the Kashagan Field and originally started in 1994. A production sharing agreement (PSA) was signed in 1997.

Operations are taking place in a highly challenging and unique environment. The Caspian Sea is the largest landlocked water body on earth and the northern part is extremely shallow. Temperatures vary from +40°C in summer to -37°C in winter, with ice being a major constraint. Strong winds can cause flooding or drying out of wide stretches of the coastal area, severely limiting access.

This area of the Caspian is a Kazakhstan State Nature Reserve and supports a wide diversity of wetland flora and fauna. This is the most biologically productive area in the Caspian Sea and an internationally important habitat for large numbers of bird and fish species, including some which are rare and endangered. Caspian seals—the only marine mammals in the area and the smallest seals in the world—come to the North Caspian Sea to raise their pups on ice in winter.

Agip KCO established a complex monitoring programme for its operations. Data collected over nearly ten years provides a significant contribution to understanding the North Caspian environment.

MIDDLE EAST

Saudi Aramco in central Saudi Arabia

Managing operations in a sensitive environment

The Hawtah Trend Oil Fields are located in central Saudi Arabia along the al-Kharj-Layla Highway about 180 kilometres south of the Kingdom's capital city, Riyadh. The development represents the Kingdom's first important production of Arabian Super Light, a premium grade of crude oil superior to most crude oils found in the world. Its high API gravity combined with extremely low levels of impurities (sulphur and metals) make it highly desirable because of its high yield of transportation fuels and low content of pollutants.

Despite the location's harsh climate, the area does contain a wide variety of plant and animal life and is close to the Ibex Reserve, an area designed to provide protection for the ibex, considered an endangered species. Through a carefully managed programme of environmental risk assessment, which includes communication with appropriate government authorities and compliance with applicable standards and guidelines, Saudi Aramco has been able to minimize the impact of negative pressures on the environment while at the same time making a significant contribution to the Kingdom's economic and social well-being.

Saudi Aramco in the Arabian Gulf, off Saudi Arabia

Restoring mangroves along the coastline

Saudi Aramco has been operating along the Arabian Gulf Coast for more than sixty years. In addition to the enormous potential of its onshore oilfields, it is also the site of the largest offshore oilfield in the world. Saudi Aramco's Ras Tanura Refinery lies adjacent to Tarut Bay, an historically important fisheries nursery ground for hundreds, perhaps thousands of years. Tarut Island and the adjacent oasis of Qatif were important agricultural communities well before oil was discovered in the Eastern Province. They continue to provide the local markets with fresh fish and produce throughout the year.

Today, the cities of Dammam, Qatif, Safwa, Saihat, Al-Khobar and their surrounding communities support a multi-national population of close to one million people, and industrial and commercial development continues to expand. In 1970 Saudi Aramco first identified the need to protect the region's mangroves that are widely considered to be one of the most productive marine ecosystems in the world. Working with the National Commission for Wildlife, Conservation and Development, Saudi Aramco have supported a project to transplant mangroves seedlings along the coastline to assist in the restoration of this important species.

Petroleum Development Oman in the Omani desert

Working to protect the Arabian Oryx Sanctuary—a UNESCO World Heritage Site

The Arabian Oryx Sanctuary (AOS) was established by Royal Decree in 1996 and declared a UNESCO World Heritage Site later the same year. The Sanctuary, part of which overlaps with one of Petroleum Development Oman LLC's (PDO's) areas of operation, is located in the central plateau of the Omani desert, some 500 kilometres south of the capital Muscat. It is home to a wide variety of wildlife species including the Arabian Oryx (*Oryx leuoryx*), which was re-introduced to the wild in 1982. The area also contains important archaeological sites, geological formations and areas of scenic beauty. As part of PDO's commitment to biodiversity and sustainable development the corporation has worked closely with the AOS to ensure the conservation of the area. Three distinctive outcomes have been agreed: cessation of activities in the core sanctuary area; establishment of guidelines on how to operate in controlled zones; and partnership in environmental education with the AOS management to enhance environmental awareness.

NORTH AMERICA AND CANADA

BP's deep-sea biodiversity programme

Exploring true frontiers

Exploration and production activities in the deeper waters off the shelf edge and down the continental slope are taking BP into true 'frontier' locations. Compared with the situation in more familiar, shallower water depths, little is known about biodiversity and physical and ecological controlling processes in these deep water environments. There is an urgent need to improve the scientific knowledge base in order to provide confidence in the ability to predict and measure impact. Information is gathered routinely by BP operating units, for example through their environmental baseline and monitoring studies. In addition, a number of more broadly based, strategic initiatives have been undertaken within the BP deep-sea biodiversity programme.

This programme involves cooperation between a number of international marine science centres and BP. It recognizes that industry has a role to play in support of deep-sea science and it addresses key research priorities. It is also based on the premise that, potentially, a great deal of 'added value' is waiting to be released at the interfaces between industry and deep-sea science, and between the earth and life sciences.

ChevronTexaco in San Joaquin Valley, California

Participating in a major habitat conservation plan to protect the natural habitat and endangered species

In the valley floor of Kern County, California, a major habitat conservation plan has been under way for 10 years to safeguard the remaining areas of natural habitat and a number of endangered plant and animal species. ChevronTexaco represents the Western States Petroleum Association on the steering committee for the conservation plan, but is now also operating its own conservation plan to protect approximately 13,500 acres of company land in the Lokern area of Kern County. A system of 'land permits' and 'habitat credits' will allow development to take place on a designated 10 per cent of the protected land whilst ensuring that any resultant impacts on the local habitat are offset for the benefit of the resident listed species.

The habitat conservation plan addresses the combined need for conservation and recovery of imperiled biological communities while allowing petroleum operations, water storage and conveyance, real estate, and other land uses to continue. The conservation elements of the plan are central to meeting long-term recovery objectives for several species described in the US Fish and Wildlife Service Endangered Species Recovery Plan for the Southern San Joaquin Valley.

Nexen in Alberta/Saskatchewan, Canada

Protecting species and habitats in sensitive native prairie environments

The mixed grasslands ecoregion of southern Alberta and Saskatchewan contains many species designated rare, threatened or endangered. Nexen operates two natural gas fields in the region and has developed and implemented programmes designed to minimize adverse environmental effects associated with its activities. Integration of environmental values into development activities began during the planning stage, when all proposed activities which might impact on the land were carefully reviewed to identify any known or suspected environmental sensitivities.

By addressing environmental considerations at an early stage potential issues were minimized or avoided completely. In addition to minimizing negative impacts associated with new development projects, Nexen has undertaken other activities to enhance local conditions. To improve the company's ability to successfully revegetate and restore these areas, Nexen actively supports native prairie restoration research in grassland ecosystems. Of note is Nexen's major contribution to a flagship project managed by the Nature Conservancy of Canada, which involves restoring previously cultivated land to its original condition.

ConocoPhillips on Alaska's North Slope

Alpine—doing it right

The Alpine field is located on Alaska's North Slope more than 250 miles above the Arctic Circle. Alpine is the largest US onshore oil discovery in more than a decade and lies in the Colville River Delta, an area of sensitive fish and wildlife habitat. The field is also located just eight miles from the Native village of Nuiqsut, home to nearly 500 residents, most of whom utilize the Colville River Delta for its subsistence resources. The environmental and cultural treasures of the area demand that Alpine's development has minimal impact on the land and the lifestyle of Nuiqsut's residents.

Alpine resides on both state-owned and Native-owned land. The oil is the first produced from Native-owned land on Alaska's North Slope. Alpine's leaseholders are ConocoPhillips Alaska (the operator) with a 78 per cent stake and Anadarko Petroleum Corporation.

The project incorporates lessons learned during more than 30 years of oil development on the North Slope and uses state-of-the-art technology. The field has been developed exclusively with horizontal well technology and employs enhanced oil recovery (EOR).

Along with its many engineering and technical achievements, Alpine has been a model for responsible resource development. Innovations in engineering, waste management and fire protection make Alpine a near zero-discharge facility with minimal environmental impact.

...NORTH AMERICA AND CANADA

ChevronTexaco in Cincinnati, USA

Reusing a former refinery site—integrating remediation with habitat restoration, recreation and economic development

Along the banks of the Great Miami River in south-west Ohio, ChevronTexaco and the local community have joined together to prepare a conceptual redevelopment plan for a former refinery. With the desire to restore the delicate balance of a unique riparian habitat and provide for the environmental and economic well-being of the community, ChevronTexaco, with the assistance of a Community Advisory Panel, has taken on the challenge.

A constructed treatment wetland (CTW) has been developed which not only meets treatment objectives but has provided environmental benefits including the creation of wetland and prairie grassland habitats that are scarce in the region. ChevronTexaco's future plans include the creation of a public park on the wetlands and restoration areas within the Great Miami riparian zone. The project has received a series of official recognitions including its acceptance by The Wildlife Habitat Council into its Registry of Certified and Internationally Accredited Wildlife Habitat Program for its dedication to restoration and management of wildlife habitat.

CENTRAL AND SOUTH AMERICA

PDVSA Bitor in the Orinoco Belt, Venezuela

Environmental aspects associated with ORIMULSION® operations in Venezuela

More than 1.2 trillion barrels of bitumen exist in the Orinoco Belt, an amount greater than 50 per cent of the world's estimated oil reserves. Utilization of this resource has been difficult because natural bitumen has a viscosity well above 10,000 cSt at ambient temperature. Since the early 1980s Bitor, an affiliate of Petroleos de Venezuela S.A. (PDVSA), has been working on means to enable commercialization of these vast reserves whilst ensuring minimal impact on the local environment. Production is now under way, and the end product of Bitor's research and development programme is called ORIMULSION®.

Operations are carefully controlled at all stages to ensure minimum environmental impact and the smallest possible footprint. In particular, the use of one of the oil industry's latest technologies—directional and horizontal drilling—significantly reduces land-take. In the near future, multilateral well technology will be used to further reduce the environmental impacts associated with bitumen production. Careful attention is also paid to the prevention of spills and the preparation of comprehensive contingency plans.

ChevronTexaco in Payardi Island, adjacent to the Panama Canal

An integrated coastal zone initiative on the Caribbean entrance of the Panama Canal

The ChevronTexaco Refinería de Panamá, S.A. (RPSA) is located on Payardi Island adjacent to the Panama Canal. Whilst the area is of international commercial importance, it forms part of an extremely sensitive coastal ecosystem made up of mangroves and coral reefs. This Integrated Coastal Zone Management Initiative involves cooperation between RPSA, European coastal research institutions, the Smithsonian Tropical Research Institution, local governments, NGOs and civil groups from the city of Colon. The aim is to protect natural resources and preserve the traditional lifestyles and economy of local communities.

Comprehensive monitoring of all aspects of the marine environment is a key part of the management initiative. In addition, individual projects (including the creation of a seaweed farm), education and data sharing are helping to ensure that this integrated project covers socio-economic as well as environmental concerns. The aim of the Initiative is to help the country to further its capacity to manage the international waterway in a sustainable manner.

Conoco in the Gulf of Paria, Venezuela

Adapting the concept of sustainability

In the Gulf of Paria, Conoco recognized at an early stage that the drilling of offshore exploration and appraisal wells to the north of the Orinoco Delta region of Venezuela would require careful management of locality issues, with a strong commitment to environmental protection and effective community relationships. The team adopted a strategy that emphasized planning, commitment of appropriate resources and communication toward satisfaction of diverse stakeholder needs. To protect the environmentally sensitive area during the appraisal programme, the team determined several methods of ensuring minimal impact on the environment.

For the community, who were engaged at all stages of the operation, the benefits of the appraisal project were both economic and social. The project provided direct employment for 134 Venezuelan nationals, 93 per cent of whom were hired locally. Despite numerous challenges, the operations were conducted in a way that protected the environment, enhanced Conoco Venezuela's reputation with important community leaders and provided economic and social benefits. The strategy will provide a strong foundation for sustainable growth as Conoco and partners Agip Venezuela and OPIC progress future work plans.

...CENTRAL AND SOUTH AMERICA

TotalFinaElf in the Andean rain forests, Bolivia

Minimizing the effects of exploratory drilling in a virgin rain forest ecosystem

In the north-eastern Andean foothills of Bolivia, a dense primary rainforest constitutes an area of high biological diversity within the boundaries of the Madidi National park. Any drilling operation taking place in such an environmentally sensitive area must be designed and executed to minimize the impacts on the environment, and to ensure the full restoration of the drilling site at the end of the operations. TOTAL Exploration Production Bolivie carried out exploratory drilling operations at the Yariapo-X-I well in this sensitive area from October 1995 to February 1996.

TotalFinaElf's innovative approach to these operations was key to minimizing the environmental impact on Madidi's forested ecosystem. This approach included using helicopters as the sole means of transport to avoid colonizing the area, minimizing the size of the drilling site and using state of the art technology to manage waste products. Social concerns were also addressed by ensuring good communications with local communities from the outset, using local labour and services where possible and providing assistance with healthcare and schooling. In order to achieve the project objectives several management tools were established including impact assessments, inspection and monitoring, and the development of contingency plans.

Repsol YPF in Ecuador

Oil production in protected areas of Ecuador

Yasuni National Park (YNP) and the Waorani Ethnic Reserve (WER) are protected by the Ecuadorian Government, and Yasuni has been designated a UNESCO Biosphere Reserve. These tropical rainforests are of great ecological and cultural importance, with uncontacted indigenous communities living in the region until the 1950s. Repsol YPF has been operating with a concession in Block 16 that occupies 12 per cent of the YNP and 22 per cent of the WER.

Given this highly sensitive environment, Repsol YPF has developed strict management practices to reduce its footprint and protect the local environment. The company has obtained ISO 14001 and 9002 certifications, established Environmental Management and Total Quality Systems, is introducing an Integrated Management System, and uses the latest technology to eliminate contamination risks. Repsol YPF works with the Waorani groups, and has established participative programmes to improve their quality of life whilst respecting their ancestral culture.

Shell in Camisea, Peru

Raising standards and learning new lessons in a sensitive rainforest environment

The Camisea project refers to an appraisal and exploration campaign carried out from 1996–99 in the Lower Urubamba region of upper Amazonia, some 500 km due east of Lima, Peru. Two world class fields containing natural gas and condensates, discovered in the 1980s, were studied under a two-year contract with the Peruvian authorities. Despite their best efforts, Shell, Mobil and the Peruvian government were unable to find solutions to the issues related to the introduction of Camisea gas into the Peruvian market within the time-frame permitted under the contract, and the licence was returned to PeruPetro.

The region is home to a number of indigenous communities based on six different ethnia and represents a highly sensitive ecosystem. The predominant tribe is the Machiguenga who have a history extending back some 5000 years. The licensed exploration block borders Manu Park on the east and the Apurimac Reserve on the west. Most of the communities have land title.

Pan American Energy in Argentina

Excellence in environmental performance

During 2001 Pan American Energy, a regional company engaged in hydrocarbon exploration and production in South America's Southern Cone, undertook a 3-D seismic study at its Acambuco Management Unit in the province of Salta, Argentina.

The project covered the so-called 'Yungas Phytogeographic Province' and a portion of the 'Acambuco Provincial Flora and Fauna Reserve' which is protected by special laws. Pan American Energy, in line with its search for excellence in terms of environmental performance, complied with, and exceeded, regulatory requirements.

The company's performance was closely watched by such government agencies as SEMADES (the Environment and Sustainable Development Secretariat of the Province of Salta) and the Federal Energy Secretariat, non-governmental organizations and society as a whole. Pan American Energy proved to be capable of excellence in the performance of this project, on the strength of its deep commitment to environmental care.

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The International Petroleum Industry Environmental Conservation Association (IPIECA) is comprised of oil and gas companies and associations from around the world. Founded in 1974 following the establishment of the United Nations Environment Programme (UNEP), IPIECA provides the oil and gas industry's principal channel of communication with the United Nations. IPIECA is the single global association representing the industry on key issues including: oil spill preparedness and response; global climate change; health; fuel quality; biodiversity; and social responsibility.

Through a Strategic Issues Assessment Forum, IPIECA also helps its members identify new global issues and evaluates their potential impact on the oil and gas industry. IPIECA's programme takes full account of international developments in these global issues, serving as a forum for discussion and cooperation involving industry and international organizations.

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