Goal 3: To provide Canadians with strategies that reduce environmental impacts in the natural resources sector

OBJECTIVES

The environment is continually fluctuating – sometimes as a result of natural processes, sometimes due to human activity. We know the environment can adjust to human and natural stresses, provided they remain within the resource's ability to adapt and renew itself; however, current scientific evidence suggests that this is not happening. Suspected links between climate change and energy use underscore the need to develop natural resources in ways that respect and protect the integrity of natural ecosystems. For a country as energy-dependent as Canada, this is a significant challenge.

NRCan has a central role in designing Canada's response options for climate change, which are integral to both the federal government's strategy and to the transformation of Canada's energy economy. The Minister of Natural Resources has been assigned the domestic leadership role in implementing Canada's response to its Kyoto climate change commitments. Efforts to promote science and technology and environmentally friendly stewardship practices are a core function of NRCan.

The next few years are critical to respond to the Kyoto challenge – indeed, addressing climate change is one of the greatest environmental and economic challenges ever undertaken by Canada.

3.1 Limit and adapt to climate change

NRCan has been called upon to develop and deliver much of the government's domestic response to Canada's climate change commitments made in Kyoto. Achieving the targeted emissions reduction will require considerable commitment on the part of consumers, industry as energy producers and users, and by federal, provincial, territorial and municipal governments. To address this challenge, NRCan has identified key strategic initiatives that will reduce greenhouse gas emissions in key sectors, and provide the science and technology that supports the development of solutions to the Kyoto challenge. A longer term view – beyond the three year period of the strategy – is essential to address this significant challenge, and as such, the first action under this objective, proposes targets that address a five-year plan of action.

Action: Reduce GHG emissions

Issue	Approach	Target
A longer-term, national implementation strategy addressing the climate change challenge is required to put Canada on a path to achieving its Kyoto Protocol greenhouse gas emissions reduction target. The *Government of Canada Action Plan 2000* on Climate Change is the federal government's contribution to Canada's *First National Climate Change Business Plan*. Action Plan 2000 targets key sectors. NRCan is the lead department or co-lead on a significant number of the emissions reductions measures included in Action Plan 2000. The expansion and promotion of new and existing technologies is key to reducing greenhouse gas emissions now and in the future. Technological innovation is an integral component of Action Plan 2000. Action Plan 2000 will expand climate monitoring and enhance our understanding of how climate change will affect Canada. It will also help various sectors develop adaptation strategies to deal with a changing climate.	*Action Plan 2000* will invest $500 million over five years on specific actions to reduce greenhouse gas emissions. It also promotes partnerships and cost-sharing with the provinces and territories. Action Plan 2000 will: Shift consumer behaviour while working to ensure that emerging technologies, cost-effective transportation and cleaner fuels will play an important role in reducing emissions over the longer term. Enhance opportunities for capture and storage of CO_2. Expand the use of low or non-emitting energy sources by four times current levels. Encourage the implementation of energy efficiency and GHG reduction measures by: expanding the Canadian Industry Program for Energy Conservation; bench marking industrial emissions reduction performance; improving awareness of alternative technologies and encouraging appropriate capital investment; generating improvements in energy efficiency of both new and existing buildings, appliances and equipment; developing and promoting best practices that increase greenhouse gas reductions or sink potential; supporting Canadian exporters of "climate friendly" technologies; undertaking technology transfer and sustainable development issues in developing countries.	By 2001, complete discussions with provincial and territorial governments on areas of mutual interest, cost-sharing and joint action. By 2003, fully implement Action Plan 2000, to take Canada one third of the way to achieving its target established in the Kyoto Protocol.

Anticipated outcome

Through Action Plan 2000, deliver an estimated reduction of greenhouse gas emissions of approximately 65 megatonnes per year in the 2008-2012 commitment period.

Direct benefits include the environmental benefit of cleaner air and the economic benefits of investment, cost savings from energy efficiency and expansion of renewable energy technologies.

Indirect health benefits to Canadians from cleaner air and water.

The Canadian economy will be more innovative and competitive.

Issue	Approach	Target	Anticipated outcome
Seventeen percent of secondary energy consumption in Canada comes from heating, cooling, lighting and operating Canadian dwellings. Significant energy improvements can be made during the construction of new houses or the renovation of existing buildings. Commercial buildings also account for approximately 12 percent of secondary energy use in Canada.	NRCan will reduce GHG emissions by increasing end-use energy efficiency through program development and delivery.	By 2002, increase follow-up rate for house energy use evaluations by 20 per cent and increase energy efficiency in those homes by 20 per cent. By 2003, Expand Energy Innovators Plus program to have 50 more pilot projects to demonstrate energy savings from retrofits. By 2003, develop guidelines, design tools and standards to allow residential and commercial Heating, Ventilating and Air Conditioning to use advanced generation and low energy systems.	*Reduced GHG emissions from residential and commercial sources.* *Increased awareness among Canadians of residential and commercial energy use.*

Issue	Approach	Target	Anticipated outcome
The transportation sector is responsible for 35% of Canada's GHG emissions. Reducing these emissions in support of Canada's Kyoto target will be difficult, as demand for end-use energy in this sector is anticipated to grow. Canada has an opportunity to demonstrate leadership and serve as a model of sustainable development by continuing to develop and share innovative technology.	NRCan will develop technologies and strengthen the knowledge base for the production of bio-energy, develop new fuel cells, electric and hybrid vehicle technologies, prototype power-sources, control systems, auxiliaries and drive-line technologies.	By 2001, achieve 40% improvement in efficiency and emissions through better hybrid vehicle controls. By 2003, 50% weight and 25-35% cost reductions in small-scale fuel cell systems for portable and other applications, and 10-15% weight reduction in vehicular fuel cell systems.	*Greater reliance on electric and hybrid vehicles to decrease energy consumption and emissions.*
	NRCan will develop lightweight, high performance materials and manufacturing processes for fuel efficient vehicles.	By 2002, establish alloying and processing conditions for production of high strength steel for automotive applications. By 2003, develop gas sensors and actuators for enhancing energy efficiency and reduced emissions. By 2003, develop aluminum casting technology for the automotive industry.	*Increased use of specialized materials and new processes by producers of parts and components for the transportation sector, reducing energy consumption and emissions.*
	NRCan will develop lower cost water hydrolysis technologies for hydrogen production at centralized-fueling and residential scales, and new hydrogen storage technologies.	By 2001, develop computer simulation of accidental hydrogen release By 2002, develop prototype of 1 kW small integrated power system. By 2002, complete field testing of residential-scale fuel appliance.	
	NRCan will work with the provinces to educate drivers about fuel efficiency. Partners include other government departments, industry associations, private sector companies and academia.	By 2002, develop new driver examiners' curriculum to include fuel efficiency awareness, in partnership with provinces. By 2002, incorporate fuel efficiency training modules into driver education programs for new driver educaters and truck drivers to reach 60% of new driver educaters and 45% of all truck drivers.	*Drivers have an increased awareness of fuel efficiency and GHG emissions.*

Issue	Approach	Target
The production of one tonne of cement, the major ingredient in concrete, releases about one tonne of carbon dioxide making a significant contribution to GHG emissions. These emissions can be reduced globally through the use of supplementary cementing materials to replace Portland cement in concrete. Canada has an opportunity to serve as a model of sustainable development by continuing to lead and share knowledge about new cementing materials which maintain or even improve the quality of the concrete.	NRCan will research, develop and promote the use of energy-efficient and environmentally friendly materials and technologies. Partners include CIDA, Technology Early Action Measures (TEAM), industry associations, the consulting industry, municipalities, and academia.	By 2003, resolve technical issues and develop engineering data for new/existing materials and technology associated with the use of supplementary cementing materials to replace Portland cement in concrete. By 2003, complete demonstration projects in India on the use of high volume fly ash concrete for housing and highway applications.

Anticipated outcome

Increased use of supplementary cementing materials (and resulting reductions of GHG emissions) by engineers, contractors, architects and consultants in the construction and related industries both in Canada and abroad.

Action: Undertake science to understand climate change

Issue	Approach	Target
The response to Canada's climate change commitments includes researching potential impacts and developing adaptation strategies as well as mitigating greenhouse gas emissions because, even if fully implemented the Kyoto Protocol will only slow – not stop – climate change and thus we will need to adapt.	Study various landscape environments in Canada, (including coastal and inland permafrost terrain, landslide hazards in the Cordillera, dune regions of the Prairies, and flood susceptible regions of Manitoba and Quebec) to improve understanding of the sensitivity of terrain stability to changes in climate.	By 2002, develop reports, databases and Web sites to communicate the impacts of climate change on various landscape types.

Anticipated outcome

Enhance partnerships for future work on climate change, improve the understanding of the impacts of climate change on climate sensitive landscapes, and contribute to the development of sustainable strategies to adapt to climate change.

Researching geological responses to past climate and current climate variability will refine scientists' understanding of what might happen in the future. It will help land use planners, governments, industry and geotechnical engineers to decide how best to change their practices to adapt to a changing climate.	Conduct a series of case studies to assess communities sensitivity to climate change. Partners include the Federation of Canadian Municipalities and individual communities, other federal departments, provincial and territorial agencies, academic institutions and private industry.	By 2001, deliver reports specific to five communities describing the sensitivities to climate change and the tools and information needed to develop adaptation strategies, including communication and outreach materials.

Anticipated outcome

Improve local knowledge of climate change at the community level.

Contribute to the development of resilient communities in the face of climate change, and improve adaptation research methodology for future community work.

3.2 Reduce environmental impacts

Our future as a prosperous, healthy and sustainable society depends on the wise use and protection of our wealth of natural resources. Resource development must remain within the capacity of natural ecosystems to respond to, and recover from, human disturbance. To achieve this objective, we must prevent problems before they arise rather than attempting to undo damage already done. This necessitates measures to avoid or minimize the creation of waste and pollution as well as efforts to make more efficient use of natural resources. This, in turn, demands that we use processes, practices, materials, products and/or energy that reduce the overall risk to human health and the environment. NRCan's scientific, technical and policy expertise develops technologies and promotes practices that minimize impacts on the environment.

Under this objective, NRCan will focus its efforts on: science and technology to reduce environmental impacts; partnerships to promote biodiversity; and, research and development for a diversified energy base.

Action: Undertake science and technology to reduce environmental impacts

Issue	Approach	Target	Anticipated outcome
Current renewable energy technologies have high production costs. They also lack the infrastructure of codes, standards and training tools needed in system selection, installation and operation and maintenance. Additional constraints include low electricity buy-back rates, surplus capacity and lack of familiarity with the reliability and performance of renewable energy systems. Kyoto targets are accelerating the emergence of a global market for renewable energy technologies and services. This creates business opportunities for Canadian companies that have the best technologies at competitive prices.	In partnership with industry, develop wind energy technologies, small hydro technologies, technologies to convert biomass into electricity, photovoltaic technologies and supporting infrastructure.	By 2002, increase wind energy conversion efficiency by 10% and small hydro turbine efficiency by 5%. By 2002, Develop three new software tools that will reduce testing and evaluation costs by 5%. By 2002, develop three Internet-based tools using GIS for assessing small hydro potential. By 2002, increase efficiency of biomass conversion systems by 5%. By 2002, develop technical guidelines for the interconnection of small power sources. By 2003, reduce manufacturing and delivery costs of wind turbine blades and control systems by 10%.	*Increased use of clean, renewable energy.* *Reduce GHG emissions.*

Issue	Approach	Target	Anticipated outcome
Long-term, environmentally sound, cost-effective solutions for mine closures, including the disposal of mine waste, are among the greatest challenges facing the mining industry in Canada.	Conduct scientific research on the options and solutions to environmental challenges facing the mining industry for the closure of both active and inactive mines. Partners include industry associations, private sector companies, other federal government departments, provincial and territorial governments and academia.	By 2002, provide data which will assist in making informed decisions regarding undersea disposal of mine tailings by assessing the long term environmental and ecotoxicological consequences of marine tailings deposition at two inactive mine sites in Newfoundland. By 2002, implement a new post-Mine Environment Neutral Drainage (MEND) program which will address the priority mine closure issues identified through an extensive stakeholder consultation process. By 2003, provide data which will assist in making informed decisions on sludge disposal options.	*Improved protocols for mine decommissioning and rehabilitation resulting in reduced environmental impacts.*
Existing pipelines in Canada represent an approximate investment of $100 billion. As Canada's oil and gas pipeline infrastructure is aging, it brings greater challenges to the ongoing management of pipeline integrity and reliability. Technical information is required by the industry to prevent corrosion and to establish effective and efficient repair strategies. Information is also needed by industry, governments and agencies to better monitor the condition of pipeline systems in order to detect problem areas before they result in failures. Canada's investment in pipelines is expected to grow by 10% over the next few years. This presents a need to develop and deploy decision support tools which will assist the industry in making these investments.	Develop and transfer science and technologies which, when implemented, will prevent, detect and mitigate corrosion and environmentally assisted cracking problems in pipelines. Partners include industry associations, companies, standards associations and regulatory authorities.	By 2002, expand current scientific knowledge base in order to develop techniques for mitigating/preventing stress corrosion cracking. By 2003, evaluate laboratory methodologies for predicting long-term performance of pipeline coatings. By 2003, develop standardized methodologies for screening corrosion inhibitors for pipelines. By 2003, expand current scientific knowledge base in order to develop smart sensors for detecting pipeline failures.	*Enhanced capability for the ongoing management of pipeline integrity resulting in reduced releases to the environment.*

Issue	Approach	Target
Forest management has evolved away from an exclusive focus on the sustained production of timber products. Management methods that are ecologically based, adaptive, and inclusive of multiple forest values are also social and legislative priorities. Successful adoption of these methods requires an enhanced understanding of how forests work and how forest management activities affect the ecological integrity of forest systems.	Conduct and lead research that increases Canadian capacity to transfer information and knowledge. Strengthen Canada's capacity to directly measure and report on the conservation of biodiversity and forest sustainability, to help Canadian forest sector industries improve their environmental performance and permit better access of Canadian forest products to international markets. Identify adaptation and mitigation options for Canadian forests as a response to climate change. Support developments in forest bioenergy development and fossil fuel alternatives. Partners include federal departments, provincial/ territorial governments, industry, the public, Aboriginal people, academia, international agencies.	From 2000 to 2003, catalogue and monitor local indicators for non-timber forest uses. By 2002, develop prediction model of how societal values change over time in resource-dependent, mixed, and retirement/ vacation communities. By 2002, develop models and tools for predicting long-term effects of harvesting regimes in Canada's forests. By 2002, develop proof of concept of engineering forest trees for resistance to fungal and insect pests. By 2003, complete study on the impacts of climate change on biodiversity. By 2003, develop models of local and regional socio-economic impacts of climate change.

Anticipated outcome

Tools and approaches to enhance timber production.

Synthesis and integration of knowledge and provision of systems to enhance decision-making capacities.

Scientific support for climate change, international forest health and policy issues, Canadian forest biodiversity issues, the development of criteria and indicators of sustainable forest management.

Conservation and protection of forest ecosystems.

Action: Develop partnerships to promote biodiversity

Issue	Approach	Target
Voluntary conservation of species and habitats by resource industries can complement proposed species at risk legislation and make important contributions to protecting Canada's natural heritage and to ensure a sustainable future. Natural resource industry associations and companies, national conservation organizations, and rural, remote and Aboriginal communities can have a positive impact by undertaking voluntary measures.	Develop partnerships, through the Biodiversity Stewardship in Resource Industries Initiative, between the resource industries and conservation organizations to undertake non-regulatory initiatives to conserve biodiversity. This initiative can make a significant contribution to the Government of Canada's environmental agenda as well as implementation of environmental principles by industry. Partners in this initiative include natural resource industry associations and companies, national conservation organizations, rural, remote and Aboriginal communities and other federal departments. Other potential partners include agricultural and fisheries associations.	By 2001, seek consensus on program implementation By 2001, broker industry-conservation-Aboriginal participation in stewardship programs By 2001, facilitate a multi-sector, on-the-ground, landscape-scale pilot stewardship action plan.

Anticipated outcome

Demonstrate that voluntary stewardship partnerships can lead to conservation initiatives that address the needs of Canada's species at risk and effectively sustain the biodiversity.

Demonstrate sound alternatives to regulatory approaches to protecting species.

Conserve biodiversity and ecological systems for future generations, contributing to knowledge generation and information exchange about wildlife and habitats, developing meaningful multi-stakeholder partnerships to ensure that decisions are integrated and responsibilities shared.

Action: Research and development in support of a diversified energy base

Issue	Approach	Target
Canada has supported the development and deployment of nuclear technologies for over fifty years. Nuclear technologies and materials are used daily across a broad spectrum of industrial, agricultural and medical applications. Nuclear energy generates a series of public confidence concerns in relation to safety and security. However, it does not produce the atmospheric emissions of conventional forms of energy. Nuclear energy currently supplies between 15 and 20 per cent of Canada's electricity requirements. Nuclear power energy presents alternatives that can contribute to sustainable energy development and at the same time reduce greenhouse gas emissions. If Canada is to support and maintain a domestic and international nuclear energy option, there is a need to support research and development of future nuclear technologies. Current research facilities are in need of refurbishment and rationalization.	Establish the legislative and regulatory framework to ensure safe and responsible management of the nuclear energy option in Canada. Continue to support nuclear R&D with a view to ensuring that R&D efforts continue to support public policy objectives; this will entail modernizing, retrofitting and rationalizing Canada's nuclear R&D facilities and making the necessary decisions pertaining to any new facilities required to better serve public policy goals in the nuclear field. Enhance public information and communications by federal departments and agencies involved in Canada's nuclear program as well as international organizations such as Nuclear Energy Association and International Atomic Energy Agency. The new modernized Nuclear Safety and Control Act and Regulations are now in effect. Work is underway to revise Canada's Nuclear Liability Act; according to current planning goals, the new legislation is expected to be established by early 2002. Nuclear Fuel Waste legislation is expected to be in place by the end of 2001.	By 2001, develop a Canada-Saskatchewan MOA on the clean-up of abandoned uranium mine and mill tailings. By 2003, complete a series of decisions relating to the rationalization, refurbishment and modernization of AECL's nuclear research laboratories, including the closure of Whiteshell Laboratories and the privatization of AECL's Waste Technology Business Unit and Underground Research Laboratory (URL). It is also anticipated that a decision regarding the replacement of the NRU research reactor will be made in the 2001-2002 time-frame. By 2001, provide a current and comprehensive Web-based package of information on nuclear energy and related issues.

Anticipated outcome

Responsible and safe management of the nuclear option to ensure that health and safety of Canadians remains paramount in Canada's nuclear energy program.

Course set in Canada to move effectively towards implementing an approach for the long-term management of nuclear fuel waste in which the public has confidence.

Federal-provincial agreements for sharing the costs of decommissioning all abandoned uranium mines and mill tailing sites in Canada (a Canada-Ontario agreement was established in 1996)

Effective and efficient nuclear R&D programs in support of the nuclear sciences and the safety and performance of Canada's nuclear energy program

Enhanced understanding by the public of the nuclear energy option and of the Government's role.

3.3 Safeguarding the environment

Risk assessment requires a knowledge of the nature of the hazard, plus the likelihood of exposure. NRCan's contributions to risk assessment associated with Canada's natural resources, the terrains in which they are found and the processes involved in their development lie in fully understanding the nature of the hazard and making reliable information available to organizations responsible for risk assessment and risk management decisions.

Action: Undertake science for risk assessment and policy making

Issue	Approach	Target
Government and industry require geoscience knowledge to develop national and international policies concerning metals and their release into the environment, and to formulate regulations for Canada. Through this initiative, NRCan will help risk assessors and policy makers make appropriate decisions regarding the monitoring and control of toxic forms of certain metals.	Provide science for risk assessment and risk management through studies on transformation, sources and sinks of metals on the environment and human health.	By 2002, publish research projects to address: the validity of historical records of metal accumulation in sediments and biota; the transportation of mercury to bioavailable forms; the modelling of metals deposition around the Rouyn-Noranda smelter. By 2002, publish comprehensive results of the 5-year Metals in the Environment (MITE) initiative.
Understanding how metals released by anthropogenic activities behave and mobilize in the environment is important to the metal mining industry, the scientific community and policy makers. Sound science is key to furthering this understanding so that stakeholders can agree on what compounds need to be managed to protect the environment and what approaches should be taken.	Conduct scientific research on the behaviour/effects of metals released to the environment. This builds on the work done for the first SDS on developing internationally recognized protocols for the classification of risks posed by heavy metals. Partners include scientific societies, academia, other government departments and industry associations.	By 2003, complete research to extend to alloys the application of the draft transformation protocol developed for the OECD hazard classification of metals. By 2003, provide an approved methodology for alternative criteria to Persistence, Bioaccumulation for hazard assessment and classification of metals. By 2003, develop an improved life-cycle assessment (LCA) model which is applicable to metals.

Anticipated outcome

Contribute to risk assessments undertaken by responsible agencies that permit NRCan to properly evaluate environmental assessments submitted for review. The knowledge will contribute to the development of effective risk management options by responsible agencies.

Anticipated outcome

Contribute a sound scientific base for the development of environmental policy and regulation.

Issue	Approach	Target
Developing natural resources in the north has unique risks, due to the harsh climate, and given the potential for significant environmental impacts as the result of an accident. The seafloor and coastline which are used as a foundation for pipelines and hydrocarbon production structures present significant challenges as the stability of the seabed and coastline are not well understood.	Develop recommendations as to the risk to pipeline and production failures due to instability of the sea floor and coastline, and damage by ice keels. Produce and distribute reports to native groups, regulatory agencies such as the National Energy Board, the Department of Indian Affairs and Northern Development, the oil industry and private consultants outlining seabed risks to pipeline and production structure development in the Arctic offshore and coastal zone. Develop recommendations as to minimizing risks to marine wildlife and coastline due to the failure of pipelines and production structures. This will be undertaken in conjunction with the Department of Fisheries and Oceans, Environment Canada and Native Groups.	By 2003 produce reports which outline the origin of subsea permafrost, and define the effects of ice scour on the sea bed and the erosion rate of the coastline. By 2003, produce reports on the distribution of extreme ice scour depths to constrain pipeline burial depths and distribution of subsea permafrost to constrain production structure design and regulation, and processes controlling coastal instability.

Anticipated outcome

Ensure that industry places pipes and production structures at the proper depth and location, while minimizing risk to the environment.

Ensure continued development of Canada's northern resources for the social and economic benefit of local communities.