

**Stakeholder Participation in
Radiological Decision Making:
Processes and Implications**

**Case Studies for the
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NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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FOREWORD

Contemporary society has become increasingly interested in participating more actively in public decision making regarding health, safety and environmental protection issues. As governments have tried to understand these interests better, and to integrate societal needs in their decision-making processes more adequately, it has become possible to highlight some common policy-level issues and lessons from the wide variety of situations in which stakeholders have participated effectively in the elaboration of decisions.

The trends within the nuclear industry mirror those in broader governance areas. Within the radiological protection community, stakeholder issues have moved steadily to the forefront of policy discussions, and clearly form key elements in decisions regarding the development and implementation of radiological protection policy.

The NEA Committee on Radiation Protection and Public Health (CRPPH) has been exploring the details and implications of stakeholder involvement in decision-making processes for several years. The roots of this interest can be found in the Committee's 1994 collective opinion on *Radiation Protection Today and Tomorrow*. On the basis of this reflection, the Committee organised the 1st Villigen Workshop in January 1998 on "Societal Aspects of Decision Making in Complex Radiological Situations", which reached the broad conclusion that radiation protection must adapt to meet the needs of society, and not the reverse. To deepen the understanding of this important subject, the CRPPH launched further studies that resulted in the organisation of the 2nd Villigen Workshop held in January 2001 on "Better Integration of Radiation Protection in Modern Society". This workshop concluded that although broad stakeholder participation was not needed to reach agreement in the vast majority of regulatory decisions, it can be the best and sometimes only way to achieve agreement in certain blocked situations. In addition, the workshop showed that it is important to develop a common understanding of stakeholder roles and responsibilities, to distinguish clearly between scientific knowledge and social judgement, and to foster an atmosphere of mutual learning.

Through the CRPPH work in this area, and the Villigen results, there has been a growing consensus that stakeholder involvement is an important component of the decision-making process, and that in some cases it is an essential component for arriving at an accepted solution and for building (or rebuilding) trust in decision-making authorities. Stakeholder involvement may be appropriate when siting new nuclear installations, managing emissions from routine operations at nuclear facilities, decommissioning existing nuclear installations, or in post-accident rehabilitation. In preparation for the Third Villigen workshop on "Stakeholder Participation in Decision Making Involving Radiation: Exploring Processes and Implications", three of these situations were addressed in case studies specifically developed between 2001 and 2003 by the Expert Group on Processes of Stakeholder Involvement (EGPSI). The studies bear on:

- the Canadian review process for uranium production projects in Northern Saskatchewan;
- the Rocky Flats controversy on radionuclide action levels;

- the ETHOS project for post-accident rehabilitation in the area of Belarus contaminated by the Chernobyl disaster.

The fourth issue, that of normal operation emissions management, was addressed by a presentation during the workshop.

The case studies undertaken by the EGPSI are presented in this report. They focus on stakeholder involvement processes and experiences with the intent to draw out lessons on how decision making may be improved. They were presented during the workshop to stimulate discussions based on concrete situations and to illustrate:

- the social goals of stakeholder participation (incorporating public values into decisions, improving their substantive quality, resolving conflict, building trust, educating and informing the public...);
- the types of stakeholder involvement processes that can be effectively used (public hearings, advisory committees, negotiations and mediations...);
- the key features playing a role in the success of stakeholder involvement (responsiveness of the lead agency, participant motivation...);
- the steps in planning and implementing stakeholder participation (when is it needed, which format is appropriate, who should participate, what role government should play, evaluation...).

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EXECUTIVE SUMMARY

CASE STUDY 1

THE ROCKY FLATS CONTROVERSY ON RADIONUCLIDE SOIL ACTION LEVELS

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This report describes how stakeholder involvement processes led to the successful resolution of a dispute over radionuclide soil action levels at the Rocky Flats Site near Denver, Colorado. During the Cold War Era, Rocky Flats, a plutonium fabrication plant, was part of the American government's multi-site nuclear weapons production facilities. Although the Rocky Flats plant had significant positive effects on the local economy, it became a target of public protest due to concerns over both public safety in the area surrounding the site and global nuclear proliferation. In the late 1980s, local safety concerns led to investigations by state and federal agencies. In 1992, with the Cold War ended, the Department of Energy decided to decommission the Rocky Flats site and to begin the long process of decontamination.

As part of its plan for managing former weapons production facilities, DOE established and funded local Site-Specific Advisory Boards at each site, including Rocky Flats. The functions of the Rocky Flats Citizen Advisory Board (RFCAB) included making recommendations to responsible agencies on issues related to waste management and cleanup. Over the years, the RFCAB has made over 100 consensus recommendations. In 1996, a decision by DOE to announce interim radionuclide soil action levels (RSALs) for the Rocky Flats site triggered a sharp controversy with the RFCAB. DOE's decision sparked public criticism, first, because the final RSALs would be legally binding and determine the cleanliness and future uses of the site, and, second, because the proposed RSALs appeared to be higher than at other remediation sites. DOE's decision thus appeared to reflect values different from those of concerned public stakeholders.

In response to the RSAL controversy, the RFCAB and other public interest groups called for an independent assessment of the levels and the process used to establish them. DOE responded by agreeing to fund an autonomous scientific study of the RSALs for Rocky Flats. A panel of community representatives, known as the Radionuclide Soil Action Levels Oversight Panel (RSALOP), was formed to monitor the new study. The RSALOP was unique among public advisory groups in the high level of technical training and experience of most of its members. The technical expertise of the RSALOP meant not only that they were extraordinarily well equipped to understand highly technical arguments, but, even more important, that they were likely to believe that such arguments carried weight. The RSALOP selected *RAC*, a team headed by John Till, to conduct the technical aspects of the project. The Panel met and worked with *RAC* monthly between October 1998 and March 2000, with all sessions open to the public. Till identified the central issue and the focus of technical discussions: "If the soil action level selected appeared to be too high, the public would be concerned about its implications on the health of future populations. If the level selected was too low, the cost of cleaning up the facility could become prohibitive."

Working together, the RSALOP and RAC produced a recommended methodology for calculating RSALs at Rocky Flats. The final result of the process (which was “painstakingly tedious and time consuming, but in the end proved to be a vital element in the project’s success”) was a range of RSALs that was somewhat lower than DOE’s interim level. After a period of reassessment and deliberation, however, DOE announced RSALs that were essentially the same as those recommended by the Panel and their consultants. Public stakeholder involvement thus contributed significantly to the successful resolution of the radionuclide soil action level controversy at Rocky Flats. This was a significant achievement, made possible by the development of trust and confidence between the RSALOP and the RAC team. The primary basis for trust in this case was shared respect for scientific/academic values: The best approach to Rocky Flats cleanup was one based on the best available scientific and technical information. All groups also believed that the best approach to obtaining the best scientific and technical information was one that was open to criticism and correction from independent, qualified individuals.

The Rocky Flats RSAL case illustrates key aspects of successful stakeholder involvement:

- 1) An event (DOE’s announcement of RSALs) caused uncertainty.
- 2) The event could have been attributed to poor performance (e.g., use of an inappropriate methodology) or, more damagingly, to conflicting values (i.e., DOE is more concerned with costs than with public safety).
- 3) A third party (RSALOP, guided by RAC) was introduced to examine the abstract technical arguments within the specific context of Rocky Flats and its possible future uses. In this way, the central trade-off between public health and costs was explicitly and concretely confronted by all parties. By contextualizing science in this way, public stakeholders and DOE were able to identify a basis of shared values on which to build collaboration and improved solutions to the management of radiological hazards.

EXECUTIVE SUMMARY

CASE STUDY 2

THE ETHOS PROJECT FOR POST-ACCIDENT REHABILITATION IN THE AREA OF BELARUS CONTAMINATED BY THE CHERNOBYL DISASTER

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The Chernobyl Nuclear Accident in 1986 had a significant impact locally, regionally and, indeed, globally. At each level, this took the form not only of tangible radioactive contamination of varying degrees of severity, but also of a less tangible, but no less real, breakdown in public confidence in the nuclear industry and the authorities charged with regulating it and responding to any problems. Nowhere was this more acute than in the regions of Belarus, Russia and Ukraine most directly affected by the contamination. In the context of such a breakdown in confidence the authorities here faced an unprecedented task as they sought to develop and implement rehabilitation programmes.

This case study begins by examining the reaction of the people in a number of villages in southern Belarus to the efforts of the authorities over the years since the accident and finds that, despite an extraordinary expenditure of resources, there is widespread criticism by those whom the interventions were intended to help. The problem appears to stem in no small measure from the fact that the authorities sought to respond to the accident and its aftermath on the basis of a *top-down bureaucratic model*. While this possessed all the virtues of centralised control in the face of a problem on a vast scale, it nevertheless lacked the ability either to capture the real concerns of people at the local level or to encourage and make use of the sorts of coping mechanisms that the people had previously developed in the face of natural hazards. As a consequence, people not only felt that those who were supposed to be in charge had lost control at the highest level, but that they too now had no way to regain control of their daily lives at a local level. In short, faced with a crisis of confidence the authorities failed to realise that their response had to be such as would allow social trust to be rebuilt.

In contrast, the ETHOS project, operating at local level and setting as a primary objective the need to understand the impact of the accident and its aftermath from the perspective of the local people, offered significant opportunities to build social trust. Instead of a top-down approach, the concrete guidelines for the project included a determination to achieve a *strong and genuine local involvement* so as to allow people to regain control over their lives; an *interdisciplinary* approach in order to cope with the complexity and interdependence of problems and to maintain a clear and strong link between the technical and social dimensions; and an aim to *integrate radiological safety* into the concrete issues of daily life rather than to see it as something separate – and perhaps even the responsibility of others.

Adopting this approach, the ETHOS team quickly discovered that the key question for local people was quite simply whether it was possible to stay in the area in the long term and to bring up children there. Despite years of interventions by the authorities, this was not something the people felt they had a clear answer to. While stressing that this was not a question the ETHOS team could answer

for the people, they indicated that they could help those who wanted to stay to improve safety and quality of life. On that basis, it became clear that anything the project did must have clear practical objectives. Consequently, six Working Groups were established which sought to develop solutions to problems that the people themselves had identified. These dealt with radiological protection of children; production of clean milk; marketing of privately produced food; radiological culture through education in school; involvement of young people in rehabilitation; and management of domestic radioactive waste.

Drawing on interviews conducted in the villages concerned, the case study seeks to draw out lessons from the undoubted success of the ETHOS project. A striking finding is the extent to which the people stress the importance of *trust* as vital to that success. As the project got under way, people were still sceptical and uncertain about the future, but at the very least they recognised a qualitative difference in the way they were treated by the ETHOS team in contrast to the attitude of the authorities previously. The factors mentioned by interviewees as contributing to the building of trust and thus to the establishment of a productive project included: active involvement or inclusion of stakeholders; personal engagement and perseverance of foreign experts; tangible objectives identified and aimed for; a real effort to help people understand the position they were in; improved contacts with the outside world and an understanding of the problems as common to many people; and a contextual approach that sought to identify and solve real local problems.

The issues facing radiological protection specialists are many and varied and few are as severe as those encountered in this case study, but the lessons drawn may well be of relevance in a much wider range of situations where public confidence in experts and authorities has been strained or lost in the event of accidents or other problems.

EXECUTIVE SUMMARY

CASE STUDY 3

STAKEHOLDER INVOLVEMENT IN THE CANADIAN REVIEW PROCESS FOR URANIUM PRODUCTION PROJECTS IN NORTHERN SASKATCHEWAN

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Over the last quarter of the 20th century there was increasing concern among Canadians regarding the environmental including socio-economic, impacts of industrial development, and the need to reduce these impacts to acceptable levels. This led to the evolution of Canada's and Saskatchewan's legislation and institutions for protection of the environment, including an environmental impact assessment (EIA) process for new developments. Democratic participation was strengthened through laws passed in the 1980s and the 1990s by introducing open, transparent public hearings that assure access of all stakeholders to the EIA process. The public became an important stakeholder in the EIA process through these hearings. The licensing and permitting process, however inter-related, still maintained an independent role.

Because of the public's concern for radiation protection, development of uranium mining has always been a particularly contentious issue. Within the EIA framework the governments appointed a *Joint Federal/provincial panel on Uranium Mining Developments in Northern Saskatchewan* (the Panel) to review six new mines. The Panel met from 1991 to 1997 with the mandate to: "...review the environmental, health and safety and socio-economic impacts of the proposed uranium mine developments in Northern Saskatchewan and assess their acceptability." The mandate further stated "However, concerns may be raised by the public which extend beyond the impacts of direct concern to the Panel, and in such cases the Panel will ensure that the public is provided a reasonable opportunity to express these concerns." The Panel was also directed to provide full opportunities for public consultation and review.

Using public hearings, scoping sessions and other consultative processes specifically intended to encourage public participation, the Panel conducted its EIA through a consensus building-management approach, rather than a technocratic-regulatory one. This was achieved by placing emphasis on values, theological and spiritual beliefs, morality and fairness, rather than considering only technical issues. A government funded support program provided C\$ 420 000 to assist stakeholder participation. Project proponents, government departments and agencies, aboriginal leaders, labor unions, non-governmental organizations and individual stakeholders took part in the public hearings process.

Following lengthy hearings and analysis of each project the Panel presented its conclusions and recommendations in a series of reports directed to the governments. In making its decisions to recommend or oppose approval of each project the Panel weighed the environmental risks versus socio-economic gains. A recommendation not to proceed with on project was made when the gains were judged to not justify the risks. (This project was later approved under a revised plan resubmitted by a new proponent.)

In interim and final reports of its conclusions and recommendations the Panel made substantial reference to the concerns and input of the public. Responding to anti-development activists, the Panel wrote “the *deep ecologist* view would suggest that a moratorium on all such activity be instituted; persons should strive to live in harmony with the pristine environment, avoiding any potential for disruption. On the other hand, the *pragmatic* view suggests that poverty is currently a greater threat to health of Northerners than is radiation.” (Jo93) In 1997 the Panel wrote: “Because it is the people of northern Saskatchewan who will experience the greatest impacts of these projects, we have paid particular attention to their concerns. After listening carefully, reading widely, and debating at length, we have concluded that the best course is to recommend that the mines be allowed to proceed under (project-specific) conditions that would limit environmental damage and enhance northern benefits.” (Jo97)

To reduce environmental, health and safety impacts, the Panel recommended improved technical designs and practices, as well as proposing initiatives to improve communication and increase involvement of the aboriginal community in project monitoring and decision making, and increase the economic benefits of uranium mining to these communities, including greater employment and business opportunities.

In responding to the Panel’s recommendations for each project, both the governments of Canada and Saskatchewan addressed every item in writing. In authorizing the respective projects to progress licensing phase, the government of Canada instructed, “The AECB and other federal regulatory agencies will ensure that the Panel’s recommendations related to environmental, technical and safety issues are fully considered as the projects move through each stage of the approval process.” (Na98) The *Occupational Health and Safety Division* of the Ministry of Saskatchewan Labour indicates it implemented every Panel recommendation regarding worker health and safety. The Saskatchewan government also adopted many of the Panel recommendations in issuing project licenses and permits. Both governments addressed broader issues, such as socio-economic concerns for the people most impacted by the mining, through other actions.

While the governments accepted many of the Panel’s recommendations, it was not bound by them. This took place with the understanding that “In making their decisions, the responsible authorities, including Ministers with jurisdiction, must consider the panel report, but are free to consider other sources of information and to make different value judgements.”

The general conclusion of a workshop held in Saskatchewan in 1998 to evaluate the process of the Joint Panel Uranium Review was “... that several benefits arose directly out of the review process in Saskatchewan, and it is probable they would not have occurred without the public review.” Cited examples include health, socio-economic and environmental benefits. (HJ98)

Since the early 1990s several major changes were implemented, some of which may have been at least partly in response to the Panel’s hearings. For example: in May 2000, the Canadian Nuclear Safety Commission (CNSC) replaced the Atomic Energy Control Board (AECB) under new legislation providing a more modern and effective regulatory framework. There has been an extensive and comprehensive reform of Saskatchewan’s legislative health and safety standards. The ICRP-60 recommendations on radiation dose limits for workers were incorporated into Surface Lease Agreements, as well as becoming the Canadian standard. A long-term epidemiological study of the province’s uranium miners was initiated. New environmental regulations require financial assurances for decommissioning and long term monitoring of all mines and tailings.

A particularly outstanding effect was the implementation, for the first time, of a cumulative environmental effects monitoring program for mining facilities. Community-nominate Environmental

Quality Committees (EQC's) were established to facilitate communication among the northern communities, mining companies and governments. The community also works with representatives of the proponents and regulators through EQC's to monitor effects that may potentially impact the health or living conditions in the vicinity of the uranium projects. In support, the Government of Canada directed that regulatory agencies support EQC activity and invite their participation in, and observation of regulatory activities; and, that the AECB should be more active in its EQC support and participation. The potential for socio-economic benefits was increased by creating a Multi-Party Training plan to train and employ Northerners in 60% of all new jobs in the northern mineral industry, as well by increasing business opportunities for Northerners and northern joint business ventures.

Several other outcomes may have (at least in part) resulted from the public hearing process:

With four new uranium mining projects now operating in northern Saskatchewan, the results of opinion polls indicate uranium mining has had a high level of public acceptance (i.e. about 70%) since the early 1990s;

Development of northern mines monitoring secretariat to support aboriginal stakeholder organizations increased aboriginal consultation with both proponents and governments in several areas of information exchange, monitoring and research, this has left to increased mutual understanding and trusts between proponents, governments and stakeholders;

The number of Northerners employed in the mining industry doubled between 1992 and 1997, and business opportunities for Northerners has greatly increased (Sa98);

Both governments implemented programs to increase the level of employment of Northerners within their own agencies (See Annex 3); and

The mine operators, Cameco, appointed Chief Harry Cook off Saskatchewan's largest Woodland Cree First Nation band to their board of Directors in 1992. (Mc00) In 2003 he continued in this capacity.

In summary, it appears that the open and transparent character of the environmental assessment process was instrumental to its political success. This gives background to the sentiment expressed by a former Saskatchewan Minister of *Environment and Resource Management* who wrote, "The environmental process must not only be done, it must be **seen** to be done." (Po94)

This case provides an example of how stakeholders are included in a formal hearings process established to evaluate the risks associated with the development of projects judged to have potential significant environmental consequences. This is a case where stakeholder involvement has developed at both the national and provincial level and is institutionalized in laws and regulations. While this case relates to issues and questions regarding radiation protection associated with uranium mining, it also shows how concerns regarding radiation protection are extended to socio-economic issues as well as broader societal concerns for the rights of individuals, nuclear non-proliferation and disturbing a pristine wilderness through industrial development.

It is generally agreed by most participants in the uranium mining review process that stakeholder participation led to positive results including improved monitoring, socio-economic opportunities for impacted communities and enhanced communication and understanding between project proponents, governments and public stakeholders. It may have resulted in improving projects and developing other benefits that may not have otherwise occurred.

Conducting the process within a governmental context extends the democratic involvement of individuals beyond traditional voting rights in a representative democracy. Furthermore, providing for stakeholder involvement in the ongoing monitoring and oversight of projects, may also strengthen the democratic process and add transparency to projects.

However, the 6-year-long Panel review, extending from August 1991 to November 1997, was a lengthy and cumbersome process adding to the cost of review and delaying project development. Furthermore involving the stakeholder in project monitoring also incurs costs and complicates the process. It also appears to duplicate activities normally conducted by licensing and other agencies. It further reduces the flexibility and independence of project proponents.

It must also be recognized that while the stakeholder has an important, vital position in the EA process in Canada stakeholder input is only one of the several sources of information used in making final decisions regarding radiation protection and the environment. Recommendations developed by a panel are only *advisory* to the governments and regulatory agencies. It is therefore necessary that stakeholders understand the limitations of their input, otherwise they may be disappointed by the results.

It would appear that the process of stakeholder participation described in this paper must be well founded by law, or formally recognized in some way. A concerted effort is required to both elicit stakeholder input, and then assure that it is taken into account in making final decisions.

An important outcome of the Canadian case has been the implementation of new stakeholder-based organizations that take part in monitoring, as well as serving to educate the public. They also form a communication link between the public, proponents and governments. This appears to be a useful mechanism for developing trust and understanding between all parties. It is important to note, however, that these activities do require financial and leadership resources.

THE ROCKY FLATS CONTROVERSY ON RADIONUCLIDE SOIL ACTION LEVELS

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Introduction

This report describes the Rocky Flats radionuclide soil action level controversy as a case study for the purpose of understanding the nature and value of stakeholder involvement in the management of radiological hazards. The report consists of three main sections. The first section outlines the Rocky Flats story, including the Cold War era, the post-Cold War era, and the transition between the two. This provides the context necessary to understand the radionuclide soil action level controversy, the main events of which are described in the second section. In the final section, the Rocky Flats case is briefly discussed within the framework of a general model of stakeholder involvement and the lessons learned from the case are identified.

The Rocky Flats story

Cold War era

The 2 600-hectare Rocky Flats site is located 26 kilometres from Denver, Colorado. During its operational period, from 1952 to 1989, the Rocky Flats Plant was a part of a huge, decentralised “national factory” established by the United States government for the production of nuclear weapons. Other elements in the system included the Hanford and Savannah River sites, which produced the plutonium that workers at Rocky Flats fabricated into hollow spheres, the “pits” that served as triggers for nuclear weapons. Approximately 700 000 plutonium pits were produced at the Rocky Flats Plant. These pits were shipped, along with components produced at other sites, to the Pantex facility in Texas for final weapons assembly. Rocky Flats operations were first managed by Dow Chemical and then, from 1975 to 1989, by Rockwell International.

From the beginning, the relationship between Rocky Flats and the civilian population that surrounded it was characterised by secrecy, a secrecy that was generally accepted as a Cold War necessity by the local population, which benefited greatly from the thousands of jobs that were created and the millions of dollars that were pumped into the local economy. Behind the wall of secrecy, managers of the plant focused primarily on efficient production. Although concerned with worker safety, managers knew the tradeoffs they were making: efficiency would be gained at the cost of worker safety. And the focus of safety concerns was almost exclusively on radiation exposure, with relatively little attention paid to fire hazards.

Plutonium processing and fabrication at Rocky Flats resulted in frequent small fires that were usually easily extinguished. In 1957, however, a blaze heavily damaged a plutonium-processing building before being controlled. The operators and the government interpreted these fires, large or small, as posing no threat to the public, and they managed to block any public release of information about them.

The end of the period of secrecy began, in 1969, with a large fire in the plutonium fabrication building. The total cost of the fire (\$70.7 million) was the highest on record for an industrial accident in the U.S. Local newspaper accounts reported that the fire caused no injuries and that radioactive contamination was confined to the building. Later studies confirmed that little or no contamination was dispersed. The source of the fire, oily rags laced with plutonium, was not revealed at the time or in later reports. Although civilian managers of the facility maintained that the fire demonstrated that significant off-site release of plutonium was not possible, government officials concluded that the Denver area had barely escaped a catastrophic release of burned plutonium in the form of powdery ash.

In response to the 1969 fire, government managers paid greater attention to fire safety, requiring stricter fire regulations and the installation of sprinkler systems. No significant fires were reported during the remaining 20 years of plutonium processing at Rocky Flats. But these measures did not satisfy the concerns that had been provoked in various segments of the public by the fire. For example, an environmentalist group called the Colorado Committee for Environmental Information did not accept the conclusion of government managers (at the time, the Atomic Energy Commission) that no plutonium escaped the plant boundaries as a result of the fire. The group, which included qualified scientists, carried out their own measurements on land surrounding the site and found plutonium oxide dust particles. Although plant managers maintained their position of denial, the environmentalists blamed the release of the plutonium particles on the 1969 fire. Faced with undeniable evidence, plant managers finally admitted that the plutonium particles came from the plant, but not as a result of the 1969 fire. The contamination was the result, they said, of the 1957 fire and of leaking drums of nuclear waste. In short, authorities, by their own admission, had been lying to the public for years in an attempt to cover up their failures to safeguard the public from radioactive releases resulting from plant operations and accidents.

Public distrust of Rocky Flats management was further fuelled by media coverage in 1973 of an accidental release of tritium into the reservoir supplying water to a town close to the plant. Plant manager assured local health officials that the site contained no tritium and therefore could not be the source of the contamination. Ultimately, the AEC identified the source as plutonium scrap metal that had been contaminated with tritium and then shipped to Rocky Flats from the Lawrence Livermore laboratory. Once again, Rocky Flats management was presented to the public as being incompetent and uncaring. Within a year, Dow Chemical was replaced by Rockwell International. In 1975 the AEC was split into the Nuclear Regulatory Commission, with control over nuclear power, and the Energy Research and Development Administration (renamed, two years later, the Department of Energy), with control over nuclear weapons production, including Rocky Flats.

Whatever the benefits brought about by the changes in management at Rocky Flats, public concern and controversy over the very existence of the plant only grew in the following years. Opposition to the plant was organised not only by environmentalists and health professionals, but now also by peace activists. In 1979, 9 000 protestors demonstrated at the gates of the plant, and 300 were arrested. Later that year, 16 000 persons, workers and their pro-nuclear allies, counter-demonstrated their support for the plant. Rocky Flats had become a focal point for a public struggle, a stage from which opposing sides could present their cases to the public.

During the early 1980s, a struggle developed between DOE and the Environmental Protection Agency over management of radioactive contamination on the Rocky Flats site. DOE claimed that Rocky Flats and other weapons sites were exempt from the environmental regulations enforced by EPA. The Chernobyl accident in 1986 stimulated an agreement between DOE, EPA, and the State of Colorado to resolve issues of regulatory compliance and hazardous waste management at Rocky Flats. Although kept secret from the public, officials at DOE knew at the time that environmental compliance at Rocky Flats was poor. Contrasting with the health and safety risks of Rocky Flats during the mid-eighties were the economic benefits: 6 000 jobs, with a yearly payroll of \$280 million, coupled with \$140 million spent for material and service support.

Toward the end of the 1980s, Rocky Flats became the focus of investigations by the FBI, EPA, and DOE. All found serious violations of environmental and waste management regulations. In 1989, these investigations culminated in a “raid” on the plant by FBI and EPA investigators. By the end of the year, Rockwell had been replaced by EG&G, and DOE had announced that plutonium operations at Rocky Flats would be “temporarily” suspended. The end of the Cold War in the early 1990s transformed the temporary stoppage to a permanent one. In 1992, DOE announced that the plutonium production mission at Rocky Flats had ended, replaced by a mandate to decommission and decontaminate the site.

Summary of the Cold War era

During the Cold War era, the relations between Rocky Flats management and the general public were characterised by secrecy and distrust. The distrust was based on conflicting values. From the public’s point of view, Rocky Flats management valued production over safety and preparations for war over the pursuit of peace. The end of the Cold War signalled a dramatic change in value orientations. Rocky Flats management realised that, in order to carry out its new mission of decommissioning and decontamination, it had to become open to the public and adopt the public’s concerns for health and safety as its primary guiding values.

Post-Cold War era

The transformation from plutonium production to cleanup, from secrecy to openness was symbolised, in 1994, by an official change of name from the Rocky Flats Plant to the Rocky Flats Environmental Technology Site. And in 1995 Kaiser-Hill, an environmental engineering joint venture, took over management of the site from EG&G.

The change of mission at Rocky Flats coincided with similarly significant changes in attitude and operations at DOE. In 1993, the Clinton administration replaced the Bush administration, and a new, reform-minded leadership, stressing the public’s right to know rather than the government’s right to secrecy, took over at DOE. One major reform, carried out between 1993 and 1996, was the establishment and funding of local Site-Specific Advisory Boards at 12 DOE sites. With the co-operation of the state and local governments, a Rocky Flats advisory board, known as the Rocky Flats Citizens Advisory Board (RFCAB), was formed in 1993. To insure broad representation, initial (and subsequent) RFCAB members were selected from 8 categories: Academic institutions, Administrative/business, Community/neighbours, Local government, Health care providers, Public interest groups/environmental organisations, Rocky Flats employees, and Technical disciplines. Membership has ranged from 15 to 25, and the work of the group has been supported by a 4-person staff.

The goals of the RFCAB, outlined in its mission statement, were:

- 1) to provide “informed recommendations and advice to the agencies (Department of Energy, Colorado Department of Public Health and Environment, and the Environmental Protection Agency), government entities and other interested parties on policy and technical issues and decisions related to cleanup, waste management and associated activities;”
- 2) to promote “public involvement, awareness and education on Rocky Flats issues.” Over the years, the RFCAB has developed more than 100 consensus recommendations.

In 1999, the RFCAB formulated a *Vision for the Cleanup of Rocky Flats*, a document that stated the Board’s positions on environmental restoration, building remediation, special nuclear materials shipment, waste management, and site reuse. The *Vision* made clear recommendations on issues for which the Board had reached consensus; on issues lacking consensus, no recommendations were made. For example, the Board opposes any radioactive waste disposal onsite, but there is no consensus on whether it should support the disposal of transuranic waste at the Waste Isolation Pilot Plant in New Mexico. Regarding the critical issue of future use of the site, the Board recommended that the entire site become open space after completion of the interim cleanup. Selection of the specific type of open space, the Board said, should be a process that includes comprehensive public involvement.

Summary of the post-Cold War era

In contrast to the secrecy and distrust of the Cold War, the years that followed it produced a growing openness on the part of DOE, resulting in the development of a degree of trust and co-operation between government managers, the RFCAB, and the general public.

The radionuclide soil action level controversy

The trusting relations that had been developed between DOE, the RFCAB, and the general public were tested in the mid-nineties when the public concern was expressed over the degree of cleanliness for the Rocky Flats site that DOE was committed to.

The triggering event

The controversy started in 1996 when DOE announced interim radionuclide soil action levels (RSALs). For plutonium, the RSAL was about $4\,300\text{ Bq kg}^{-1}$ – assuming a dose limit of 0.15mSv y^{-1} . The RSALs, which determine post-cleanup limits for radionuclides in Rocky Flats soil, were incorporated into the Rocky Flats Cleanup Agreement (RFCA). The RFCA is the legally binding agreement between DOE the regulatory agencies (EPA and the Colorado Department of Public Health and Environment). When members of the public had a chance to examine the RSALs, concerned developed over the fact that the RSALs for Rocky Flats seemed to be higher than at other remediation sites. This public concern led to calls from the RFCAB, local government officials, and public interest groups for an independent assessment of the RSALs and the process used to establish them. A series of discussions between these groups and DOE led to an agreement by DOE to fund an independent scientific assessment of the RSALs for Rocky Flats.

From Controversy to Collaboration: The Radionuclide Soil Action Levels Oversight Panel and Risk Assessment Corporation

A panel of community representatives, known as the Radionuclide Soil Action Levels Oversight Panel (RSALOP), was formed to monitor the new study. This panel was similar in some ways to the RFCAB, and some individuals were members of both groups. The RSALOP was unique among public advisory groups, however, in the high level of technical training and experience of most of its members: out of 13, 5 had Ph.D.s, 2 MSs, and 5 BSs (DOE, EPA, and CDPHE were each represented by an ex-officio member). The technical expertise of the RSALOP meant not only that they were extraordinarily well equipped to understanding the highly technical arguments associated with RSAL assessment, but, even more important, that they were likely to believe that such arguments carried weight. That is, the members of the RSALOP believed in the legitimacy of scientific arguments and evidence, and would base their recommendations on an assessment of those arguments and that evidence.

The general orientation of the RSALOP was immediately evident when they followed the standard procedure of soliciting proposals for the RSAL assessment from technically qualified consultants. Risk Assessment Corporation (*RAC*), a team headed by John Till, and with previous experience at Rocky Flats, was selected for the job. Till has described the structure of the interaction between his team and the RSALOP as follows:

The Panel met for work sessions with *RAC* monthly between October 1998 and March 2000, with all meetings open to the public. An additional three informational meetings were held specifically to update the community on progress and results. The regular monthly Panel meetings lasted about 3 h. Before each meeting a 2 h technical discussion session allowed Panel members, DOE, and others to have a more in-depth dialogue with *RAC* scientists. This format proved to be very successful because of the intense interest in carefully following the assumptions being made and in understanding the technical methods applied. If the soil action level selected appeared to be too high, the public would be concerned about its implications on health of future populations. If the level selected was too low, the cost of cleaning up the facility could be come prohibitive. (Till & Meyer, 2001, p. 371)

Thus, Till and his team saw the focus of their job to be on explaining to the RSALOP both the technical aspects of their work and the tradeoffs involved in recommending RSALs for Rocky Flats. The Panel, in turn, concentrated on understanding the technical arguments, interpreting them for the RFCAB and the broader community, and, finally, advising DOE.

The RSALOP organised the project into eight tasks:

1. Cleanup levels at other sites

As noted above, the widespread public belief that DOE's initial RSALs for Rocky Flats were higher than those at other sites led to a call for an independent assessment. The RSALOP and its consultants released a report in April 1999 that confirmed public concerns: RSALs for Rocky Flats were higher than at other sites. But the report went beyond simple comparisons. It identified the key parameters in the calculation of RSALs and showed that the differences in RSALs among sites could be explained by differences in the assumptions made for the key parameters. This basic technical understanding of RSAL calculation provided a foundation for the remaining tasks in the project.

2. *Computer models*

The *RAC* consultants produced a report in July 1999 that surveyed available computer programs for use in calculating RSALs. Among these was the RESRAD program, which had been used by DOE. Discussions between *RAC* and the RSALOP led to the selection of the RESRAD program. In addition to familiarising the RSALOP with the ways RSALs are calculated, this task was important in enabling the Panel to understand why DOE had used the RESRAD program in the first place.

3. *Inputs and assumptions*

Both John Till and the RSALOP have described the difficulties involved in this critical task. According to Till, the initial goal of Panel members was the recommendation of a single specific soil action level for each radionuclide. The sole criterion, according to some Panel members, should be health risk. Till and his team, in contrast, stressed that economic and socio-political factors should also be taken into account and that their work should lead to a methodology rather than a specific RSAL. And the methodology must be based on stochastic procedures, incorporating probability distributions as input and output. Even with the relatively high level of technical expertise represented on the RSALOP, Till and colleagues experienced difficulties in communicating the meaning of the probabilistic concepts that were central to their methodology. According to Till, the process was “painstakingly tedious and time consuming, but in the end it proved to be a vital element of the project’ success.”

In addition to the difficulties of dealing with probabilistic concepts and models, the Panel and the *RAC* consultants also had to tackle the more concrete and politically sensitive problem of defining exposure scenarios for possible future site uses. This part of the task was perfectly suited to Panel members, of course, and, through them, members of the RFCAB, and, ultimately, the general public. According to Till, there were significant differences among Panel members regarding beliefs about possible future events. A good deal of time was devoted, by both Panel members and the *RAC* team, to discussions of exposure scenarios, particularly to breathing rates and soil ingestion rates. Outside experts were also consulted. Till called these discussions the most difficult of the entire project. In the end, three scenarios were selected to form the basis of RSAL calculations: (1) a rancher who lived onsite and downwind from the most highly contaminated area, (2) a child of the rancher who lived at the same location as the rancher, and (3) an infant of the rancher.

4. *Methodology*

This task encompasses the project as a whole, reflecting the position advocated by the *RAC* team that the overall goal of the project should be the selection of a methodology for calculating RSALs, as opposed to recommending specific RSALs. Since methodological issues are discussed in the reports produced for the other specific tasks, no separate report was published for this general task.

5. *Independent calculation of RSALs*

The report for this task presents the results of *RAC*’s independent assessment of RSALs for the selected exposure scenarios.

6. *Soil sampling protocols*

In December 1999, *RAC* released a report that reviewed the current site sampling program and procedures and provided recommendations for the development of a sampling protocol for future use at the site.

7. *Interaction with the Actinide Migration Panel*

Toward the goal of developing the best possible approach to the closure of the Rocky Flats site, the Actinide Migration Panel (AMP) gathered state-of-the-art knowledge on the behaviour and mobility of actinides in the environment. To take advantage of this effort in their own work, both RSALOP members and *RAC* consultants regularly attended AMP meetings.

8. *Public involvement*

The public was invited to attend the monthly meetings between the RSALOP and the *RAC* team. In addition, three public meetings were held at key points to obtain reactions from the community on all phases of the technical review.

The eight project tasks and the constructive interaction between the RSALOP and the *RAC* team reflected the general scientific/academic orientation of the Panel. Another indication of the Panel's overall approach was its formation of a Peer Review Team made up of five nationally recognised experts in relevant fields. This Team provided ongoing review and comments on all documents produced by *RAC*. According to John Till, this peer review process contributed to the quality of the consultants' work. Till cites the specific instance of peer reviewers calling *RAC*'s attention to the neglected impacts of fire on their calculations. *RAC* responded in writing to every comment provided by the peer reviewers, and the responses were in turn reviewed by the RSALOP. This continuing interaction throughout the project contributed significantly to the Panel's growing confidence in *RAC*'s technical approach.

Assessment of the RSALOP/*RAC* collaboration

In a summary statement on the project, John Till highlights both success and failure:

The primary objective of this project was to calculate a radionuclide soil action level for cleanup at the Rocky Flats Environmental Technology Site. The project was performed with oversight and input from a Panel made up of community and government representatives to improve the acceptability of the results as a decision-making tool for establishing a cleanup level of the site. The results were presented as probability curves of possible values for several of the most restrictive exposure scenarios. Assuming a dose limit of 0.15 mSv y^{-1} and taking uncertainties into account, the results indicated a range of radionuclide soil action levels between about 700 and 2 000 Bq kg^{-1} – assuming a 10% probability level results in a nominal value for a radionuclide soil action level of about 1 300 Bq kg^{-1} . Although this result formed the technical foundation for a soil action level for cleanup based strictly on meeting a specified level for permissible exposure to radiation, it most likely will be given further consideration by accounting for economic and socio-political factors that were not addressed in this study. (Till & Meyer, 2001, pp. 377, 378)

The project was very successful within its restricted mandate: RSALs were calculated and recommended to Rocky Flats management. This was a significant achievement that the development of trust and confidence between the RSALOP and the RAC team made possible. The trust between the two groups was based primarily on shared respect for scientific/academic values. Both groups believed that the best approach to Rocky Flats cleanup was one based on the best available scientific and technical information. And both groups also believed that the best approach to obtaining the best scientific and technical information was one that was open to criticism and correction from independent, qualified individuals. So long as outside critics shared their scientific/academic values, the RSALOP and RAC would listen to what they had to say and take account of it. That is, broader participation in the process – by *qualified* individuals/groups – can lead to better, more technically defensible results. Although the specific results of the project were not universally accepted – either by DOE or by public critics – the open process followed by the RSALOP and RAC certainly contributed to acceptance of the general approach by the wider public.

Within the context of scientific and technical discussion/debate, this project was very successful in demonstrating the power of graphic presentations. Here is John Till describing one such presentation:

The technical approach provided a series of probability curves based on the different scenarios developed with the assistance of the Panel. One key feature considered was the occurrence of a prairie grass fire. A fire could significantly affect the amount of vegetation present and, thus, increase subsequent resuspension. The fire was accounted for in the different scenarios using a probabilistic approach. (The figure) is a composite graphic illustrating the most restrictive scenarios and the importance of considering the prairie fire. A probability level of 1 implies that the dose limit will be exceeded. Although a 10% probability level was used in our calculations because this level represents generally acceptable scientific levels of uncertainty, it was stressed to the Panel that it could change the probability level to whatever value best reflected the concerns of the community.

To better visualise this range of radionuclide soil action levels, (the figure) is underlain with a spectrum that expands in both directions around $1\ 200\ \text{Bq kg}^{-1}$, which is about where the rancher curve intersects the 10% probability level. The spectrum is darker near the centre and lighter farther out. The graphic suggests a range of possible radionuclide soil action levels between about 700 and $2\ 000\ \text{Bq kg}^{-1}$. Although there is no quantitative basis for this range, it is apparent that going too far in either direction from the centre of the spectrum can potentially be problematic for a variety of reasons. Radionuclide soil action levels that are significantly lower may correspond to overly conservative scenario descriptions and may incur significantly greater costs than can be justified. On the other hand, radionuclide soil action levels that are significantly larger lead to a high probability of exceeding the prescribed dose limit and could impact human health. This representation of probability curves greatly enhanced the Panel's understanding of our results and aided in their selection of a soil action level for cleanup at Rocky Flats. (Till & Sharp, n.d., p. 5)

The colourful graphics employed by the RAC team were very effective in helping to communicate complex, probabilistic technical information. But it must be kept in mind that the audience for these presentations was generally technically sophisticated, if not in the specific topic being explained. Also, the RSALOP was eager to learn; they saw that becoming familiar with and learning to understand relevant technical issues was central to their mandate as representatives of the RFCAB and the wider public.

The successes of this project – the establishment of trust, the open discussion of highly technical issues, the development of a methodology to calculate RSALs – all depended significantly on the narrowness of the context in which the project took place. That narrow context is also the source of the project’s failures. One specific shortcoming, identified by John Till, was the failure (because excluded from the mandate) to consider RSALs in conjunction with economic and socio-political factors. Another failure mentioned by Till was a failure to plan and provide for the implementation of the results of the project. Not only was there no budget to support possible implementation efforts, there was no provision for implementation in the agreement with DOE and the state and federal regulators. Instead of accepting the work of the RSALOP and RAC, DOE and the regulators performed their own reassessment of the RSALs. Although not yet officially announced (as of December 2002), DOE officials have indicated that the final RSALs will be close to those recommended by the RSALOP and RAC.

A general failure of the project, again stemming from the narrowness of its mandate, was its inability to generate much interest or involvement in the wider public. In an important sense, this lack of public involvement is not a failure at all. It can be seen as a triumph of efficient representation, of those who are qualified and motivated representing those who are affected but either not qualified or not motivated. Still, it is a stated goal of both the RFCAB and the RSALOP to involve the wider public. The RFCAB undertakes many routine activities aimed at increasing public involvement, such as placing advertisements for meetings on a monthly basis, sending monthly meeting notices to a mailing list, publishing a newsletter, maintaining an Internet web page, etc. Among the 30 attendees at a recent meeting, however, there was only one independent member of the general public. Given the realities of daily life, most people, except in times of crisis, seem to be willing to rely on trusted representatives to do most of their public participating for them.

In sum, the project was a significant success within the boundaries of its mandate. And without those clearly defined boundaries, success may not have been possible.

Conclusions and lessons learned

As with every case study, the specific historical and cultural context of the Rocky Flats radionuclide soil action level controversy made possible – and set limits on – successful stakeholder involvement. Nonetheless, the Rocky Flats case suggests several lessons that may prove valuable in other risk management contexts.

The context of Rocky Flats

The most significant event in the history of Rocky Flats was the end of the Cold War, which led to the transformation of mission from plutonium production to cleanup. During the production period, the concerns of public critics of Rocky Flats and those of DOE were diametrically opposed. DOE was in the business of producing dangerous weapons, with the collateral production of dangerous wastes. Public opposition was based not only on environmental concerns but also – particularly for the broader public outside the vicinity of the plant – on nuclear weapons and war concerns. When DOE stopped making weapons and waste and started planning for cleanup and closing, it, in effect, ceded victory to its former opponents and joined them in working toward goals that everyone (at Rocky Flats, if not at the places to which Rocky Flats wastes were to be shipped) endorsed. There was broad consensus on a shared set of values; confrontation had been replaced by co-operation.

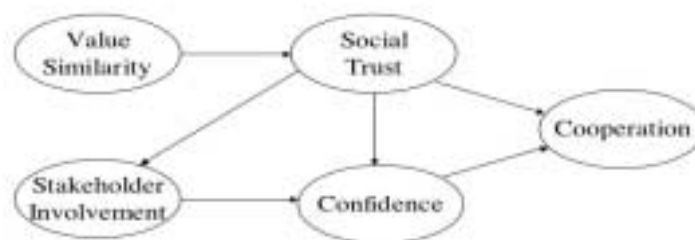
When the environment of its operations changed, DOE adapted appropriately for the most part, as did their former opponents. Of course, the consensus that evolved was not all encompassing. Public concerns, as represented by the RFCAB and local governments, centred on public health, in the present and far into the future. The public wanted the site to be as clean as practically possible. DOE, on the other hand, had to be concerned with the costs of the cleanup, and the workers on the site (still 5 000 during the cleanup phase) were concerned about keeping their jobs. The disputes during cleanup, then, were totally different from those during production. They were not about basic values; they were about tradeoffs between values – costs and cleanliness – that everyone agreed were important. This is the context within which the dispute over RSALs took place.

Understanding stakeholder involvement at Rocky Flats

Stakeholder involvement in the radionuclide soil action level controversy at Rocky Flats was successful because it was based in, and legitimised by, a relationship of mutual trust that had been established, first, between the RFCAB and DOE, and, second, between the RSALOP and RAC. The RFCAB and DOE were able to work co-operatively because they were working toward the same goal, the cleanup of Rocky Flats. The scope of their trust was limited, of course, and those limits were tested in the radionuclide soil action level controversy. Still, in that controversy, the RFCAB and DOE were able to agree on constituting the RSALOP, trusting it to manage a process acceptable to both groups. In addition to sharing the goal of a clean Rocky Flats, the Advisory Board and the Panel also shared with DOE a broad acceptance of the efficacy and legitimacy of scientific procedures. This was demonstrated throughout the collaborative process carried out by the RSALOP and RAC.

The successful stakeholder involvement process at Rocky Flats can be understood within the general model of stakeholder involvement shown below:

A general model of stakeholder involvement



This model, derived from a general theory of social trust (Earle & Cvetkovich, 1995; Earle, Siegrist, & Gutscher, 2002), shows that successful stakeholder involvement is dependent on the prior establishment of social trust. In other words, there is nothing in stakeholder involvement procedures, *themselves*, that will lead to confidence in the good behaviour of the other and co-operation between groups. The value of stakeholder procedures, such as public involvement in advisory groups, is interpreted within the context of existing social relations. If those relations are distrustful, as was the

case in Cold War Rocky Flats, no amount of involvement or advice giving will lead to confidence and co-operation. Once trust is established, however, stakeholder involvement can be very effective in building confidence in the other, leading to co-operation. How is trust established? As the model shows, social trust is based on shared values. Thus, a clear demonstration that two groups are pursuing the same goal, as was the case in post-Cold War Rocky Flats, can lead to trusting relations, which in turn can provide the context for productive stakeholder involvement and mutually beneficial co-operation.

The Rocky Flats radionuclide soil action level controversy is a prime example of what Charnley (2000) has called *Democratic Science* and Beierle and Cayford (2002) have called *Democracy in Practice*. As outlined by Charnley, the process involves the following steps:

1. Stakeholder values help clarify concerns about potential risks and risk management goals.
2. Questions that must be answered to address stakeholder concerns are articulated and the factual information needed to answer those questions is identified.
3. Stakeholders then identify and agree on whom should be responsible for obtaining the needed factual information.
4. After the needed scientific information is obtained, it is combined with other information and used either to re-frame the problem and risk management goals or to guide decision-making.

The democratic ideals articulated by Charnley and by Beierle and Cayford are values shared by many stakeholders and by many risk managers. The activation of these ideals, however, requires – as our model of stakeholder involvement shows – that specific stakeholders and specific risk managers share certain specific values. Trust and successful stakeholder involvement depend less on agreement on general, abstract formalities than they do on agreement on local, concrete concerns.

The lessons of Rocky Flats

In this report, 8 key events in the history of the Rocky Flats radionuclide soil action level controversy were highlighted:

1. The nationwide transition from Cold War secrecy (based on opposing values) to post-Cold War openness (based similar values, at least in part).
2. The establishment by DOE of site-specific advisory boards, including the RFCAB, to provide advice to DOE and other agencies and to promote public involvement.
3. The announcement by DOE of interim RSALs for Rocky Flats.
4. The expression, through the RFCAB and other organisations, of public concern over the interim RSALs.
5. The formation of the RSALOP.
6. The hiring of RAC.

7. The collaborative interaction between the RSALOP and RAC, resulting in a recommended methodology for calculating RSALs for Rocky Flats.
8. The implementation of the project results (or lack thereof).

This series of events reveals the three general lessons of Rocky Flats:

1. Absent a basis in shared values, collaborative public involvement in the management of radiological hazards is not possible.
2. Given a basis in shared values, collaborative public involvement can lead to improved solutions to the management of radiological hazards.
3. Risk managers should therefore seek to understand the values of public stakeholders and to identify ways, through stakeholder involvement, that those values can be incorporated in management practice.

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THE ETHOS PROJECT FOR POST-ACCIDENT REHABILITATION IN THE AREA OF BELARUS CONTAMINATED BY THE CHERNOBYL DISASTER

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1. Introduction

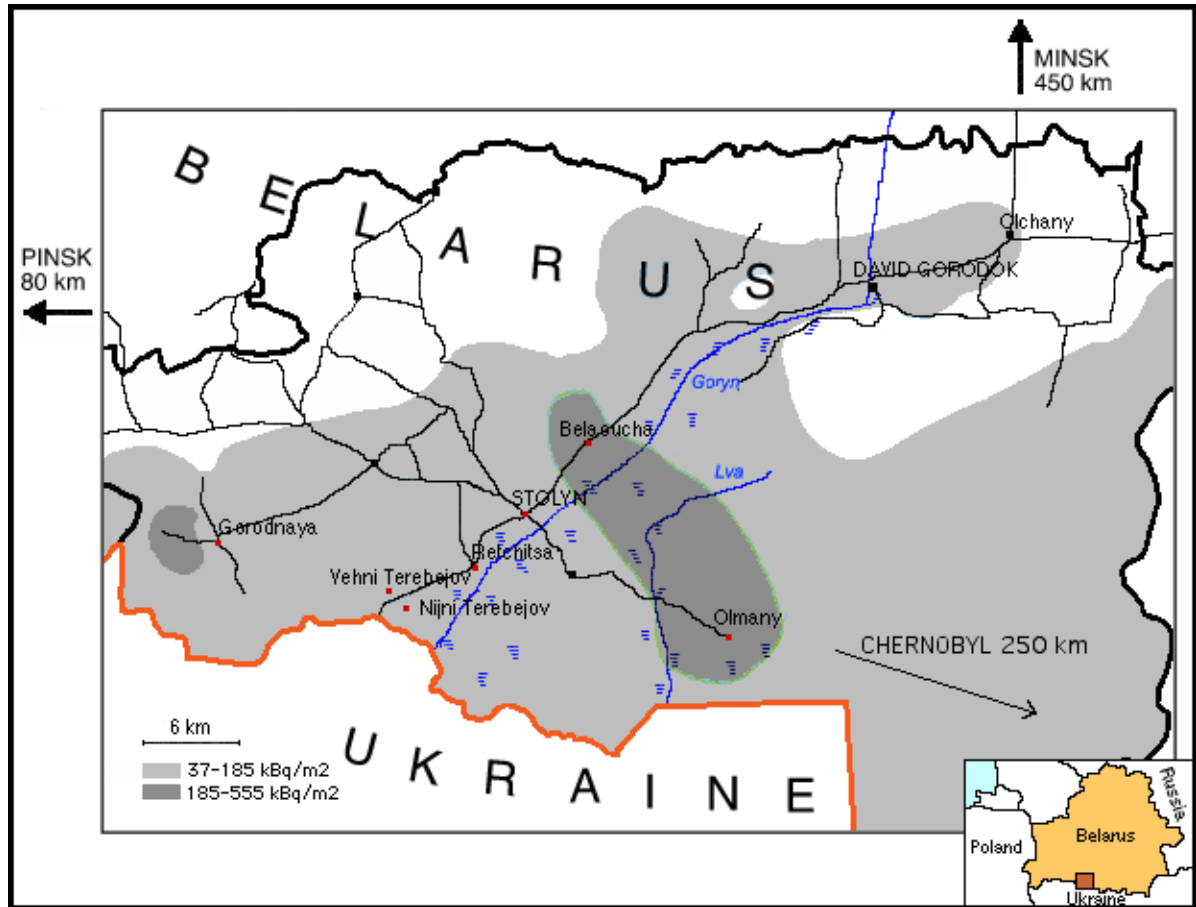
The Chernobyl Nuclear Accident in 1986 has had a significant impact locally, regionally and, indeed, globally. While the acute health effects of the accident are perhaps not as serious as had been feared, uncertainties remain as to the consequences of prolonged exposure to low doses of radiation. Beyond that, the psychological effect of the accident has been significant if less easy to measure for those still living in the areas officially designated as contaminated in Belarus, Russia and Ukraine. And, of course, the broad socio-economic consequences for those areas should not be underestimated.

The impact of the accident was also felt throughout the world in the form of a diminution, even a breakdown, of public confidence in both the nuclear industry and the authorities charged with regulating it and responding to any problems. Nowhere was this more acute than in the regions of Belarus, Russia and Ukraine most directly affected by the contamination. In the context of such a breakdown in confidence the Soviet, and later the post-independence, authorities in these countries needed to make a significant effort to build public trust to a point where confidence returned.

After setting out the background situation in some more detail (section 2), this case study examines the reactions of people in a number of villages in the contaminated area of Belarus to the efforts of those authorities (section 3). It then examines an innovative approach to post-accident rehabilitation implemented by a French team working in the region from 1996 onwards, the ETHOS project (sections 4 and 5), before considering the local people's responses to that new approach (section 6). It then sets out the people's own ideas for future improvements to post-accident rehabilitation efforts as an indication of the way in which the ETHOS approach has had a positive effect on the population's attitude to its long term future in the region (section 7). The study then provides a conceptual analysis of the ETHOS approach (section 8) and examines the extent to which it fits within the UN's Strategy for Recovery (section 9) before drawing conclusions (section 10).

The study draws on documentation produced by the UN, OECD-NEA and the government of Belarus, as well as by the ETHOS project itself. Significantly, however, it is based especially on a series of interviews conducted in July 2002 in Minsk, Stolyn and in some of the villages participating in the ETHOS project – Olmany, Gorodnaya, Nizhni Terebezhov and Belaoucha.

Map – Villages involved in the ETHOS Project, contaminated zone, southern Belarus



Source: ETHOS Project

2. Background

The broad background to this case study is, of course, well known. The fifteenth anniversary of the Chernobyl Nuclear Accident was an opportunity for an appraisal of the response on the part of the authorities to the challenge it presented them, and some valuable data were produced at that time. From the perspective of the international community the UNDP and UNICEF produced a key report (2002), while in Belarus the government Committee responsible for dealing with the consequences of the accident produced a detailed national report (2001). A full up-to-date picture of the situation is therefore readily accessible, and this section offers only an outline by way of orientation. It also serves the purpose, however, of providing an impression of the preoccupations of the international and national authorities with respect to post-accident rehabilitation and therefore offers the chance to compare the assessment of the people (described in section 3) with that of the experts.

On 25 April 1986 an explosion and fire in the number 4 reactor at the Chernobyl nuclear power plant in what is now Ukraine released a substantial amount of radiation to the atmosphere. The bulk of the material expelled during the accident fell out in the immediate vicinity of the plant, but lighter material was carried by the wind causing significant contamination across a wider area of Ukraine, Belarus and Russia. Contamination was also evident to a lesser extent in other parts of Europe and the effects of the accident could be measured throughout the entire northern hemisphere.

The causes of the accident are now accepted to be a combination of flaws in the reactor design and a poor safety culture within the plant that led operators to take risks that a better degree of co-ordination would have revealed and prevented. As the worst civilian nuclear accident in history, the Chernobyl disaster presented the authorities with an unprecedented problem. The immediate containment and more prolonged clean up operations eventually involved as many as 600 000 people (known as liquidators) and some hundreds of thousands of residents were evacuated from their homes and relocated to uncontaminated areas.

There is a lack of data on the nature and level of contamination in the immediate aftermath of the accident, but it is clear that ¹³¹Iodine was the most significant component, leading as it did to an increased incidence of thyroid cancer especially in children under seven, and apparently affecting a much wider area than that generally recognised as contaminated. Beyond the effect on the population from this radio-nuclide, which with a half-life of 8.05 days quickly disappeared, the significant dose in the following months and years in the area now generally regarded as contaminated came from ¹³⁷Caesium, ⁹⁰Strontium and trans-uranium elements. The dose pathways were both external (from radiation emitted by particles falling out on buildings, soil, crops, etc.) and internal (from radiation emitted by contaminated foodstuffs).

The response of the Soviet authorities to the accident was first and foremost to protect people from the radiation that had been released. This took the form of evacuation from a 30 km exclusion zone and then (whether on a compulsory or voluntary basis) from areas manifesting a particular level of ¹³⁷Caesium contamination or a particular average individual dose. Such mass relocations, a feature of Soviet life in earlier decades, were carried out on the basis of a very conservative approach to the acceptable level of exposure. Decontamination took the form, for example, of washing fallout from buildings and streets and removing contaminated topsoil. Meanwhile waterworks were constructed to reduce run-off from contaminated areas, and restrictions were placed on land use in and the movement of food from such contaminated areas. A very significant feature of the Soviet response was compensation or social assistance for people affected by the disaster; amounts varied depending on the level of contamination in the area where an individual lived, whether they had been evacuated, whether they had been involved in the clean-up, and so on.

Chernobyl was then a major point of discussion between Russia and the newly independent states of Belarus and Ukraine when the Soviet Union broke up in 1991 as well as a key feature of internal politics in those countries. There are indications that the costs of compensation and rehabilitation had already been huge during the Soviet era, and national legislatures now approved expenditures often without due regard to available funds. By the time the shortfalls were realised, however, political pressures were such that it was difficult if not impossible to renege on the promises, placing intolerable burdens on national budgets.

Expensive projects detailed in the National Programmes of first the Soviet parliament and then the individual national legislatures include, for example, ongoing compensation schemes, and major resettlement programmes and associated infrastructure. While figures indicate apparently impressive numbers of houses and flats constructed, school places provided or kilometres of gas pipeline laid, the United Nations has recently noted, that “it is difficult to assess the qualitative impact, and hence the cost-effectiveness of the expenditure involved” (UNDP/UNICEF 2002, 30).

Similar concerns attend the ongoing social assistance schemes, which are very complex (ranging over as many as 70 benefits in Belarus and affecting every aspect of life), not always evidently rational (with, for example, some people in less contaminated areas receiving higher benefits) and unequally applied (due, for example, to resource shortages). This approach has had an effect on the ability of government to provide appropriate healthcare as benefits are based on risk

rather than actual need. It is also perceived to have encouraged a dependency culture and even a victim syndrome. Again figures point to apparently successful programmes (for example, the number of free trips to sanatoria for children) but say little about the benefits actually produced on health.

Already by the mid-1990s, then, the governments in the countries affected by the accident were becoming aware of the mismatch between the costs of the rehabilitation programmes they were committed to and the level of resources they had available, as well as of the need to ensure that the level of benefits produced was in accord with the level of cost expended.

This, then, was essentially the context that the ETHOS team entered in 1996 with a radically different way of approaching the question of post-accident rehabilitation. But in order fully to understand the impact of this new approach, it is necessary first of all to consider how the people themselves viewed the response of the authorities.

3. Perceived problems with the approach of the Soviet and post-independence authorities

To criticise the behaviour of the authorities faced with the worst civilian nuclear disaster ever with the benefit of some 17 years of hindsight is of course relatively easy. (Could *any* government claim with certainty that it would have been better able to cope with an accident on the scale of Chernobyl?) But it risks being a pointless exercise unless the aim is to attempt to draw broader lessons for the future. To criticise them on the basis of prevailing *expert* models, however, also risks missing an extremely important lesson that surely needs to be drawn from this event – what was the perception of the *ordinary people* of what the authorities were doing? It is surely clear that a nuclear accident may result in such a catastrophic breakdown in public confidence that the assistance and co-operation that authorities will need from ordinary people as they move to respond will simply not be forthcoming. Unless the response is such that it actively seeks to restore confidence, it may actually be counterproductive. The interviews conducted for this case study suggest that this is precisely what happened in the aftermath of the Chernobyl Nuclear Accident.

The interviews revealed that the approach of the authorities (both Soviet era and post-independence) to the contaminated areas in Belarus is criticised at all levels. The strongest criticism comes from the ordinary people, but even the local authorities themselves concede that things could have been done better. The problems identified can be grouped under the following inter-related headings:

- A top-down approach without proper monitoring or feedback.
- Consultation and measurement processes that were more formal than real.
- An approach that produced unintended side effects.

(a) *A top-down approach without proper monitoring or feedback*

The overall approach of the authorities could best be characterised as *top-down*. Money was allocated at the highest level where it was then, in essence, assumed that the problems had been solved. This attitude arose from the fact that the process of identifying the problems was itself top-down. This could accordingly give rise to the construction of a picture of the situation on the ground quite different from that perceived by the people actually requiring help, and also to a poor understanding of the range of potential solutions actually available.

Sometimes this meant that radical solutions were implemented instead of more measured efforts to meet basic needs of clean food and clean fuel. Such policies frequently ended up being more costly, not least because they produced unintended side effects. A typical example cited by interviewees was a preference on the part of the authorities for the abandonment of contaminated areas without a proper appraisal of whether rehabilitation was in fact possible and without their being able to afford and thus complete the new settlements intended for the people relocated – to say nothing of the psychological problems associated with forcible, and even voluntary, relocation.

Once at the local level, decision making with regard to the expenditure of funds was often poor due to the fact that there was inadequate risk- and cost-benefit analysis. This led to expenditure on relatively large-scale infrastructure projects, which required ongoing investment and which could not therefore be sustained. Examples cited included the construction of new outpatient clinics in small villages that have never been much more than empty shells because of a lack of funds to equip them, instead of developing existing healthcare infrastructure in slightly larger centres.

(b) *Consultation and measurement processes were more formal than real*

It would of course be entirely wrong to suggest that the Soviet and post-independence authorities did not engage in *any* local level consultation as a means of achieving a better characterisation of problems or did not take decisions based on radiological measurement. The evidence of the study suggests, however, that these processes were often carried out in a way that suited bureaucratic forms rather than the needs of the people they were supposed to help.

People in the contaminated areas readily admit that the authorities and experts did come to ask them questions about local conditions and problems but they complain that little real effort was made to understand their position, to find out what *really* concerned those living there. A similar criticism is made of foreign and international organisations, which are perceived to have treated the contaminated areas and their inhabitants in an unduly disengaged manner. No doubt science requires this dispassionate approach but the perception of those living in the contaminated areas was that they were being treated as guinea pigs.

Criticism of radiological measurement in general was a recurring theme in the interviews conducted. While a good deal of such measurement was clearly carried out, people complained that it was not always systematic or well related to local needs, essentially only allowing identification of the most contaminated areas. They also complained that data collected by different agencies was apparently contradictory and that poor communication between the agencies meant that no effort was made to remove or explain apparent inconsistencies. As a consequence it was difficult to relate the data to the identification of problems or the development of solutions. There was also a feeling that measurement of people was often ‘for the sake of measurement’ rather than with any clear healthcare objective in sight, whether at an individual or collective level.

The scientific community, beyond its role in radiological measurement, comes in for similar criticism: a failure to engage properly in the understanding of real problems as opposed to working to its own unexplained agenda. When information was shared it was either not properly explained or perceived to be too basic to be of any real use.

Overall, then, the bureaucratic structure is seen as having favoured *formal* as opposed to *real* outcomes. Reports were required which confirmed the allocation of funds, the expenditure of funds, the numbers of people re-housed, and so on, but none of this ensured that what was being done was actually of any use to the people it was all designed to help. The net effect of this formal and top-down

approach is widely perceived to have been the hugely inefficient expenditure of vast sums of money by the authorities in the years following the accident without a proper understanding of the problems. And beyond that, the lack of proper planning and monitoring is seen to have produced unintended side effects.

(c) An approach that produced unintended side effects

At its most basic, the overall approach of the Soviet and post-independence authorities is frequently criticised by interviewees for its incoherence and inconsistency such that near neighbours could be in receipt of quite different levels of benefit for no readily understandable, or at least no clearly explained, reason. Beyond that, the fact that benefits were linked to levels of exposure seems in some cases to have led to irresponsible behaviour, with reports of people deliberately increasing their exposure to radiation with a view to receiving higher-level benefits. It was also suggested that even if the system was widely perceived to be incoherent or ill adapted to the problems at hand, the fact that people were actually receiving money or other benefits from it meant that there was little incentive to reform it.

Perhaps the most frequently cited unintended side effect relates to the policy of offering children in the contaminated areas trips to sanatoriums as a means of reducing the total radiation dose they receive in the course of a year. A typical child might go on two such trips a year, each lasting 21 days. This certainly looks like a good idea but its implementation may indeed be making matters worse. First of all, the trips are organised during the academic term when the children are in any case most of the time in relatively clean schools. This leaves them at home during the summer holidays when they often spend time in the forests or swimming in the many ponds, both of which are more likely to be contaminated. And beyond this failure to address adequately the dose issue it is explicitly designed to respond to, the policy is also perceived to be having an adverse effect on the children's education, thus affecting life chances in an area where prospects are already diminished. Again, however, it was suggested that the unhelpful facts relating to dose are being ignored because too many people feel they are benefiting from it as it stands: for example, bureaucrats who can point to the number of children sent on trips – again a symptom of a formal and top-down approach.

In conclusion, then, it can be said that there is considerable overlap between the assessment of the situation provided, for example, by the recent UN report and the perception of the local people who directly experienced the various dimensions of the authorities' response. Significantly, however, there is in the people's assessment also an indication of a more fundamental problem than simple bureaucratic irrationality and inefficiency – the fact that the authorities behaved the way they did meant that they failed to make any headway towards the restoration of the confidence lost in the aftermath of the accident. Not only, therefore, had the authorities lost the quotidian and mundane popular acceptance of the fact of nuclear power, their costly efforts at a response were regarded by those they were supposed to benefit as exacerbating rather than solving the problems.

It is necessary, of course, to reiterate the unprecedented scale and nature of the challenge facing the authorities and to ask whether any country would have fared significantly better.

4. The ETHOS approach

It was into this context that a European-funded team of French radiologists and other experts arrived in Belarus in 1996. They were very much aware that problems existed in the contaminated areas beyond the obvious radiological issues and the question of the efficiency of the response by the

authorities. They had seen, for example, that surveys of the population in these areas in the early 1990s had revealed:

- widespread social and psychological effects arising from concerns about the effects on the environment and especially on the health of children;
- a perception that quality of life along a variety of axes was irreversibly reduced;
- a feeling of an inability to avoid radiological hazards;
- a general feeling of a loss of control due to a lack of trust in the authorities and in experts;
- a feeling that experts and authorities who played down the risks associated with the accident and the contamination were in fact denying the risks.

Significantly, however, the team took the view that these were not simply side issues to the main task of post-accident rehabilitation, but rather fundamental problems that were intimately bound up with that task. In short, they believed that the failure of authorities and experts to *build trust* in the aftermath of the loss of confidence occasioned by the accident was actually standing in the way of reconstruction and rehabilitation. In a sense, it would not matter what the authorities did, however well informed or well intentioned it might be, because the people they were attempting to help simply did not trust them. It is important to recognise that the authorities, both Soviet and post-independence, as well as international experts, were not unaware of the psychological dimension of the situation. But their response to it was not well judged to address the root cause. Rather by treating the symptoms as a medical problem they actually served to exacerbate the situation.

The view of the French team by contrast was that the population needed to feel that they had some control over their lives and enjoyed a level of protection that they could regard as acceptable. The team understood the so-called psychological symptoms displayed by the population as indicating that this situation had not been achieved. Furthermore, they saw that this situation could not be achieved insofar as the people had lost confidence in the systems around them and did not trust the authorities and experts charged with responding to the crisis. An important consequence of this realisation was that a standard risk communication response was not appropriate. It is true that the characterisation of the risk situation by experts, on one hand, and the population, on the other, was quite different, but this was not due to a lack of understanding on the part of the people which could be addressed simply by educating them about the “true” nature of the risks they faced. The exasperation of experts, both national and international, with the apparent failure of people to take on board the information they were being given was therefore misplaced. There may indeed have been a degree to which effective communication between the two sides was an issue, but this was of minor importance compared to the extent to which the people simply did not trust the experts and the authorities. In such circumstances, it does not really matter much what is communicated or how.

The assessment of the situation by the French team was, therefore, different from that derived from the use of traditional analytical tools, and the responses regarded as appropriate consequently different from those associated with a traditional bureaucratic model. In particular, they perceived that the response of the authorities to date had left certain fundamental problems unresolved.

- a) First of all, the pre-existing response had failed to recognise the extent to which the post-accident situation was characterised by a complex array of interdependent problems. This meant that traditional solutions along any single dimension that did not take

account of the greater complexity were as likely to fail as to succeed. The unintended side effects clearly identified by the local people could therefore be explained and understood; the organisational and disciplinary divisions and distinctions that traditional bureaucratic and expert structures regarded as a virtue actually handicapped them in such a context.

- b) The fact that radioactive contamination is long lasting meant that reinstatement or a return to the status quo ante was not possible. While relocation was a key feature of the initial response, the difficulties caused by the sheer scale of the planned operation meant that even nearly a decade after the accident many people scheduled to be relocated were still in their original homes. Nor were resources for the completion of the original plans likely to become available. In many cases, however, the relocation was not in fact strictly necessary provided people knew how to live in areas with a certain amount of contamination.
- c) People living in the contaminated areas displayed a wide range of successful coping mechanisms and strategies for dealing with the natural hazards that they had faced over a long period of time. The apparent inability to cope in the face of the post-accident situation was due in large part to its unprecedented nature and the fact that people consequently had no experience of it.
- d) The centralised approach to the characterisation of areas as contaminated or clean, as safe or unsafe made sense from a bureaucratic perspective, but it was really too broad-brush when one moved down to the local level where centrally planned solutions had to be implemented, and, by extension, justified. An inability to accommodate local complexities made justification – and therefore implementation – difficult.

This characterisation of the complex post-accident context led the ETHOS team to the following guiding conclusions as they embarked upon their work:

- a) Given the complexity of the post-accident situation, any response itself needed to be adequately complex.
- b) Any solutions developed needed to be responsive to local conditions.
- c) Given the undoubted ability of the local people to adapt to difficult situations and to develop coping mechanisms and strategies, there was a need to provide them with sufficient knowledge and means to allow the emergence and ongoing development of a radiological culture adapted to their environment.
- d) In particular, there was need for a contextualised rather than a centralised approach to radiological protection.

Importantly, given the concerns of traditional analytical and bureaucratic models, the approach envisaged by the ETHOS team would not only deal with the problem of a lack of trust and thus result in strategies that enjoyed greater acceptance on the part of the people; it would also result in the more effective and efficient use of limited resources. This was an ambitious goal, and the guiding principles still rather abstract – albeit closely related to their analysis of the post-accident situation. As a consequence, as the team moved towards the implementation phase, they sought to define more concrete guidelines for the work they would do.

- a) There needed to be a *strong and genuine local involvement* so as to build trust, re-establish confidence and allow people to regain control over their lives. Only in this way could rehabilitation and recovery be achieved.

- b) The approach needed to be *interdisciplinary* in order to cope with the complexity and interdependence of problems and to maintain a clear and strong link between the technical and social dimensions.
- c) The aim must be to *integrate radiological safety* into the concrete issues of daily life rather than to see it as something separate – and even as something that was the responsibility of others. Only in this way could a higher level of overall safety be achieved and with it a better overall quality of life.
- d) The aim must also be to ensure that the local population was *voluntarily committed* to the project.

All of that said, the unprecedented nature of the situation that had posed such problems for the authorities also meant that there was no ready-made methodology for how the team would now proceed. Therefore, having chosen the village of Olmany to launch the project (on the basis both of its location in the rehabilitation zone and of the level of local commitment evident) the team (through interpreters) set about developing the methodology in partnership with the people. In other words, the lesson of the problems encountered by the authorities up to this point had been well learned: where expert and bureaucratic models are confronted with problems with which they have no experience, blind adherence to those models is likely to be sub-optimal at best and an openness to other perspectives is required – especially in situations where there is a need to build trust.

From a series of face-to-face meetings, the team sought to establish the real concerns that the local people had. In other words, the people actually living with the contamination became active in setting the agenda – a situation strongly contrasted with the prior approach where people were the passive recipients of official action. The key question that they had was whether it was possible to stay in the village in the long term and to bring up children there. The team were clear that this was not a question that they could answer for the people, but they could help those who wanted to stay to improve safety and quality of life. On that basis, it became clear that anything the project did must have clear practical objectives. Consequently, six Working Groups were established which sought to develop solutions to problems that the people themselves had identified. These were:

- Radiological protection of children.
- Production of clean milk.
- Marketing of privately produced food.
- Radiological culture through education in school.
- Involvement of young people in rehabilitation.
- Management of domestic radioactive waste.

In each case, the group, which consisted of local volunteers and experts from the French team embarked on a process of collective learning about the nature and extent of the problems they confronted. Thus, there was no sense in which outside experts were imposing an interpretation of the situation on the people, but rather there was a joint effort to assess and characterise the local context in view of the specific objective set for each group. While the experts, therefore, regarded themselves as learning just as much as the local people, the work nevertheless proceeded on the basis of sound science. Thus, in each case, the process began with the radiological measurement of the situation – although not by the experts. Rather they trained and assisted local people to carry out the measurement

themselves and to develop an accurate characterisation of the contamination of their area. This comparatively small effort had a fundamental effect inasmuch as people now both understood and believed the data relating to the safety or otherwise of their situation, and could immediately grasp that the potential existed to continue to live in the village.

With this collective characterisation of the situation complete, the Working Groups proceeded to develop solutions to the problems identified, but importantly with careful regard to the level of resources available locally; the funding for ETHOS was relatively limited and any solutions developed had to be self-sufficient and sustainable. As work progressed, a flexible approach was adopted so that goals and methods could be adapted to the emerging situation. The picture of the situation held by the local people changed progressively from one that was relatively confused to one that was relatively clear and that revealed both positive and negative surprises. As the potential of even quite limited resources emerged, the self-confidence of the people began to return along with the feeling that they were regaining control of their lives. This in turn led to increased participation by local people in the Working Groups and to the Groups seeking new partnerships with stakeholders whom they could see had a contribution to make – including, significantly, the local, regional and national authorities.

5. An example of an ETHOS working group

To gain a clearer picture of how this process operated in practice, it is possible to look in some more detail at one of the Working Groups, that involving mothers in the radiological protection of children.

This Working Group emerged from the recognition of the concerns expressed by especially young mothers at initial meetings organised by the ETHOS team upon their arrival in Belarus. Their worries about the health of their children arose from the uncertainty they faced regarding the cleanliness of the food they were giving them to eat and also from the generally negative assessments of the doctors who came periodically to their schools to examine them. The team discovered that even ten years after the accident the mothers were unable to characterise the levels of contamination or the mechanisms of exposure. The information that undoubtedly existed had either not been shared with the population or at least not in a manner or a form that promoted understanding.

The initial response of the team was to adopt a traditional didactic approach, but they quickly discovered that this was counter-productive. It was not so much that the mothers were unable to understand what they were being told as that they once again felt themselves to be on the receiving end of the actions of outside experts and without any control over what was happening. The presence of a psychologist as well as radiological experts on the team allowed this problem to be rapidly identified and the didactic method abandoned before the trust that was progressively being established was lost.

The team, therefore, adopted the radical approach of involving the mothers directly in the measurement and characterisation of their local environment, beginning with their own houses and gardens, as a means of improving their understanding first of all of the external exposure of children. Using simple and robust dose meters, measurements were made in and around houses and the readings plotted on schematic maps and on graphs using the average ambient background reading in France (0.15 $\mu\text{S/hr}$) as a reference. The principal finding was that practically all measurements within houses fell below the reference value except those taken near stoves due to the presence of ashes. Half of those taken in gardens fell below the reference values, the others relating especially to woodpiles and

manure heaps. Beyond the immediate domestic environment, the highest dose measurements were found in forest areas.

The result of this exercise was the production of a simple dose rate scale that mothers could use to make decisions about how long their children should spend in given locations on the basis of the ambient rate. Where the rate was below 0.15 $\mu\text{S/hr}$ there was no need to take any action; where it fell in the range 0.15 – 1 $\mu\text{S/hr}$ the mothers should reduce the time their children spent in a given location as the dose increased; and where the rate was above 1 $\mu\text{S/hr}$ that location should be avoided except in specific circumstances.

Even if the mothers had previously had a poor understanding of exposure mechanisms, they were aware that internal exposure was potentially more serious than external. In their pre-existing position of uncertainty, however, they were unable to estimate and manage such exposure, except by simply banning certain foods on the basis of blanket advice from the central authorities. Accordingly, in the second phase of the work of this Group, mothers noted down what their children were eating and samples of all the foodstuffs consumed in the village were measured. It became clear that wide variations in diet and in levels of contamination made averages useless. An individual approach was, therefore, adopted with each mother noting diet and taking measurements over a few days that were regarded as representative. These measurements allowed the team to produce a table showing foodstuffs classified according to their sensitivity to contamination. The first category contained highly sensitive foodstuffs which displayed wide variations and high contamination levels; the second contained products with a low degree of sensitivity which displayed low and only slightly variable levels of contamination; and the third contained neutral products which were usually bought from shops and displayed no or only slight contamination.

This table allowed crude predictions to be made about the ingestion of becquerels and revealed that, depending on whether the minimum or maximum contamination values were assumed, the same diet could show a difference in contamination of up to 20 times. The table also showed that such large variations were mainly due to the few products that the authorities had previously classified as potentially dangerous. On the basis of these findings the Working Group produced an internal contamination scale with a view to allowing the mothers to manage the situation. Under 50 Bq/day, the diet was considered to be safe; between 50 and 300 Bq/day, the mothers should aim to reduce the consumption of highly contaminated foodstuffs; and levels above 300 Bq/day should be avoided as far as possible.

The previous official approach was to classify foodstuffs as either “clean” or “dirty” without any chance of taking account of local or seasonal variations. The only apparently safe approach for the mothers was therefore to exclude foods in the “dirty” category. The fact that this category included important foods such as milk led to unbalanced diets because most mothers were unable to afford “clean” milk from the shops. In such circumstances, many mothers had adopted a fatalistic attitude where they simply did not want to know about the levels of contamination. By contrast, the new approach led to a more realistic “annual contamination budget” that allowed them to feed their children a balanced (and affordable) diet while being confident that they were minimising the amount of contamination.

In recognition of the way in which an overly rigid approach on the part of the authorities had failed to recognise knock-on effects of policies on other sectors (or indeed opportunities for more efficient or effective action resulting from a co-ordinated approach), the Working Groups informed each others’ work, with the mothers group, for example, feeding its findings into the work of the groups dealing with clean milk and meat production.

In a third phase, the Working Group sought to establish a new relationship between the mothers and the doctors so that the effectiveness of the new approach could be measured through whole body monitoring. Previously this relationship had been strained as the doctors perceived a downward trend in children's health and blamed the mothers for ignoring official advice, while for their part the mothers struggled to comply with that advice due to concerns about a balanced diet and economic hardship. A new protocol of examination and measurement was agreed and the results revealed a significant reduction in the contamination of children, with an average decrease of more than 50%. This very striking achievement was ultimately attributed to the combined efforts of all the Working Groups rather than to any one factor as all had played a part in improving the overall radiological culture of the village. Such dramatic improvements also revealed potential flaws with the official policy of providing free holidays for children in sanatoriums outside the contaminated areas. All else equal, a child remaining in the village and subject to the new approach would receive the same dose as a child maintaining the old approach to food, etc. but taking advantage of free trips outside the contaminated area.

It is probably too early to draw firm conclusions about the long-term effects of the approach introduced by the ETHOS project, but all the indications are very encouraging. Furthermore, the team was able to draw some tentative lessons from the experience of this Working Group: when limits are seen as an absolute boundary between "clean" and "dirty" the effects can be negative rather than positive; by contrast developing dose scales in partnership with those who are directly affected encourages an ALARA (as low as reasonably achievable) approach to dose; finally, acceptance of the new approach and its continued use over the long-term is seen to be encouraged by the ability of the people themselves to make their own measurements both of their environment and of foodstuffs so as to have rapid access to accurate and trusted information.

6. ETHOS assessed by its stakeholders

On the basis of such results, it is surely reasonable for the ETHOS team to feel justified in judging their work a success. In terms of improving the quality of life for the people of Olmany and the other villages that joined the project in its second phase, there has been a feeling on their part that they have regained some control over their lives, especially with regard to their understanding of the radiological situation and their ability to reduce their exposure. As regards sustainability, there is evidence of this insofar as those directly involved in the Working Groups have diffused their knowledge and experience through their own networks of friends and family, in addition to the fact that the improvements in the cleanliness of the food being produced have resulted in enhanced economic value and thus a very clear and tangible benefit of adopting the new approach.

Of equal if not greater interest is, of course, the assessment of the project by the people it was designed to benefit, the people who were so disillusioned by the top-down approach of the Soviet and post-independence authorities. The same interviews that gathered attitudes to that approach also sought the views of the people with regard to ETHOS, and these data are considered in the present section.

In contrast to the prior approach adopted by the Soviet and post-independence authorities, that introduced by the ETHOS project is much more favourably regarded at all levels, from the ordinary people in the villages involved right up to the head of the local administration. In particular, the ETHOS approach is praised because it *involved* local people right from the identification of problems, through the collection of data to the taking of decisions.

Whereas the approach adopted by the authorities previously failed to build trust so as to get to a point where confidence was restored, the building of such trust was explicitly referred to throughout the interviews as a key achievement of the ETHOS project. It is important, therefore, to examine the mechanisms by which this trust was built. These can be considered under the following headings identified by the people interviewed:

- Active involvement or inclusion of stakeholders.
- Personal engagement and perseverance of foreign experts.
- Tangible objectives identified and aimed for.
- A real effort to help people understand the position they were in.
- Improved contacts with the outside world.
- A contextual approach.

(a) *Active involvement or inclusion*

Throughout the interviews conducted in the contaminated area a recurring theme was profound appreciation for the fact that the ETHOS project actively *involved* the people it was designed to help. *This indeed was frequently identified as the main reason for the success of the project.* People welcomed the fact that the project allowed them to contribute to the identification and characterisation of problems. They also appreciated the fact that the project demonstrated to them that they had real choices and were allowed to exercise them – an approach that produced a significant shift in attitude from the fatalism that previously characterised the contaminated area. Importantly, they felt that they had a meaningful involvement in the project, that they were being helped to help themselves, and not that they were being used as guinea pigs. This was also expressed as a need to feel that they were being invested in rather than being the passive recipients of humanitarian aid – important as this undoubtedly was in some phases of the crisis. This sort of involvement was frequently described as having inspired people, as having tapped the potential that was always there but which the previous approach had failed to utilise. People readily admitted that they had taken too many things for granted, had believed they simply could not be changed, until the ETHOS project had allowed them to think about their situation more positively. It is worth noting in conclusion that many were keen to emphasise that there was no financial incentive to be involved in ETHOS – people gave of their time and energy because they believed in it. One doctor’s assessment was simply that the best results were achieved when people were engaged through the issues that concerned them most, and that was why ETHOS had succeeded.

(b) *Personal involvement and perseverance of foreign experts*

In contrast to the perception that authorities and experts had previously been remote and uncaring, the foreign experts in the ETHOS team were seen to have shown personal commitment and perseverance, indeed enthusiasm. This was not only evident in their frequent visits and obvious concern for the people they were working with, but also in the fact that they were prepared to take a stand for them vis-à-vis the authorities, for example in winning the release of clean lands for cultivation. That was just one example of the way in which the French team was seen to have cut through the pre-existing indifference of the authorities. Whereas the latter were seen to have no stake

in the area and thus not to care, the French team lived and worked with the people. This personal involvement was also seen as very important in helping to calm people's fears during the economic crisis in Belarus in the mid-1990s – an example of the way in which the approach developed by ETHOS was flexible enough to cope with emergent problems that added to the complexity of the situation.

(c) *Tangible objectives identified and aimed for*

In contrast to the lack of information people previously had about what was being done for them and the frequent feeling that the authorities and experts actually had no clear aim in sight, the ETHOS project's preoccupation with meaningful tangible objectives which the people themselves had helped to frame was identified by many interviewees as a reason for its success and a key building block in the attainment of trust by the French team. Significantly, some in the local administration also held this view, admitting previous mistrust between the people and the authorities and identifying the focus on the achievement of real results as an important factor in the success of ETHOS in overcoming that problem. The use of demonstration projects was especially appreciated and was often identified as a particularly successful means of informing and engaging more people in the overall work. It is one thing to tell people that adopting a particular agricultural practice will minimise radiation and maximise yield and income, it was said, and quite another to show them that it actually works.

(d) *A real effort to help people understand the position they were in*

Again in contrast to the previous lack of understanding and the consequent negative and fatalistic outlook, the ETHOS project's emphasis on ensuring that people understood what was going on was seen as vital in building trust. A frequently cited example was people's direct involvement in radiological measurement so that they could see, understand and, crucially, believe the information produced. Another example was the comparison drawn with the situation in France with regard to background radiation, which helped to put the situation in Belarus into perspective – previously the focus had simply been on the fact that Belarus was contaminated, leading people to feel that the country had, by implication, no future.

(e) *Improved contacts with the outside world*

For people who felt remote and isolated in the contaminated area, the mere presence of foreign experts who did more than simply pass through was already reassuring. More than that, however, the way in which the ETHOS team, whether actively or passively, helped to develop links especially with Western Europe was seen as very significant. Local people felt that they had something in common with people in other places who faced relatively high levels of background radiation. They also felt that others were now treating the aftermath of Chernobyl as a common trans-boundary problem in need of solutions rather than as something they had to suffer alone and essentially without hope.

(f) *A contextual approach*

A very significant factor in the building of trust was seen to be the extent to which the ETHOS approach was contextual and thus allowed a meaningful response to specifically local needs,

which in turn allowed local initiative to re-emerge. Examples of this aspect of the ETHOS approach emerging from the interviews include:

- the taking of systematic measurements and the setting of household level norms with regard to contaminated ashes;
- the development of practical exercises as an integral part of normal school lessons so that pupils could relate what they were learning to their local area and specifically could understand how they could continue to live in that area;
- the development of detailed maps which demonstrated that whole villages should not be regarded simply as contaminated but rather as containing varying levels of contamination and clean areas which once identified could be used strategically to reduce dose;
- a similarly detailed and context-specific approach to the production of food;
- the production of individual dose charts for each child in a kindergarten class so that children and parents could see the effects of different strategies for dose reduction rather than the child simply being part of a nebulous average; and
- the micro-analysis of land in order to identify precisely rather than roughly where it is safe to plant crops.

7. The way forward

Perhaps the clearest indication of the success of the ETHOS approach in effecting a dramatic shift in the outlook of the people with regard to their ability to live in the contaminated areas, however, is the way in which it has stimulated them not only to frame the problems they face and to develop practical solutions, but also to think about the ways in which these solutions can be further improved, and indeed the ways in which the ETHOS approach itself can be strengthened and developed. A striking feature of the interviews conducted, therefore, was the extent to which they revealed that people had been enthused by ETHOS so that they were now proactively looking for ways to enhance their situation further. The following list of just some of the proposals put forward by interviewees is offered by way of exemplifying this new enthusiasm.

(a) *Dissemination – external*

One of the recurring suggestions offered by interviewees for future work was that the success of the ETHOS project should be disseminated throughout the areas affected by radioactive contamination. There was a clear desire to “spread the good news” and to get more people interested – not least as a means of encouraging especially the national authorities to recognise the value of an inclusive approach to post-accident rehabilitation. Concretely, recognising that local people who had been sceptical about the project had changed their minds when they had seen the tangible results that their neighbours could achieve, there were suggestions that any information campaign might usefully use those people leading the healthiest lifestyles as positive role models.

(b) *Dissemination – internal*

Many interviewees recognised that while ETHOS had had a significant impact on the lives of many people in the villages involved, there were still people it had not reached. By and large, the parents of young children were those most likely to be actively involved, but teachers noted that even in this group there were those who remained unconvinced. Here there was evidence of a genuine desire and effort to engage these parents, especially by trying to develop practical means rather than relying on traditional parent-teacher meetings. The group that caused the greatest concern, however, was the older generation. Time and again, interviewees reported that older people were the most resistant to new ideas. Nevertheless, people had ideas as to how they too might be engaged. It had been noted, for example, that sceptical older people had been converted to adopting a safer lifestyle when they had seen the tangible results achieved by a neighbour in terms of producing cleaner milk or better yields of vegetables. In short, it was better to show this group what could be done rather than simply telling them.

(c) *Computer Networking*

Doctors and others working in the villages in the contaminated areas frequently had computers, which they used to assist them in the collection, analysis and dissemination of data for the project. They recognised, however, that if these computers were networked the value of their work could increase exponentially. It was also felt that such a connection would have a psychological benefit in that it would help those individuals to feel part of a wider community and less isolated.

(d) *Resolution of conflicts with official bodies and policies*

The progressive approach adopted by the ETHOS project has inevitably led to some conflicts with official bodies and policies, and there was concern on the part of many interviewees that these should be resolved so that the ETHOS approach might be allowed to continue. Sometimes these conflicts appeared rather mundane but could nevertheless have a significant impact on the sustainability of the project. For example, teachers reported that the demands of the national curriculum (strictly enforced by visiting testing authorities) placed restrictions on the time they could devote to the sort of educational approach to radiological matters they had developed under ETHOS. Although the national curriculum had recently changed to take better account of radiological issues (with ETHOS being identified as a key influence) it was still felt to be insufficient.

(e) *Need for bureaucratic rigidity to be exposed and removed*

The fact that change at the level of the authorities has begun to occur during the period of the ETHOS project does not mean, according to many interviewees, that the old bureaucratic rigidity has finally disappeared. A doctor, for example, reported that while the authorities continued to take a close interest in contamination in milk, the fact that similar regulations did not apply to water meant that he could not get them to take an interest in contamination there despite the measurements he had carried out and the concerns he had about the impact of such contamination on the health of his patients. Meanwhile, others complained about the rigid application of rules relating to land use. In one village, financial constraints meant that certain fields could not be cultivated. The land use rules meant that if this situation continued the fields in question would be withdrawn from use by the authorities and replaced with less fertile land with significantly higher levels of contamination. The effect of this

approach was that if and when the village was in a financial position to extend cultivation, it would be on to land that would have a detrimental effect on health.

(f) Money

A striking feature of the interviews as regards the future development of the ETHOS approach was how infrequently the need for more money was mentioned. Some of the ideas discussed above would undoubtedly require a degree of funding, but the ideas themselves were presented in terms of their tangible and very plausible benefits rather than in terms of the money that would be required. Where more substantial sums were explicitly identified they too were in relation to specific projects or equipment where there was a genuinely felt need. Doctors, for example, bemoaned the dearth of whole body counters and other equipment to carry out more accurate and meaningful research on the sorts of issues and conditions they and the local people were concerned about or felt they could observe but lacked the resources to respond to. Equally teachers who were desperate to develop teaching of a radiological culture lacked the materials to do so.

(g) Children

If any more proof were required as to the extent to which the ETHOS project has had a positive impact on the villages involved it may be found in the reports from teachers concerning the fact that the children in their schools are already thinking about how they will protect *their* children and ensure that *they* can live safely in the contaminated zone. There is certainly no room for complacency, as a continuing trend in rural depopulation shows, but the sort of approach to post-accident rehabilitation developed by ETHOS surely has a greater chance of stemming that trend.

These are just some of the examples of the array of ideas offered by interviewees about how the approach introduced by ETHOS could be further developed. What this demonstrates is the way in which the ETHOS approach engages and stimulates the potential that exists in a population, in a way that traditional methods do not necessarily achieve – and in the case of the immediate post-accident response may actually have served to stifle.

8. Analysing ETHOS

How can the apparent success of ETHOS be accounted for? The key lies in the team's recognition of the nature of the situation they faced: one characterised, first of all, by complexity and the interdependency of problems and thus not easily amenable to traditional centralised expert and bureaucratic responses, and, secondly, by a profound loss of confidence on the part of people in the systems around them as a result of the accident. This fundamental understanding of the difficulties led the team to adopt their radical approach: one characterised by the inclusion of the local people in the assessment of their situation and in decisions about what the appropriate responses could be in that context. In one move, therefore, the ETHOS team had begun to address the problem of complexity and interdependency – by mobilising the beneficiaries of any official action to set priorities at the local level and to establish responses that were sensitive to the possibility of knock-on effects and of synergies – and the problem of the loss of confidence – by acting always so as to build trust and by discontinuing any approach that threatened trust.

While the practical experience of the ETHOS team was crucial to the emergence of the approach they eventually deployed in Belarus, it did not exist in a theoretical vacuum. Many of the

members of the team were also involved in the TRUSTNET project, a EURATOM sponsored concerted action, which, over very much the same period as ETHOS has been considering the ways in which complex risk situations, such as the Chernobyl post-accident environment, are dealt with by society. It would be true to say that there has been a cross-fertilisation of ideas between these two projects with practice informing the development of theory and vice versa. The result is that a conceptual account of the sort of model that the ETHOS approach represents and how it differs from more traditional models is readily available. Explicitly contrasting its ideas with the sort of bureaucratic and technocratic approach discussed in sections 2 and 3 above, the TRUSTNET project developed an alternative paradigm of what it described as risk *governance* that is characterised by *mutual trust* as opposed to a *top-down* structure.

This new paradigm can be summarised as follows:

The Mutual Trust paradigm of risk governance is characterised by broad involvement of the stakeholders in the risk assessment and management process as well as in the justification of hazardous activities. Public Authorities govern as much as possible by framework and process oriented regulations, including a broad participation of the concerned stakeholders. Decision-making is decentralised as much as possible to the relevant local context... Science is no longer presented to the public as an exclusive determining factor in the decision making process. Expertise become pluralistic and available to all parties involved. The Mutual Trust paradigm gives room for open political processes involving the concerned stakeholders to justify the activities giving rise to social concerns in the relevant context. (2000, 15)

The picture of the ETHOS project emerging in the present study can very clearly be identified in this description of the Mutual Trust model. And the knowledge gained of ETHOS can help in answering some of the concerns that would otherwise arise if such a paradigm were described only in the abstract. Take first of all the fact that, in this new approach, decision-making processes are to be open to all concerned stakeholders, from the definition of problems, through the development and implementation of solutions, to their evaluation and revision. Given the problems that have been encountered by the risk communication approach, it might have been felt that any more radical attempt to engage stakeholders in the taking of decisions would have been doomed to failure. But ETHOS shows that the converse can be true. Similar concerns would surely have attended the notion of making expertise available to all parties – such a move would certainly fulfil democratic criteria, but the practical problems look to be significant. Again, ETHOS demonstrates that people have the potential to become involved in the gathering and analysis of quite complex data and to inform their decisions accordingly.

Secondly, while the proposal regarding an emphasis on framework or procedural regulation is very much in tune with current regulatory thinking, as is the emphasis on decentralisation to relevant local contexts (subsidiarity), there would surely have been concerns about the possibility of applying this sort of approach to decisions about risk – not least the apparent suggestion that different levels of risk might have to be tolerated in different contexts. Once again, what appears problematical in the abstract takes on a quite different appearance in practice. ETHOS demonstrates that there are circumstances, perhaps even some of the most challenging circumstances, when such an approach seems to work particularly well.

Thirdly, while there may no longer be much surprise at seeing science lose its role as the overriding factor in discussions about risk, there would surely have been concerns that this repositioning should be accompanied by an appreciation that science remains a uniquely good way of generating knowledge when compared to other possible approaches. Once again, the ETHOS project

shows that in practice science does indeed remain a vital foundation for taking sound decisions in risk contexts. It also shows, however, that these are decisions which are very clearly “trans-scientific” and which cannot, therefore, be answered by science alone, but must also take account of value judgements, economic realities, etc.

Lastly, involving all concerned stakeholders in the justification of hazardous processes or the acceptance of risks may appear, on the face of it, to be entirely uncontroversial, but when looked at more closely would surely be suspected of opening the possibility of paralysing the decision making process as stakeholders demanded, for example, zero risk or absolute guarantees about all future contingencies attending a given situation or activity. Yet again, ETHOS demonstrates that in practice this need not happen. All stakeholders ultimately have an interest in a decision being taken and, when appropriately involved in the collection and analysis of data, recognise the constraints that may exist – including the inability to avoid or continually defer a decision.

In each case, however, it is important to realise that the success of ETHOS depended crucially on the team’s constant awareness of the importance of trust. Inclusion, contextualisation, sharing expertise, and so on, only deliver the benefits promised by TRUSTNET’s new paradigm when all concerned recognise the need to build trust in situations where confidence has been lost or is severely strained.

It is also worth noting that TRUSTNET and ETHOS are not simply isolated examples of this new approach to the governance of risk situations. Funded as they are by the European Commission, these projects and others like them have clearly had an impact on that body’s thinking about the future direction of risk governance. Ideas very similar to those discussed above appear, for example, in the White Paper on European Governance published in July 2001 where the European Commission expresses the intention to produce “guidelines on the collection and use of expert advice in the Commission to provide for the accountability, plurality and integrity of the expertise used” (2001, 19). Further details of Commission thinking in this regard are to be found in the report of one of the Working Groups involved in the preparation of the White Paper, entitled Democratising Expertise and Establishing Scientific Reference Systems. There can be found explicit discussion of the need “to improve the interactions between expertise, policy making and public debate” and the identification of a key action line which aims at “Ensuring access, improving participation and developing intermediary platforms for more transparent and accountable policy making and informed public debate” (2001). Among the themes listed under this action line are the following:

- Participatory procedures for debate on risk issues and their regulation.
- “Soft” co-ordination of participatory mechanisms.
- Intermediary platforms to facilitate the interaction between experts, public, policy makers and the media.
- Broadening and integrating the expertise used in policy making.
- Integrated procedures for risk governance.
- Methods and platforms for “joint problem definition”, taking into account policy and social concerns (2001).

Whatever the challenges posed, therefore, by the sort of approach proposed by the TRUSTNET Mutual Trust paradigm and implemented by ETHOS, it does not appear that the European Commission perceives them to be insurmountable.

The TRUSTNET report itself is at pains to state that the ideas put forward are not intended to be a panacea. The Mutual Trust paradigm is not offered as a blueprint. Rather the report sets out only to contribute to the debate about how society copes with risk and to stimulate further discussion. Nor is the top-down approach simply thrown out once and for all. Rather it is explicitly to be retained where it is the most appropriate way of dealing with risk. Similarly, while the European Commission's Working Group report talks about "democratising" expertise it sets this alongside the aim of "expertising" democracy, ensuring that the best possible information is available in a transparent manner to inclusive decision making processes. The ETHOS project can stand as an example of how these ideas can operate in practice. Furthermore, it can serve to clarify why it is that the TRUSTNET report in an annex discusses the utility of distinguishing clearly between the concepts of *trust* and *confidence* rather than using them interchangeably as tends to happen not only in everyday language but also in more technical discussions. In this regard, the report draws heavily on the ideas of Tim Earle who contributed not only to the TRUSTNET project, but also to the present series of case studies.

In contrast to the traditional assessment of the limitations of the risk communication approach – that it ultimately confronts a too complex array of different logics, rationalities and discourses, too many different ways in which risks can be perceived, assessed and ranked, to allow any integrating or translation mechanism to be easily implemented – Earle suggests that the main reason for its failure is quite different. For him, the problem lies in the fact that "most of the public, most of the time, is more interested in, and preoccupied by, the ordinary, predictable, familiar flow of life's events than in possible, low-likelihood, disruptions in them" (2002, 28). In other words, it is experts who spend more time thinking about disruptions while the public actually seeks to avoid doing so. The net effect of this imbalance, however, is that when something goes wrong and a disruption occurs the public becomes intensely interested in risk – but more specifically in how it might be eliminated and pre-disruption normality regained rather than in a "rational" consideration of the risk itself. Recognising this fact directs attention away from risk perception and risk communication and towards a concern with *confidence* and how it is restored.

In order to understand fully why this shift is perceived to be necessary, we need to consider Earle's definition of confidence:

Confidence is the belief that, based on experience or evidence, certain future events will occur as expected... Our confidence in the constancy of our ways of life is based on information about the performance of persons, organisations, or other aspects of our physical or social environments. (2002, 29-30)

That information may be derived from personal experience or from others and though it may be consciously analysed, it will most often be gathered and acted upon subconsciously, confidence thus becoming the result of familiarity. Occasionally, however, the familiar is disrupted and confidence is lost. Suddenly, it is no longer possible to proceed "on automatic pilot". Instead there is an urgent need to process perhaps considerable amounts of information about the disruptive situation – so much so that it is impossible for any individual to do so alone. Assistance is required from others who are sympathetic to the way of life that has been disrupted. In other words, when confidence has been lost, what is required is *social trust*.

Social trust, therefore, comes into play when uncertainty is confronted, bridging the gap between the old constancy that has been disrupted and the new constancy that is sought. Thus, “social trust is the willingness to make oneself vulnerable to another based on a judgement of similarity of intention or values” (2002, 29-30). One person therefore trusts another whom they judge to share relevant values. Since values are defined by groups those who are trusted are those who are considered to be members of the same group.

Confidence and social trust are accordingly different but related. As regards the precise relationship between them, it can be seen that while trust is a transitory phenomenon, confidence cannot be restored without it. Once confidence has been restored, trust can recede into the background.

And indeed, there is evidence from the ETHOS team that after a period some people became disengaged from the project. While this could have been interpreted negatively as an indication that the project was failing, the evidence rather points in the direction of trust having been built, confidence restored, and people increasingly content that matters that were of concern to them are now being adequately dealt with, whether by their peers in the ETHOS project, or indeed by the authorities who have become progressively involved in the new approach.

9. ETHOS and the UN’s strategy for recovery

Despite the positive assessment and analysis of the ETHOS project contained in this study, all of this would count for nothing if that approach were not perceived to fit with the overarching concerns of the national and international community with respect to the post-accident situation in the areas affected by the Chernobyl Nuclear Accident. In this regard, it is worth considering the extent to which the ETHOS approach fits in with the principal themes of the Strategy for Recovery recently produced by the UN (UNDP/UNICEF 2001).

Five key principles underlie the approach recommended in this strategy:

- An holistic approach.
- Aim to help individuals take control of their lives.
- Allocate resources according to need to ensure efficiency.
- Aim for change that is sustainable and long-term and based on a developmental approach.
- International efforts must support and amplify local, national and voluntary efforts. (2001, 3)

These could almost have been written with the ETHOS project specifically in mind, and a similar close relationship between the Strategy and the project is evident throughout the document. For example, the Strategy calls for inclusive local reviews to map out options for the future in the affected areas (p7); it notes the impossibility of ring-fencing the radiological issue because of the complexity of the situation (p9); it recognises that there has been “little serious consideration... by the research community to ameliorating the psychosocial effects of accidents such as Chernobyl” (p9); it calls for a determined effort “to promote a balanced understanding of the health effects of radiation” because many people are suffering distress due to “ill-founded fears” (p10); it notes that while the economic burden on the state is significant, the beneficial effects felt by individuals is often insignificant,

meaning that there is a need to “promote economic and social recovery and to give individuals and communities greater control over their own destinies” (pp10-11); it recognises that “Public information and education initiatives have been among the least consistently planned and least effective measures” because they have been “one-way top-down” processes resulting in “Strong anxiety and fear of radiation... compounded by mistrust of official information and an inability to interpret available data” (p45); it notes that activities undertaken so far in environmental policy “have failed to increase trust and reduce anxiety” (p46); it recognises the need to link education with practical measures (p47); it stresses the importance of ensuring that pilot projects are rolled into substantive programmes and of avoiding the situation where projects are designed by western experts with no knowledge of the local situation (p72).

It is surely not necessary to spell out the extent to which ETHOS meets these concerns and can thus serve as a model for the recovery strategy envisaged by the UN.

10. Conclusion

This case study of the ETHOS Project for post-accident rehabilitation in the area of Belarus contaminated by the Chernobyl disaster serves to demonstrate that when people’s confidence in the systems around them (technological, regulatory, etc.) has been lost or very severely strained, the response of the authorities must be geared towards the restoration of that confidence if the situation is not in fact to become even more serious. Traditional bureaucratic and expert approaches promise certainty and rationality, but in such circumstances they may not respond to the felt needs of those they are designed to assist. Then, there must be an effort to *build trust*. As the ETHOS example shows, there is no blueprint for how this must be done because each context will have different characteristics. At a minimum, however, all concerned, all with a stake in the situation, will have to embark on a process of collective learning. Thereafter, the degree to which different stakeholders will be involved will vary, but the determining factor for that involvement must be whether it is required for social trust to continue to be built to a point when confidence returns.

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STAKEHOLDER INVOLVEMENT IN THE CANADIAN REVIEW PROCESS FOR URANIUM PRODUCTION PROJECTS IN NORTHERN SASKATCHEWAN

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1. Introduction

This report describes the Canadian environmental review process for uranium production projects as a case study for the purpose of understanding the nature and value of stakeholder involvement in the management of radiological hazards. While the Canadian review process potentially applies to any development, this case study focuses on the assessment of the uranium projects of northern Saskatchewan conducted during the 1990s. It describes the environmental assessment (EA) conducted in the 1990s for six new uranium facilities (including mines and mills and related tailings disposal sites) planned in northern Saskatchewan.

Both the Canadian federal and the Saskatchewan provincial government have extensive environmental review processes that must under law be complete before any major industrial development judged to have potential environmental impacts is undertaken within their respective territories. However, even in those instances where no clear potential environmental impacts are evident, Canadian law mandates “if public concern about the proposal is such that a public review is desirable, the initiating department shall refer the proposal to the Minister for review by a Panel.” (Wh95) As a stakeholder under law, in both Canada and Saskatchewan, the public plays an important role in the environmental review process. To encourage participation and assist the public in its review the two governments may provide funding (as done in this review) to assist qualified individuals or groups to participate in the review process.

The first section of this case study sets the scene. It describes the Saskatchewan uranium mining story, focusing on how the importance of the public stakeholder evolved to become a major component, under law, in the EA process for new uranium mines. This increase in stakeholder involvement opportunities coincided with heightened public concern for the socio-economic impacts of the projects. In the late 1980s both governments were advised by proponents of their intent to develop new uranium mines in northern Saskatchewan. This resulted in Canada and Saskatchewan cooperating in 1991 to establish the *Joint Federal/Provincial Panel on Uranium Mining Developments in Northern Saskatchewan (Canada-Saskatchewan)* (the Panel) to conduct an EA of the proposed projects. This Panel employed a public hearing process for intensive consultation with all stakeholders.

Stakeholders may be defined as “...individuals who have a personal, financial, health, or legal interest in policy or recommendations that affect their well-being or that of their environment”. The environmental impact assessment, or EIA, is a well established process for consulting with all

stakeholders affected by proposed projects – including local governments, labour unions, non-governmental organisations (NGOs), private sector interests, and the impacted populations, both direct and indirect. In Canada both the national and the provincial government are intimately involved in licensing, administering and assessing the environmental impacts of the uranium industry. In this report however, the term “stakeholders” refers to the public, individuals, non-governmental organisations and other environmental interest groups. As is the normal practice in the Canadian review process the term “stakeholder” does not refer to the proponents, the governments, or its agencies. During the environmental review the northern Saskatchewan residents living in the region where uranium mining is conducted (identified as “Northerners”) were recognised as the most important stakeholders in the EA process. More than 75% of the Northerners are Aboriginal people.

The second part of this case study describes the Panel review process. It recounts how the Panel consulted with public stakeholders, and then took into consideration the input and stakeholders concerns in reporting the results of the review and decisions regarding recommendations for development of the uranium projects. It includes a description of how stakeholders were identified and involved in the review process, together with the important outcomes.

In completing its review of each mine project and making decisions to recommend or oppose approval, the Panel weighed the environmental risks versus socio-economic benefits. In summary, the Panel wrote: “After listening carefully, reading widely, and debating at length, we have concluded that the best course is to recommend that the mines be allowed to proceed under conditions that would limit environmental damage and enhance northern benefits.” Furthermore “...we have tried to achieve this objective by making project-specific recommendations.” (Jo97)

Another objective of the Panel was to make it possible for Northerners to continue their traditional lifestyle and maintain their culture. Among other things the project-specific conditions are intended to develop and support consultation with the Northerners, as well as provide them with educational, employment and business opportunities. The Northerners are to be included in monitoring and study activities intended to establish a better understanding of environmental impacts. In addition to recommendations related to socio-economic concerns, the Panel also made recommendations regarding technical aspects of the projects, as well as health, safety and radiation protection and protection of the environment.

The third part of the case study examines the effects of the environmental review. Indications of the relative success of the stakeholder involvement process are given in the opinions expressed in a workshop held in 1998 to review the Panel process. Most participants agreed the Panel hearings contributed by improving projects and developing additional benefits that may not have otherwise occurred.

This process led to the licensing and permitting of the projects by both the federal and provincial governments. By January 2003 new mines have come into production at three (i.e. Dominique-Janine, McArthur, McClean Lake) of the five sites, (i.e. Cigar and Midwest remain in development). The new JEB mill (McClean Lake Project) and the modified Key Lake mill are in operation. By 2003 mining of the Dominique-Janine deposit is complete and the project is being closed.

It is now possible to look at the review process in retrospect and consider to what extent stakeholder input is reflected in the operation of these new projects. Furthermore the environmental review process is still evolving, as various stakeholders (including both governments) continue to review both the function of, and outcomes of the process. The final section of this case study draws some of the general lessons learnt.

2. Uranium mining in Northern Saskatchewan

2.1 *Northern Saskatchewan and its people*

Saskatchewan, one of Canada's 10 provinces (plus 2 territories), has an area of more than 650,000 square kilometres, or 6.5% of Canada's total area. The province lies between 49° and 60°N, and 102° to 110°W, extending nearly 1300 km from the northern border of the USA to the sub-arctic north. Saskatchewan's new uranium mines are located in the Athabasca basin, between 57° and 59°N, and 104° and 110°W. This area, located in the northern limits of the boreal forest, has a sub-arctic continental climate. See Figure 1.

Saskatchewan contributes about 3% of Canada's total population. The great majority of the 1 million inhabitants live in the southerly one-third of the province's primary agricultural region. Only about 3% of this 1 million live in small communities scattered over the 250 000 square kilometer northern portion of the province where uranium mining takes place. Demographically the region's population is 75% Aboriginal people. They represent the Woodland Cree and Dene, both treaty Indians (First Nations), as well as the Metis Nation. Treaty rights in Canada include, among other things, hunting and fishing, access to post-secondary education and special taxation considerations. The traditional Aboriginal ways of living close to the land are still held in high esteem. At the same time, mining in the Athabasca basin has become the primary economic activity and source of employment for the 37 500 residents (1997 estimate) living in northern Saskatchewan.

2.2 *Profile and history of the Saskatchewan uranium industry*

Uranium (U¹) production began in Canada in 1942, first developing in northern Saskatchewan and then Ontario. By the 1980s Canada had become the world's leading uranium producer and exporter. After 40 years, in 1996 uranium mining ended in Ontario. Since then all Canadian production has come from northern Saskatchewan. See Figure 1. The early mines of Saskatchewan (i.e. the Beaverlodge, Gunnar and Lorado mines) were subsequently replaced as the new Rabbit Lake, Cluff Lake and Key Lake deposits were discovered respectively in 1968, 1969 and 1975, followed by Midwest in 1978 and McClean in 1979. Discovery of the Cigar Lake and McArthur River deposits followed in 1983 and 1987, respectively.

These later discoveries are higher grade, higher value ore bodies. While the early Saskatchewan mines were supported by ore bodies grading as low as 0.04% U, the Rabbit Lake deposit had an average grade of 0.27% U. The more recently discovered deposits have average grades between 1 and 20% U. See Table 1. These deposits are often associated with significant concentrations of heavy metals including nickel, arsenic, molybdenum and others. (CI02) Saskatchewan will continue to be the location of the most impressive uranium mines in the world. Over its 15-year life, the Key Lake mine and mill (averaging 2.6%U), was the world's leading producer of uranium. By producing 5 400 metric tonnes (t)U/year, about 73 300 tU were recovered. Although open pit mining of the Key Lake ore bodies is complete, the Key Lake mill is now used to process ores from the McArthur Mine.

All of the deposits that were to be reviewed by the Panel have unusually high grades of greater than 1% U. With average grades around 20% U, McArthur River and Cigar Lake are like no other deposits that have been mined. They are the largest and highest-grade uranium deposits known.

1. A list of abbreviations is included at the end of the report before the list of references.

The very large uranium concentrations and high average grades of the deposits have a major impact on the amount and intensity of associated radiation. For example, the total uranium resource of 313 962 tU (816 million lbs U₃O₈) of the 7 Saskatchewan uranium deposits, (as of 12/31/2001), is accompanied by over 3 872 teraBq Radium. There are respectively, 1 098 and 2 248 teraBq Ra contained in the identified ores of the Cigar Lake and McArthur River deposits. See Figure 2. An additional 1 200 teraBq Ra is contained in tailings from the ores already mined from Cluff Lake and Key Lake. Other tailings also exist in the area. Both the high level of associated radiation and the heavy metals in some of the deposits make it necessary to carefully design and control mining, ore treatment and waste disposal methods.

Cigar Lake and McArthur River also attract attention because they are the first major underground mines to extract high-grade ore in the region. The ores are deep (i.e. 450 to 550 meters), occurring with high-pressure ground water, uncertain rock and mining conditions. Because of the unusually high ore grades, special attention is needed for radiation protection of both miners and mill workers. While nearly all of the uranium (98% or more) will be extracted during processing, most of the associated radiation remains in the tailings, including very large accumulations of long-lived radionuclides such as ²²⁶Ra. See Table 1.

The McArthur River ore is valued at more than C\$7 500/tonne, making it the most valuable ore being mined in the world today. (La02) Even valued at today's low uranium price of about US\$28/kgU the in-ground value of the McArthur River resources of 185 000 tU is about C\$7 billion (US\$5.3billion) as of June 2003.

The high ore grades of the McArthur River and Cigar Lake deposits have other important ramifications. Both McArthur River and Cigar Lake will only need to mine and process 100 to 150 t of ore/day to produce 6 900 tU/year. This is less than the amount that can be produced in one shift at each mine, which helps account for the very small mine and mill staffs. Furthermore, a much smaller volume of tails results than would be left by uranium extraction from lower grade ores.

Occupation and Public Exposure Limits

On the national level, the new Canadian *Nuclear Safety and Control Act* was passed by the Senate on March 1997, and brought into force in May 2000. In anticipating this enforcement, in 1999 the regulator AECEB introduced new regulations incorporating ICRP-60 exposure limits. At that time the maximum allowable occupational limit became 20 millisieverts per year averaging over 5 years, with no one year exceeding 50 millisieverts. The public exposure limit became 1 millisievert per year.

Prior to about 1997 the occupational and public exposure limits for radiation in Saskatchewan were 50 and 5 millisieverts per year, respectively. They were based on the 1977 ICRP-26. By the mid-1990s the province had amended existing surface leases with the industry to incorporate the intent of ICRP-60 and ICRP-65 and had reached an agreement on the details for implementation of the anticipated federal standards.

Figure 1. Map of Saskatchewan indicating the location of Cigar Lake

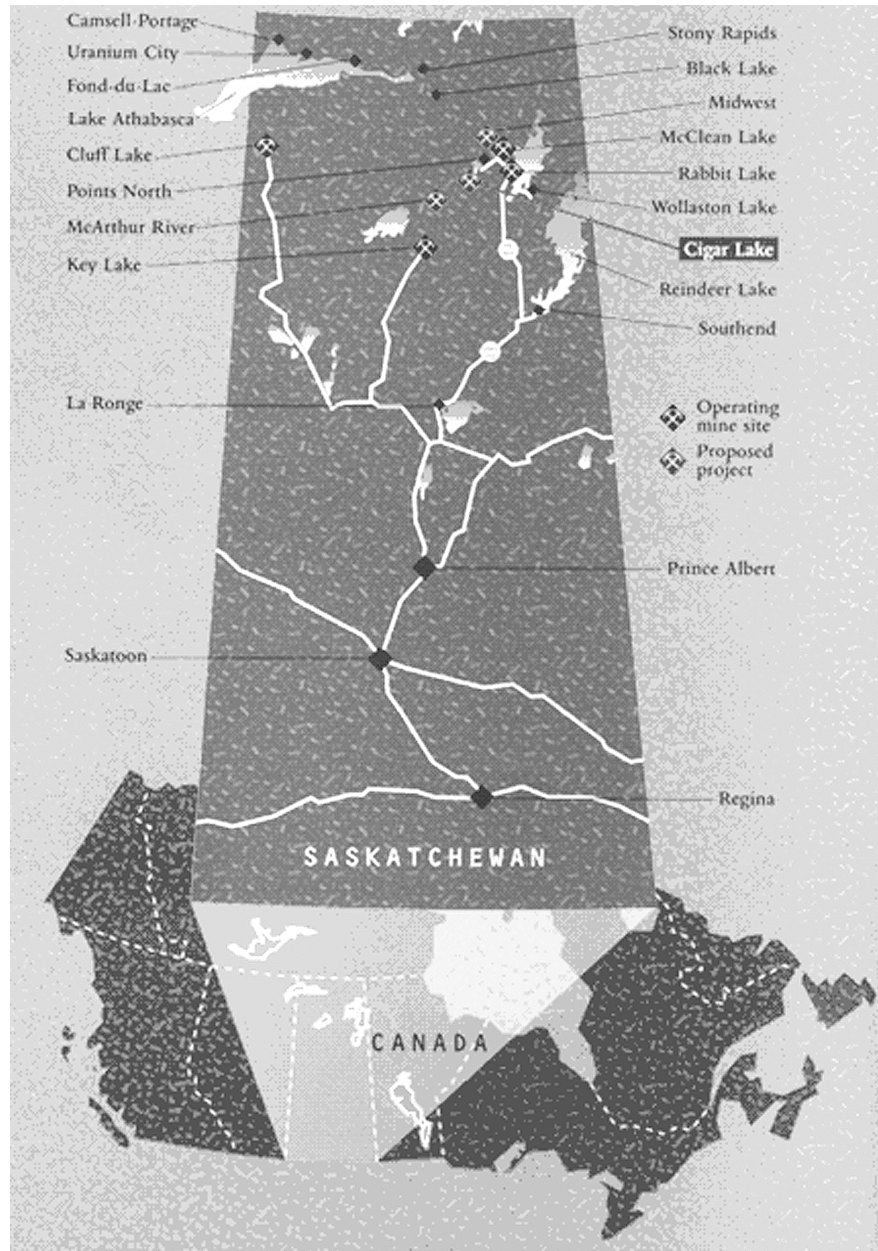
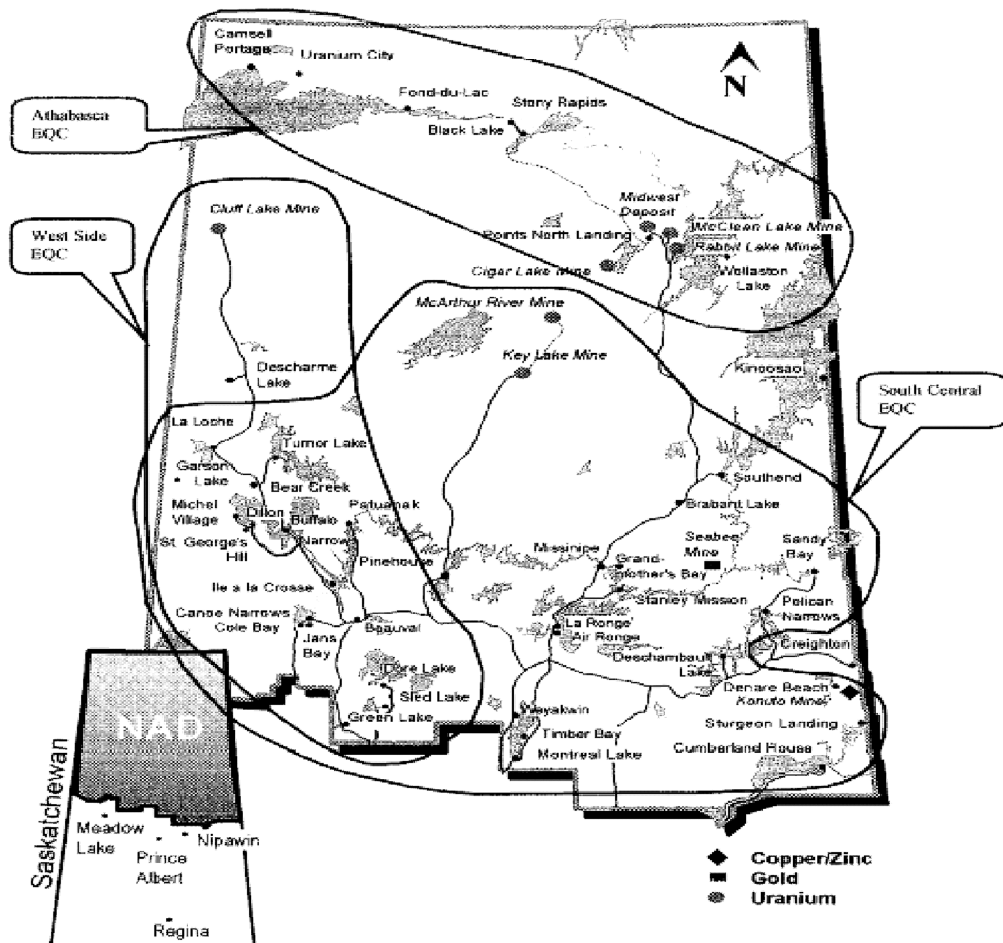


Figure 2. Northern Saskatchewan's Uranium Mines and areas represented on the Environmental Quality Committee



Source: Saskatchewan Post-Secondary Education and Skills Training, La Ronge, October 5, 1998.

Table 1. Saskatchewan's Uranium Reserves, Resources and Associated Source Term
(as of 31 December 2001)

<i>Deposit</i>		Mining	Millions	Average	t U	t ore	Bq Ra
		Method	of	Grade			(teraBq)
			U₃O₈	U₃O₈			
<i>McArthur River</i>		underground	473.8	0.233	182 231	920 125	2 248
<i>Cigar Lake</i>		underground	231.5	0.206	89 038	508 501	1 098
<i>Rabbit Lake</i>		underground	18.9	0.012	7 269	712 670	90
<i>McClean Lake</i>	<i>Sue A,B,C,D</i>	open pit (in situ/ stockpiled)	36.7	0.018	14 115	922 574	174
	<i>McClean Lake</i>	underground	12.9	0.021	4 962	277 957	61
	<i>JEB</i>	stockpiled	0.9	0.05	346	8 145	4
<i>Midwest</i>		underground/ open pit	36	0.045	13 846	361 991	171
<i>Cluff Lake</i>		underground	4.7	0.025	1 808	85 068	22
<i>Key Lake</i>		open pit	0.9	0.005	346	81 448	4
TOTAL URANIUM RESERVES¹			816.3		313 962	3 878 478	
TOTAL TeraBq RADIUM²							3 872

Note 1: Reserves from Ca02b.

Note 2: 1 gram Radium per 3 t U; 1 gram Ra = 0.037 TeraBq.

3. Development of stakeholder involvement in the EIA process

3.1 *Regulatory Background*

Specific provisions exist in the laws of both the Government of Canada and the Province of Saskatchewan for including the public in decisions regarding projects that may impact the environment. The provisions for including the public in such decisions regarding uranium projects developed in the 1970s in response to public protest, blockades and political dissent regarding further development of Saskatchewan uranium resources. (CI02) This dissent arose in reaction to a heritage of orphan uranium production sites, uncontrolled discharges and polluted surface water, the legacy of uranium mining started in the 1940s. Little attention had been paid to environmental issues or waste management related to these operations.

During the period of the review in the 1990s the federal government had overall jurisdiction over Canada's uranium industry through the *Atomic Energy Control Act* of 1946. (Canada's *Nuclear Safety and Control Act* replaced this act in May 2000.) Uranium operations are classified as nuclear facilities, and were controlled by the AECB under the provisions of the Act and the regulations derived from it. Although uranium-mining activities have always been subject to the requirements of the Act and its regulations, a more strict licensing system was put in place in 1976. The AECB issues licenses for the operation of uranium mines after ensuring that they will not have a significant effect on the health and safety of the mine workers and the public, and after reviewing measures designed to ensure adequate protection of the environment.

The AECB has always imposed on its uranium-mining licensees the responsibility of reducing a miner's radiation exposures to levels as low as is reasonably achievable. As time passed the AECB also started regulating waste management practices to ensure that the radiological impact of uranium tailings does not pose any undue public health and environmental risks. However, regulation of the early mines followed the prevailing practice of the times, focusing on radiation safety of project personnel, while providing little protection for the environment. As a result the Gunnar and Lorado mine sites were abandoned without decommissioning and are now considered orphan sites (i.e. no company or other non-governmental organization is responsible for them). In contrast, the Beaverlodge facility has been successfully decommissioned.

3.2 *Canada*

Canada first introduced environmental assessment requirements by cabinet memorandum in the early 1970s. Only federal government works initially required these assessments. Proprietary crown corporations such as Eldorado Nuclear (e.g. a uranium producer) were invited, but not required to participate. It was designed to ensure that the environmental consequences of all project proposals with federal government involvement were assessed for the potential adverse effects early in the planning stage. In 1984, a cabinet Guidelines Order (GO) was approved to clarify the rules, responsibilities and procedures of the *Environmental Assessment and Review Process (EARP)*. In addition to application to federal works, it included any activities regulated by federal laws or agencies. *EARP* remained largely uncontested until 1989/90, when two decisions by the Federal Court of Appeal effectively converted the GO into a legal requirement for rigorous application. The Supreme Court of Canada upheld the constitutionality of the *EARPGO* in 1992, rendering compliance with the Order by all federal government decision-makers a mandatory requirement.

The original process did not require hearings. Meetings were held to inform the public about the projects and questions were answered. The 1977/78-panel review of the Port Granby uranium refinery (e.g. a non-mining) project is reported to be the first review that included hearings. Mandated public involvement substantially increased over the years. Beginning with the Port Granby process, the public was invited to comment on the Environmental Impact Statement (EIS) furnished by the proponent and to speak at the hearings. The EIS guidelines were developed by a steering committee consisting of representatives of the proponent and experts from relevant regulatory agencies. (Fr98)

Canada became the world's leading producer and exporter of uranium during the late 1980s. Since that time the Canadian public became sensitised to numerous issues concerning environmental degradation, ranging from the Chernobyl accident to ozone depletion. It was during this period in 1991, the AECB referred six new Saskatchewan uranium-mining projects for environmental review, pursuant to the *EARPGO*. (Wh95).

The *Canadian Environmental Assessment Act* (CEAA) was brought into force in 1995 replacing *EARP*. The CEAA has four objectives, to: i) ensure that the environmental effects of projects receive careful consideration before responsible authorities take action, ii) encourage those authorities to take actions that promote sustainable development, iii) ensure that projects carried out in Canada or on federal lands do not cause significant adverse environmental effects outside the jurisdictions in which the projects are carried out, and iv) "ensure that there is an opportunity for public participation in the EA process". (Wh95) Four guiding principles are to be followed in applying CEAA, including: Early accountability, accountability, efficiency and cost effectiveness and *open and participatory* processes. (Wh95)

3.3 *Saskatchewan*

In 1976 the province established its own Environmental Impact Assessment Branch in its Environment Ministry. In response to public concerns, the Saskatchewan government (using a public hearing process) established the *Cluff Lake Board of Inquiry* in 1977, under Justice Ed Bayda. The Board's mandate was to review proposals for a uranium mine in the Cluff Lake area and to advise on conditions under which the industry may proceed. In response to the *Board of Inquiry's* 1978 report, the Mines Pollution Control Branch of Saskatchewan Environment and Resource Management was established in 1979 to ensure environmental protection at uranium mine sites. The *Key Lake Board of Inquiry* was established in 1979 to consider the proposal to mine the Key Lake deposit (C102). Both the Cluff Lake and Key Lake Boards of Inquiry were quasi-judicial processes with sworn testimony and cross-examination. (Fr00)

At these reviews, the public expressed concerns over the interveners' proposals to develop new uranium mines in the Athabasca Basin. Topics of concern included environmental protection, the health and safety of workers, economic development, and the benefits to local communities. Both *Boards of Inquiry* found that the measures proposed by the uranium industry were adequate to protect the environmental quality, safeguard occupational health and safety, and meet the requirements of Canadian and Saskatchewan law, regulations and policies in a satisfactory manner.

As a result of these and other non-uranium inquiries, the Government of Saskatchewan established a new *Environmental Assessment Act* in 1980, and created special units within its departments of the Environment and Labour to license and inspect uranium mines. Saskatchewan's EA review and regulatory processes were restructured to accommodate federal/provincial review for new uranium mining developments. (Wh95) A fundamental feature of the 1980 *Act* is to provide the

public with opportunities to review environmental documents, provide comments and advice to the minister, and be consulted by the proponent and/or the government. (Go93c)

The Saskatchewan provincial government allows uranium production to occur taking into consideration that the industry must meet stringent environmental and worker health and safety standards. In meeting these standards mining companies must: Protect the environment; protect the health and safety of workers; and provide an appropriate distribution of socio-economic benefits.

3.4 *Limitations on stakeholder recommendations*

While the laws of both Canada and Saskatchewan assure that the public has a major role in the EA process, there are limits, however to the degree that final decisions of the government are bound by recommendations made by the Panel. For example, a representative of the AECB, the national regulatory body responsible for licensing nuclear activities wrote, "...the intent of Section 3 of the *EARPGO*, the Order under which we (the AECB) referred this (uranium project) to a panel, the "initiating department shall, as early in the planning process as possible and **before irrevocable decisions are taken**, (emphasis in original reference)...refer the proposal to the Minister for public review by a panel." A fundamental premise for the hearings was to allow input, mainly by non-governmental organisations and individuals, into the decisions, which had to be made related to the project."(AECB, Appendix C, HJ98)

Furthermore, there is a specific directive that: "The decisions arising from panel reports are to be made by all Ministers with jurisdiction, including the Minister of the Environment. In making their decisions, the responsible authorities, including Ministers with jurisdiction, must consider the panel report, but are free to consider other sources of information and to make different value judgements." In addition "Upon receipt of a panel report with recommendations, it is the responsibility of the initiating department to decide, in co-operation with other departments, the extent to which the recommendations should become a requirement of the Government of Canada. It is worth stressing that recommendations developed by a panel are advisory to government and to the regulatory agencies." (Wh95)

4. *The environmental review process in the 1990s*

4.1 *Launching the process for new mines*

During the 1980s the Cluff, Key and Rabbit Lake deposits approached the end of their respective mine life as ore reserves would be exhausted during the 1990s. Three companies, both private and crown, were involved (see Table II.). These operators started planning to bring new mines into production. One of the first steps in securing government authorization to proceed with development of a new project is preparing an Environmental Impact Statement (EIS). The proponents therefore submitted proposals for preparing EISs to the Saskatchewan government for the Dominique-Janine, Midwest Joint Venture and McClean Lake projects in 1989. The Saskatchewan Minister of Environment responded by drafting and issuing the EIS Guidelines to the public for the respective projects in late 1989 and early 1990. As required by law, the Minister also gave public notice that the project proponents intended to conduct environmental impact assessments (EIAs) in response to the release of the EIS Guidelines. Preparations were also underway by the government of Canada to conduct an EIA for the projects. Concern that this dual review program would result in much duplication of work led the respective governments to coordinate the review procedures.

Table 2. New Saskatchewan Uranium Mining Projects
(as of 1995, with subsequent changes indicated)

PROJECT/OPERATOR ¹	PROJECT TYPE	OWNERS ² (SHARE %)
Dominique-Janine Extension/ COGEMA Resources Inc.	Mine Extension	COGEMA Resources Inc. (100)
Midwest Project/ Minatco Limited/ (COGEMA Resources Inc. became operator in 1994)	New Joint Production Centre (see McClean)	COGEMA Resources Inc. (56)_(54.8) Denison Mines Limited (19.5)_(0) Uranerz Exploration and Mining Limited (20)_(0) OURD (Canada) Co., Ltd (4.5)_(4.5) Redstone Resources Inc. (0)_(20.7) Tenwest Uranium Inc. (0)_(20.0)
McClean Lake Project/ Minatco Limited (COGEMA Resources Inc. become operator in 1994)	New Joint Production Centre	COGEMA Resources Inc. (70) Denison Mines Limited (22.5) OURD (Canada) Co., Ltd (7.5)
Cigar Lake/Cigar Lake Mining Corporation/ (Cameco Corporation became operator at end of 2001)	New Production Centre	Cameco Corporation (48.75)_(50.025) COGEMA Resources Inc. (36.375)_(37.1) Idemitsu Uranium Exploration Canada Ltd (12.875)_(7.875) Korea Electric Power Corporation (2)_(0) TEPCO Resources Inc. (0)_(5)
McArthur River Project/ Cameco Corporation	New Mine / {Milling at Key Lake}	Cameco Corporation (53.991)_(69.805) Uranerz Exploration and Mining Limited (29.775)_(0) COGEMA Resources Inc. (16.234)_(30.195)

1. Where project operators changed subsequent to 1995 the new operator is identified.
2. The first number following a company name indicates percentage project ownership in 1995. The second number identifies ownership in 2002 (for only those projects where ownership changes have occurred.)
(Table After Whillans, 1995, p. 145; and/or modified by author to reflect subsequent changes.)

In April 1991, while the proponents were preparing their EISs for the three projects, the governments of Canada and Saskatchewan announced that they would jointly review the proposed developments under their respective environmental assessment legislation. In August 1991 *The Joint Federal/Provincial Panel on Proposed Uranium Mining Developments in Northern Saskatchewan (Canada-Saskatchewan)* (the Panel) was established. The Panel was appointed jointly by the federal Minister of the Environment and by the provincial Minister of Saskatchewan Environment and Public Safety to conduct public reviews in compliance with the federal *EARPGO* and the provincial *Environmental Assessment Act*. The governments of Canada and Saskatchewan signed an agreement to share the costs incurred by the reviews, including participant funding costs. (See section 4.4.) The Federal Environmental Assessment Review Office (FEARO) (followed by the succeeding organization, the Canadian Environmental Assessment Agency (CEAA)) administered the review processes on behalf of both the federal and the provincial governments.

4.2 *The panel process in perspective*

The Panel review is a major part of the EA and licensing process. However, other important steps take place both before and following the Panel review. Following referral of the project to the Federal and Provincial assessment offices, an EA is organised only when the responsible office is of the opinion there are potential environmental impacts (or the public insists on holding a review). Once the decision is made to conduct an assessment, scoping sessions are organised to identify key environmental issues and concerns as a basis for preparing the EIS guidelines. The proponent then prepares an EIS in response to the guidelines. Following public hearings the Panel completes its assessment and issues recommendations. The Governments then respond to the Panel report and issue a go/no go decision whether the project should proceed to the licensing stage. The respective Canadian and provincial agencies then conduct the rigorous reviews required for licensing. In Canada during the 1990s the Atomic Energy Control Board (AECB) was the agency responsible for licensing nuclear activities.² Among other things the province is responsible for environmental protection and resource management, labour standards and public health.

Table III summarizes the various stages of the complete environmental review and licensing process. The Joint Panel Review Process is preceded by the stages to the left and followed by the stages to the right.

Table 3. **Stages of the Complete Environmental Review and Licensing Process**

Proponent	Governments	Joint Panel Review Process			Governmental Process	
Proponent refers project to Federal and Provincial Assessment Offices	Governments announce EIA process and invite public to participate	Scoping; Preparation of EIS Guidelines; Proponent prepares/ submits EIS	Public hearings	Panel issues report	Governments respond with go/no go recommendations to proceed to licensing	Federal and Provincial Licensing

4.3 *Panel review process*

In August 1991 the members of the Panel were appointed as follows:

- Chairperson: Dr. Donald Lee, Head of Department of Chemistry, University of Regina, Saskatchewan;
- Dr. James Archibald, Associate Professor of Mining Engineering, Queen's University, Ontario;
- Mr. John Dantourze, Vice-chief, Prince Albert Tribal Council, did not participate in Midwest public hearings and resigned 15 August, 1996;
- Dr. Richard Neal, Associate Dean (Academic) and Professor of Biology, College of Arts and Sciences University of Saskatchewan; and

2. In June 2000, Canada published a new nuclear act and AECB was replaced by the Canadian Nuclear Safety Commission.

- Dr. Annalee Yassi, Associate Professor and Director of Occupational and Environmental Health, Faculty of Medicine University of Manitoba, participated in Midwest public hearings and resigned 1 October 1996.

One of the selection criteria for Panel members was to assure they had no association or specialization with uranium mining. Only three members remained on the Panel from October 1996 to its closure in November 1997, as no replacements were appointed for the two members that resigned. A two-person secretariat composed of representatives from FEARO and Saskatchewan provided technical support to the Panel.

Panel mandate

As authorized by the provisions of respective federal and provincial legislations, officials from FEARO, AECB and Saskatchewan jointly developed terms of reference for the Panel. (See Annex 1, *Final Terms of Reference*). The mandate was clear: “The Panel shall review the environmental, health, safety and socio-economic impacts of the proposed uranium mine developments in Northern Saskatchewan and assess their acceptability.” It further states “However, concerns may be raised by the public which extend beyond the impacts of direct concern to the Panel, and in such cases the Panel will ensure that the public is provided a reasonable opportunity to express these concerns.” As a result, in addition to assessing the principal impacts of the mines, the Panel made wide-ranging recommendations or statements to the governments regarding such topics as sustainable development, alternative energy sources, local and global economics of uranium mining, involvement of northerners in regulatory agencies, foreign ownership of mining, the nuclear fuel cycle, non-proliferation treaty, high level waste disposal, revenue sharing and nuclear non-proliferation. In responding to the Panel both governments addressed many of the issues that are beyond the primary mandate of the review.

Structure of panel reviews

The Panel developed procedures, including the following sequence of activities:

- Scoping sessions define relevant issues (public included for Cigar Lake and McArthur River only).
- Panel issues guidelines for development of an EIS.
- EISs submitted by proponents to Panel.
- Panel releases EISs for public review and comment, usually for 90 days.
- Technical comments submitted to the Panel by the public, NGOs, federal and provincial governments.
- EISs, technical submission and independent studies reviewed by panel to determine if the information provided in the EISs met requirements of project-guidelines:
 - If information complete, Panel considers EIS satisfactory to proceed to public hearing.

- If information incomplete Panel requests additional information from the proponent.
- Any additional information submitted to the Panel is made available for public review prior to holding public hearing.

Public hearings and project guidelines scoping sessions were held variously in 13 communities:

- Uranium City, Fond-du-Lac, Stony Rapids, Black Lake, Wollaston Post, La Ronge, La Loche, Buffalo Narrows, Ile-à-la-Crosse, Pinehouse, Prince Albert, Saskatoon and Regina.

Following completion of public hearings, the Panel reviews all the submissions and then itself reports to:

- Federal Minister of Energy and Natural Resources.
- Federal Minister of Environment.
- Provincial Minister of Environment and Resource Management.

“On receipt of EIS’s from the proponents for each of the projects the Panel released the documents for public review and comment, usually for a period of 90 days. Technical comments submitted to the Panel by the public, interested groups and both federal and provincial governments were reviewed by the Panel to determine if the information provide by the proponents was complete and satisfactory for the Panel to proceed to public hearings. The Panel also had the ability to contract independent studies of the EIS’s. These studies were available for public review.

In the event the Panel judged that the information contained in an EIS was incomplete the Panel requested additional information from the proponent. Any additional information submitted to the Panel was made available for public review prior to the public hearings being held. Following completion of public hearings on a project the Panel reviewed all the submissions and presentations and prepared its report for submission to the federal ministers of Energy and Natural Resources and Environment and the provincial minister of Environment and Resource Management.” (Appendix D of HJ98)

Public hearings

The public hearings were informal, rather than a quasi-judicial process. No opportunity for cross-examination was provided. Oral presentations to the Panel during public hearings were recorded in written form and made available to the public. Hearings commenced with short presentations by corporate representatives giving overviews of the projects. After members of the Panel questioned the corporate representatives, members of the public were invited to do so.

Presentations to the Panel by government, non-government organisations and members of the public were also open to questions from the floor and corporate representatives. (Appendix D of HJ98) The Panel’s decisions to either support or oppose a project were based on consideration for weighing the socio-economic benefits against the environmental detriments.

4.4 *How and when were stakeholder issues identified?*

Stakeholder issues were identified during public hearings held at several locations in seats of government and business centres, as well as in communities throughout the region where the uranium development was planned. The public were free to make both verbal and written presentations to the hearings. At other times the Panel invited written questions, concerns, comments and opinions from the public regarding the proponent's planned developments and activities. The process for identifying public concerns include:

- Scoping meetings for Cigar Lake and McArthur River, (EIS guidelines for the other projects were issued prior to the Panel being established).
- Public meetings.
- Meetings with elected officials (Band Leaders, etc.).
- Meetings with Northern and/or Aboriginal organisations.
- Advertisements placed in Native, Northern and Southern publications.
- Permanent information display boards located in Athabaskan Communities.
- Distribution of information pamphlets.

The Panel was charged with reviewing and analysing this input relative to the proponent's development plans. This information is reflected in the Panel's final reports to the Canadian and Saskatchewan governments.

Public participant funding

In association with the Joint Review a Public Participant Funding Program was established to support participation in the Panel review. A panel (not the Joint Review Panel) evaluated applications for funding received from: individuals, non-government organisations, environmental groups and First Nations. The funds, jointly provided by Canada and Saskatchewan, were used to pay costs of participation in the review process, including fees for expert advice. CEAA issued 47 grants with a total value of C\$419 700.

4.5 *Panel activities and results*

Before completing its work in November 1997, the Panel had conducted public EA reviews of seven uranium mining proposals in northern Saskatchewan, including:

- McArthur River Underground Exploration Program;
- Dominique-Janine Extension, Cluff Lake Mine;
- McClean Lake Mine;
- Midwest Joint Venture Mine;

- McArthur River Mine;
- Cigar Lake Mine; and
- Midwest Mine (subsequent to Midwest Joint Venture Mine).

In completing its mandate the Panel published four environmental review reports addressing the: 1. McArthur River underground exploration program (January 1993), 2. Dominique-Janine Extension, McClean Lake Project, and Midwest Joint Venture (October 1993), 3. McArthur River Project (February 1996), and 4. Midwest Project and Cigar Lake Project (November 1997). The *Cumulative Observations Panel Report* was published as part of the 4th report. Each report gives the results of the Panel's review, including its recommendations for the relevant projects. With the exception of the Midwest Joint Venture (MJV), which it rejected in 1993, the Panel made positive recommendations, subject to site-specific conditions. After a new proponent submitted the MJV project as the revised Midwest Project in November 1994, the Panel gave a positive recommendation for development.

Major health issues associated with the deposits were identified: occupational health and safety, radiation health risks and combined effects of radiation and the high concentrations of heavy metals, such as arsenic, associated with the uranium, epidemiological studies, noise reduction, importance of worker involvement in health and safety and the need for occupational health professionals. Some of the effects of the effluents and tails were thought to be potentially cumulative: 1) through time; 2) in space; 3) through impacts of several different contaminants on a single species; and 4) by impacting one or more species through species alteration. Therefore long term environmental monitoring was implemented. (Jo93)

Once concerns about worker health and safety had been addressed, the principal radiological issue was management of mill tailings, both during and following operations. In its reports the Panel made technical recommendations to assure the isolation of the tailings and limit the risk that contaminants will be released to the environment. To assure that tailings facilities performed as planned, long term monitoring was implemented which includes the participation of local stakeholders. See Annex 2, How clean is clean enough?

In its 1993 report the Panel wrote it "was given a three-fold mandate: to review the environmental, health, safety and socio-economic impacts of the proposed uranium mine developments; to determine from its review whether each project was acceptable or unacceptable; and to provide full opportunities for public consultation and review." (JO93)

During a workshop held in 1998 to review results of the Panel process a representative of the provincial *Environmental Assessment Branch* (HJ98) indicated: "...with seven projects under review over a period of six years, the review process was both lengthy and complex. There were a large number of events and opportunities in which the public, industry and stakeholders participated. This was supported by a program of participant funding that encouraged public participation at several stages, along with a program of public viewing centres for documents, translation into aboriginal languages and other opportunities for both successes and shortcomings, from which lessons can be learned for future reviews."

The vast extent of the review is illustrated by the Panel's comments written at the conclusion of its work in November 1997: "Since the...Panel was created in 1991, it conducted public reviews of a total of seven environmental impact statements.... Included in the reviews were the mining of nine ore bodies, the construction of one mill, the design of two tailings management facilities and the

expansion of the transportation system. In completing its work, the Panel read 42 586 pages of information provided by the proponents; received and read 587 written submissions; listened to and made notes on 764 verbal presentations; generated 10 485 pages of transcripts; commissioned nine technical reports; issued nine requests for additional information; and, wrote six reports. During that time, the Panel spent 84 days in public hearings and participated in 39 Panel meetings, as well as an un-totaled number of conference calls. Altogether the Panel spent 62 days in northern Saskatchewan. An amount the Panel believes is more than any other panel or commission of its kind.” (Jo97)

Over the years the complexity of the review process has grown enormously. The 1970s review of the Key Lake mine/mill (the largest uranium project to date) included an EIS consisting of 2 or 3 volumes numbering less than 500 pages. The McArthur River EIS comprised 15 volumes of 12 000 pages. Following the Panel’s two days of information sessions on McArthur River, the Panel requested further information. This was supplied in a two-volume addendum of 800 pages. (Fr00)

A representative of the proponent indicated the public had nine opportunities to offer comments on the McArthur River Project, three of these in public hearings (i.e. scoping, underground exploration and main project). The added opportunity occurred as the Panel also reviewed the underground exploration project. (Appendix C, HJ98)

4.6 *What was at stake, or “negotiable” in the process? What philosophy guided Panel decisions?*

Put simply, an aboriginal community leader addressed the tension of finding a balance between the urgent desire for jobs and the need for environmental protection. He urged steps to ensure the full participation of people residing in the areas affected by proposed developments. (HJ98)

In conducting its environmental review and reaching its conclusions and recommendations the Panel’s approach was to balance potential benefits against potential risks. It wrote, “it is necessary to minimize the potential for environmental damage and to maximize the likelihood that a substantial portion of the socio-economic benefits derived from uranium mining will remain in northern Saskatchewan. Regional risks, associated with the possible contamination of air, land and water, must be exceeded by socio-economic benefits to justify a continuation or expansion of the uranium industry.”(Jo93)

What was at stake?

At the conclusion of its review the Panel wrote: “Because it is the people of northern Saskatchewan who will experience the greatest impacts of these projects, we have paid particular attention to their concerns. After listening carefully, reading widely, and debating at length, we have concluded that the best course is to recommend that the mines be allowed to proceed under conditions that would limit environmental damage and enhance northern benefits.” (Jo97)

The Panel agreed that the 25% of the population of Saskatchewan opposed to uranium mining, (reflected by an opinion survey conducted pre-October 1993) should not be dismissed as a small group of environmental or anti-nuclear activists. It wrote “The ‘deep ecologist’ view would suggest that a moratorium on all such activity be instituted; persons should strive to live in harmony with the pristine environment, avoiding any potential for disruption. On the other hand, the “pragmatic” view suggests that poverty is currently a greater threat to health of northerners than is radiation.” (Jo93)

It also wrote, “Ideally there should be no necessity to choose between jobs and the environment; sustainable development principles suggest that the two can coexist. Some environmentalists argue that uranium mining could be rejected, with the needed economic development provided through alternative non-mega project options. Uranium mining proponents, on the other hand, insist that the environment can be maintained and restored to an almost pristine state, posing no direct or indirect threats to human health or well-being.”

The philosophy brought to the specific recommendations by the Panel is one of proceeding with cautious development while attempting to ensure the maximum benefit to the people of Saskatchewan, and particularly to the impacted communities. (Jo93)

5. The governmental response to panel recommendations

Following review of the Panel’s reports and recommendations, both the governments of Canada and Saskatchewan responded in writing to every issue raised by the Panel. In so doing they adopted or agreed with many of the Panel’s recommendations, including those regarding the concerns of the public in general, and the northern residents in particular. Many of the concerns expressed in the Panel’s reports are addressed in the operating licenses that were later granted to the uranium projects by the Canadian and Saskatchewan governments.

There was initially little response to the Panel’s 1993 recommendation for increasing revenue sharing with Northerners. By 1997 however, when the Panel’s Cigar Lake report was published (Jo 97), it noted with pleasure that progress has been made on the formation of a Fiscal Table that will permit a tripartite negotiation between Saskatchewan, Canada and FSIN of fiscal matters, including revenue sharing related to northern development.

The Government of Canada supported the Panel’s work, even though the regulatory agencies are not bound by the Panel’s recommendations. In its statement authorizing the Cigar Lake and Midwest projects be considered for licensing, the Government indicated, “The AECB and other federal regulatory agencies will ensure that the Panel’s recommendations related to environmental, technical and safety issues are fully considered as the projects move through each stage of the approval process.” (Na98)

To assist Native northerners in achieving their objectives the Government of Canada also recommended that adequate financial support be provided by provincial and federal governments for the Environmental Quality Committees (EQCs), especially for education and training EQC members in the various issues related to uranium mining and milling; and “...that regulatory agencies support the EQCs actively and invite their participation in, and observation of, regulatory activities; and, that the AECB should be more active in its EQC support and participation.” (Go97)

License application to the AECB for a project that has undergone a public review by the Panel must also undergo a further internal review by AECB staff with contributions from other government agencies such as the federal departments of Environment, Human Resources Development, and Fisheries and Oceans, and their provincial counterparts. These agencies make up what is called the Joint Review Group, (i.e. not the Panel) and this consultative process is known as the Joint Regulatory Process. All relevant comments from the Joint Review Group, and those from the public review panel, are then reflected in a recommendation from AECB staff concerning appropriate licensing action to the five-member executive of the AECB. If the Board is satisfied that a proposal is acceptable with respect to health, safety, security and protection of the environment, a license is issued”. (Wh95)

However, some stakeholders apparently did not accept the limitations on the Panel's recommendations and were dissatisfied with the outcome of the Joint Review process. These stakeholders expressed dissatisfaction with some of the government of Canada's decisions to not support the Panel's recommendations for: maintaining a 5-year moratorium on development of the McClean Lake project; recognizing all of the risks associated with uranium mill tailings disposal; and for showing little concern with respect to nuclear weapons proliferation.

5.1 Change during the 1990s – the projects

The Review Panel met in a dynamic time period during which many changes took place. These included changes in government policy, as well as changes surrounding the uranium projects. Some of these changes involve uranium project ownership, as well as advances in technology, planning and scheduling for the various projects. Therefore the review process took place against a backdrop of changing players, policies and circumstances.

Evolution of government policy, regulation and oversight of uranium mining

The period of the Joint Review Panel (1991-1997) coincided with a period of active development and promulgation of new policies and regulations by both the provincial and federal governments. Many of these changes may have been partly in response to, or with consideration for, development of the new uranium projects. For example, in 1993 Saskatchewan introduced a new *Occupational Health and Safety Act*, followed by a *Radiation Health and Safety Act*. The Government of Canada introduced its *Minerals and Metals Policy* in 1996 recognizing that the operations of the mining industry involve the need to integrate environmental, social and economic considerations in decision-making. The federal Minister of Natural Resources announced a new *Radioactive Waste Policy Framework* in July 1996. This *Framework* consists of a set of principles governing the institutional and financial arrangements for disposal of radioactive waste-by-waste producers and owners.

Because of the ongoing monitoring, investigations and flexible environmental regulations designed to meet changing conditions and new considerations that may emerge, the full impact of the review process will not be known for several decades. Saskatchewan's decommissioning policy is to "use best available technology at the time of decommissioning in support of the objective of best possible environmental protection." (Sa93)

Furthermore, in 1999 the Canadian Environmental Assessment Agency published a "Review of the *Canadian Environmental Assessment Act*, A Discussion Paper for Public Consultation". In addition, planning for, and development of the Cigar Lake mine continues. The project's proponent continues its efforts to inform, as well as consult with the public and other stakeholders regarding plans for the project. (Sc02)

6. The panel process and results

6.1 Defining the panel process and the results

The World Resources Institute identifies two types of EIA process – the **technocratic/regulatory approach** and the **consensus building/management approach**. (Wo95)

The **technocratic/regulatory approach** type has a narrow focus and has the primary purpose of produce information to help agency staff and project sponsors identify the projects and activities that best satisfy pre-ordained policies and standards. Its ultimate objective is to improve project decision-making and to support related regulatory programs. This type of process tends to be highly technical, precise in scope, internally oriented, and advisory. It also tends to be project-focused and to concentrate more on physical environmental impacts than on social or economic issues. Depending on the stage of the planning/design cycle in which it is applied, it may or may not identify and evaluate alternative course of action.

In contrast, the **consensus building/management approach** is a means of integrating environmental with social and economic planning processes and of improving project outcomes by broadening the range of values and concerns taken into account in decision making. Under this approach, EIA is a tool for identifying and exploring issues, as well as resolving them. It tends to be process-focused, externally oriented, and open-ended. Public participation is seen as the heart of the process. Early consideration of basic alternatives, as well as of impact mitigation measures, is a fundamental element of the search for broad-based support for proposed activities.

The Joint Review process followed the second approach. Commenting on its own process, in 1993 the Panel wrote, “Some participants were concerned that undue emphasis would be placed on technical rather than non-technical considerations such as values, theological and spiritual beliefs, morality, and fairness. The panel has endeavoured to ensure that this was not the case.” (Jo93)

In its evaluation of the process, in 1998 the AECB wrote “– it (i.e. the joint review process) met its objective of giving the public the opportunity for input and to have their positions factored into the considerations. The public’s input was apparent throughout the panel reports.” (Appendix C, HJ98)

Not only did the Government of Canada acknowledge the public input in the Panel’s recommendations, it actively supported its work. For example, in authorizing the Cigar Lake and Midwest projects to be considered for licensing, the government indicated, “***The AECB and other federal regulatory agencies will ensure that the Panel’s recommendations related to environmental, technical and safety issues are fully considered as the projects move through each stage of the approval process.***” (Na98)

6.2 Workshop to evaluate the panel review process

In August 1998 the provincial ministry of Saskatchewan Environmental and Resource Management (SERM), in co-operation with CEAA, organised a daylong workshop entitled “Evaluating the process of the Joint Panel Uranium Review in Saskatchewan”. Participants discussed their involvement in the review process and how the experience can contribute to future environmental assessments. The Workshop results are summarized in a report by H.J. Linnen and Associates Ltd. (HJ98) and are described below.

Workshop results: opinion of the chair of the panel

During the workshop Dr. D.G. Lee, the formal head of the Panel, presented a list of some of the benefits that arose directly out of the review process in Saskatchewan, and which he argued would not likely have occurred without the public review.

Environmental benefits

- The number of tailings disposal sites was reduced during the course of the review.
- The monitoring of environmental effects was improved, including establishment of a cumulative effects monitoring group.
- Environmental Quality Committees (EQCs), composed of northern residents, were created with both a monitoring and education mandate.
- Revisions to the Midwest Project led to a better technology, which created an improved mining method.

Health benefits

- An epidemiological study of lung cancer among uranium miners was launched.

Socio-economic benefits

- A Multi-Party Training Plan was created to prepare northern residents for jobs in the mining sector.
 - (Training programs for northerners is now part of trade union agreements at the mining sites).
 - Employment and business opportunities increased significantly in northern Saskatchewan.
 - Multi-year community health studies funded by one of the mining companies demonstrated how the review process helped engender greater understanding and more positive relationships between mining companies and northern communities.

Opinion of NMMS

In response to the Panel's first report (1993) the Saskatchewan government established the *Northern Mines Monitoring Secretariat* (NMMS). It charged NMMS with the responsibility for collecting monitoring information from the provincial Departments of Environment and Resource Management, Labour, Municipal Government and Education, Training and Employment, and for communicating this information to interested groups and individuals. The information includes results from environmental monitoring, as well as socio-economic issues. Acting in a neutral manner, NMMS evaluates and transmits the information in an understandable fashion to Northerners and the rest of the province. (Go93)

NMMS's Manager wrote to the Workshop, "Although the process was lengthy, many positive initiatives resulted. There is a general consensus within the EQCs that the government and the uranium industry may not have otherwise initiated many of the socio-economic and environmental programs that are present today as a result of this assessment and review. Initiatives such as the Cumulative Effects Monitoring Program, the creation of the NMMS and the EQCs, the reform of

Saskatchewan's Health and Safety regulations and the dialogue with the northern leaders to address a long term socio-economic strategy for northern Saskatchewan are the direct result of this review process." (Letter from NMMS, Appendix C, (HJ98))

Annex 3 of this report entitled, "Evolution of Stakeholder Organisations in Northern Saskatchewan" provides an overview of the development of three stakeholder organisations in northern Saskatchewan, including: Athabasca Working Group (AWG), EQCs and NMMS and the Community Vitality Coordinating Committee. The geographic areas represented by the EQCs are shown in Figure 1. In summary, there are several examples of outcomes of the Panel review process that may be directly linked to participation of the public stakeholders.

6.3 Evaluation by SERM

SERM is the provincial ministry responsible for evaluating the environmental impacts of proposed developments – to ensure projects are planned in an environmentally responsible manner, and stakeholders and the public have an opportunity to express their opinions on developments. In a 1998 statement following completion of the Panel's work, SERM indicated this was the first time in Saskatchewan history potential cumulative effects of proposed uranium mine developments had been considered prior to development. (Sa98)

Furthermore, public hearings conducted in both northern and southern communities were a critical part of the process. For example, the Gunnar and Lorado uranium mine sites were operational during the 1950s and 60s. During public hearings, northern residents expressed their desire to have the abandoned sites cleaned up, a sentiment endorsed by the Panel and the Saskatchewan government. Negotiations led to securing cost-shared federal/provincial funding to clean up these sites and optimize training and employment opportunities for northerners in the decommissioning and reclamation process.³

SERM wrote that proposed uranium developments would not be allowed to proceed unless they were judged to adequately protect the environment, provide for the health and safety of workers, and provide an appropriate distribution of socio-economic benefits. All of the Panel's reports contained recommendations on these issues. SERM identified some of the key outcomes:

- new environmental regulations requiring financial assurances for decommissioning all mines;
- implementing a cumulative environmental effects monitoring program for mining facilities;
- establishing the NMMS and community-nominated EQCs to facilitate communication among northern communities, mining companies and government;
- incorporating the ICRP's most recent recommendations on radiation dose limits for workers into Surface Lease Agreements;
- extensive and comprehensive reform of Saskatchewan's legislative health and safety standards;

3. It is noted, that as of October 2002 this activity had not started because federal funding had not yet been forthcoming.

- initiating a long-term epidemiological study of the province's uranium miners;
- creating a Multi-Party Training Plan to train and employ northerners in 60% of all new jobs in the northern mineral industry;
- the number of northerners employed in the mining industry doubled between 1992 and 1997; and
- increasing business opportunities for northerners and northern joint business ventures.

In summary, while the Panel's work ended in 1997, the outcomes of the environmental assessment process are on going and will continue for many years. (Ca99) *The Environmental Assessment Act* requires any changes and/or modifications to approved developments be assessed, including those arising from the Panel's recommendations.

By 2003 project performance indicators are available for some of the new uranium projects.

6.4 Environmental monitoring by stakeholder organisations

One of the outcomes of the Panel's reports was the development of environmental monitoring programs involving residents of northern communities working together with representatives of both the proponents and government agencies.

In 2000 the EQCs were an active part of SERM's Cumulative Effects Monitoring (CEM) Program designed to measure the cumulative or combined environmental effects of Saskatchewan's uranium mines. Three different areas are each monitored once every three years, allowing sufficient interval that any changes would be noticeable. By 2000, results from the CEM program indicated there were no noticeable measurable cumulative effects being created as a result of mining activities in the Cluff Lake region. (En01)

The AWG conducts a monitoring program to show if the environment used by Athabascans is affected by uranium mining operations. To accomplish this in 2000 three uranium companies and seven Athabaskan communities jointly designed and implemented a community-based environmental sampling program. Sampling is carried out in and near the communities where people live, hunt, fish and collect plants for food. With the help of local hunters and other residents, water, air, plants, fish and animal tissues, such as caribou and moose, were sampled in and around the communities. The analysis of hundreds of samples shows no significant difference between "effects" and "reference" stations, and indicates no effects from uranium mining. (At00)

6.4 Performance of McArthur mine

Mining of the McArthur River deposit began in December 1999 using remote-controlled equipment and non-entry mining methods that allow employees access to the high-grade ore without increasing radiation exposure. Monitoring conducted in 2001 showed that employee radiation levels were, on average, less than 7 per cent of the allowable limit. (Co02)

6.5 *Economic impacts*

Saskatchewan's 2001 uranium production of 12 522 t U (32.6 million lbs U₃O₈) was 34% of world production. The output had an approximate value of US\$378 million, based on the price of US\$11.60/pound U₃O₈, the value Canada received for its 2001 uranium exports. The projected value of uranium to be produced in 2005 is between US\$278 million and US\$550 million. These estimates are based on current uranium values and expected 2005 production of between 9 225 t U and 18 450 t U. (Na02)

In addition to ongoing capital and operating costs, by late 2001 the uranium industry in Saskatchewan had invested about C\$⁴1 billion (US\$670 million) to bring the McClean Lake and McArthur River deposits into production. The Cigar Lake and Midwest deposits represent more than C\$500 million (US\$330 million) in further investments. (La02) These investments were projected to create direct and indirect employment opportunities for several hundred workers, many from the largely Aboriginal communities of northern Saskatchewan (Go97). Furthermore the proponent for the McArthur River project anticipates purchasing more than US\$700 million worth of goods and services during the mine's production phase. It was expected that if all of these uranium production projects are given approval and reach their full output potential, uranium export sales revenues in Canada could soon exceed US\$700 million annually, up from the US\$350 million in 1998.

In 2001 the mine staff from the northern Saskatchewan, the majority of which are of aboriginal origin, received C\$35 million in salary and benefits. In addition, payment for C\$180 million worth of goods and services for the uranium industry went to businesses based in northern Saskatchewan.

Uranium production in perspective

Uranium production activities (i.e. mining and milling) constitute the front end of the nuclear fuel cycle. These activities are similar to mining and milling techniques associated with other commodities. Although only one step in the cycle, uranium production activities contribute the largest volume of radioactive fuel cycle wastes. The specific activity of the bulk residues is generally low. The radionuclides in these wastes are naturally occurring and are very widespread in the environment. They are therefore characterised as low activity, high volume waste, but do not pose an acute hazard as are associated with most other steps of the nuclear fuel cycle. Never the less, residues of processing, such as uranium tailings contain long lived nuclides and require appropriate management and disposal. In addition to the radioactive components, other constituents of the tailings may have toxic or other negative effects requiring their own appropriate management. The waste management methods are usually different from other fuel cycle wastes and involve disposition on or near the surface, in the vicinity of the mill and/or mine sites. Because of the high grade of the northern Saskatchewan ores, the resulting wastes have a much higher specific activity than do wastes from other uranium mines.

As with other mining activities, uranium production has in many locations to contend with opposition to its activities. In addition, because of its association with radioactive materials it routinely draws more attention than other mining. As a result uranium production is frequently held to a higher standard than are other mining activities. In most cases modern uranium production facilities are operated to higher safety and environmentally standards than are many mining facilities. This is reflected by the number of recent awards and recognition earned by Saskatchewan's uranium facilities for worker safety, environmental management, and supporting aboriginal business initiatives.

4. C\$ = Canadian \$.

Opinions regarding uranium mining

The results of annual public opinion surveys on the perceptions of the uranium mining industry in Saskatchewan indicate the industry enjoys a high level of support in the province. (La02) Results indicate 70% of the people polled in 1999 were either very supportive or somewhat supportive. Support increased to 80% when people learned that nuclear power plants do not emit greenhouse gasses that contribute to global warming. While 62% of the people were concerned about the environmental impact of the uranium mining industry in Saskatchewan, this was considerably lower than the level of concern with the: forestry (74%), oil and gas (74%), and agricultural (72%) industries. Grandey further noted that public support had remained at a high level for the 8 years preceding 1999. (Gr99)

6.6 *What are the implications of this case?*

This case provides an example of how stakeholders are included in a formal hearings process established to evaluate the risks associated with the development of projects judged to have potential significant environmental consequences. This is a case where stakeholder involvement has developed at both the national and provincial level and is institutionalized in laws and regulations. While this case relates to issues and questions regarding radiation protection associated with uranium mining, it also shows how concerns regarding radiation protection are extended to socio-economic issues as well as broader societal concerns for the rights of individuals, nuclear non-proliferation and disturbing a pristine wilderness through industrial development.

It is generally agreed by most participants in the uranium mining review process that stakeholder participation led to positive results including improved monitoring, socio-economic opportunities for impacted communities and enhanced communication and understanding between project proponents, governments and public stakeholders. It may have resulted in improving projects and developing other benefits that may not have otherwise occurred.

In 1995 R.T. Whillans of NRCAN wrote: “The Government of Canada is convinced that the EA process has helped to demonstrate that new uranium mining projects are being developed in a responsible manner, after full consideration has been given to the potential impacts and public concerns associated with these facilities.” He also indicated “In Canada, the impact of the EA process on new uranium mining developments has been profound. It has changed the way projects are designed and will change the way they are brought on stream. The process has been time consuming and often difficult, but it has revealed that these new uranium mining proposals are environmentally sound and can remain so over their lifespan.” (Wh95).

Conducting the process within a governmental context extends the democratic involvement of individuals beyond traditional voting rights in a representative democracy. Furthermore, providing for stakeholder involvement in the ongoing monitoring and oversight of projects, may also strengthen the democratic process and add transparency to projects.

In summary, it appears that for any environmental assessment process to be politically successful it must be open and transparent. This is the sentiment expressed by a former Saskatchewan Minister of *Environment and Resource Management* who wrote, “The environmental process must not only be done, it must be **seen** to be done”. (Po94)

However, the 6-year-long Panel review, extending from August 1991 to November 1997, was a lengthy and cumbersome process adding to the cost of review and delaying project

development. Furthermore involving the stakeholder in project monitoring also incurs costs and complicates the process. It also appears to duplicate activities normally conducted by licensing and other agencies. It further reduces the flexibility and independence of project proponents.

It must also be recognized that while the stakeholder has an important, vital position in the EA process in Canada stakeholder input is only one of the several sources of information used in making final decisions regarding radiation protection and the environment. Recommendations developed by a panel are only *advisory* to the governments and regulatory agencies. It is therefore necessary that stakeholders understand the limitations of their input, otherwise they may be disappointed by the results.

It would appear that the process of stakeholder participation described in this paper must be well founded by law, or formally recognized in some way. A concerted effort is required to both elicit stakeholder input, and then assure that it is taken into account in making final decisions.

An important outcome of the Canadian case has been the implementation of new stakeholder-based organizations that take part in monitoring, as well as serving to educate the public. They also form a communication link between the public, proponents and governments. This appears to be a useful mechanism for developing trust and understanding between all parties. It is important to note, however, that these activities do require financial and leadership resources.

In summary, we may also refer to the “Best practice environmental management in mining” program developed by the Environment Protection Agency of the Australian Federal Environment Department (En95a). This program includes principles developed to assist in establishing a sound ethical relationship during community consultation and involvement with stakeholders; (En95b) They include:

- put a broad interpretation on the “environment” and the community so no important aspects or groups are overlooked;
- begin the consultative process early;
- listen to community concerns;
- delegate authority to project teams to commit the project to undertakings; and
- identify special interest groups and acknowledge their needs.

LIST OF ABBREVIATIONS

AECB	Atomic Energy Control Board
AWG	Athabasca Working Group
C\$	Canadian dollar
CEAA	Canadian Environmental Assessment Agency (replaced FEARO)
CEAA	Canadian Environmental Assessment Act (replaced EARP in 1995)
CEM	Cumulative Effects Monitoring
CNSC	Canadian Nuclear Safety Commission (replaced AECB in May 2000)
CVCC	Community Vitality Coordinating Committee
EA	Environmental assessment
EARP	Environmental Assessment and Review Process
EARPGO	EARP Guidelines Order
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EQCs	Environmental Quality Committees
FEARO	Federal Environmental Assessment Review Office
FSIN	Federation of Saskatchewan Indian Nations
ICRP	International Commission on Radiological Protection
NMMS	Northern Mines Monitoring Secretariat
NRCan	Natural Resources Canada the “Panel” Joint Federal/Provincial Panel on Proposed Uranium Mining Developments in Northern Saskatchewan
PPIMs	Panel-Proponent Information Meetings
Ra	Radium
SERM	Saskatchewan Environmental and Resource Management
tU	Metric tonne uranium metal
U	Uranium
US\$	US dollar

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ANNEXES TO CASE STUDY 3

Annex 1

STAKEHOLDER INVOLVEMENT IN THE CANADIAN REVIEW PROCESS FOR URANIUM PRODUCTION PROJECTS IN NORTHERN SASKATCHEWAN

Final Terms of Reference for The Environmental Assessment Review By The Joint Federal/Provincial Panel on Proposed Uranium Mining Developments in Northern Saskatchewan (Wh95)

Mandate

1. The Panel shall review the environmental, health, safety and socio-economic impacts (hereinafter referred to as “impacts”) of the proposed uranium mine developments (listed in Schedule A) in Northern Saskatchewan and assess their acceptability.

In assessing the acceptability of the proposed developments, the Panel will include in its review and consider:

- a) the historical experience with past and existing uranium mining operations in Saskatchewan;
 - b) the cumulative impacts of exiting operations and the proposed developments;
 - c) the short and long term impacts of the proposed projects, spanning their construction phase, operating period, decommissioning phase and post-decommissioning phase;
 - d) the impact of employment and socio-economic opportunities afforded northern resident by the proponents and the measures necessary for implementation of those opportunities;
 - e) the adequacy of measures proposed by the project proponents to protect environmental quality and to safeguard worker health and safety, and whether the measures can be expected to meet the requirements of Canadian and Saskatchewan law, regulations and policies applicable to uranium mine developments;
 - f) the adequacy of monitoring, enforcement and compliance systems to ensure that measures necessary for mitigating adverse impacts can be implemented;
 - g) the benefits afforded by the proposals.
2. The Panel shall determine from its review whether a project is acceptable or unacceptable.

In concluding that a project is acceptable, the Panel may recommend that specified minimum terms and conditions, including any mitigative measures or any other measures relating to the impacts under the Panel's review, be implemented where it considers these necessary for the protection of health, safety and the environment or for dealing responsibly with socio-economic concerns. The Panel may also suggest measures that it considers would enhance the acceptability of the proposals.

If the Panel concludes a project is unacceptable, it shall provide its reasons for this conclusion.

3. In fulfilling its mandate, the Panel shall provide full opportunities for public consultation and review.

Review procedures

Detailed written procedures for conducting the review shall be established by the Panel and made available to the public.

Technical experts

The Panel may secure the services of independent technical experts to assist and advise on complex technical and/or socio-economic issues related to its mandate. Such experts will also be available to respond to inquiries from review participants.

Stages of the review

Schedule A lists the five proposals to be reviewed by the Panel. The five proposals have been referred due to potentially significant or unknown adverse environmental effects and public concern.

While all of the proposals are in the planning stage, some are further advanced than others. Environmental Impact Statements (EIS) have been prepared for the first three proposals listed in Schedule A, one of which (Dominique-Janine Extension) is associated with the existing operation uranium mining facility and two of which are for new uranium mining facilities. EIS documents have yet to be prepared for the last two proposals listed in Schedule A. The Panel will take the differing stages of these projects into consideration in scheduling its review.

The Panel will seek public comment on the three available EISs and determine their adequacy before proceeding to public hearings. When the Panel is satisfied with the information provided, including that with respect to the cumulative impacts, it may report on one or more of these projects to the Ministers as described in the following stages of the review. The Panel shall submit its final report(s) on these proposals within 18 months of its appointment.

In reviewing the remaining two proposals, the Panel will conduct scoping sessions with appropriate communities to solicit public comment and, based on these comments and its own consideration, prepare and issue Guidelines to the respective proponents for the preparation of EISs. The cumulative impacts of these two proposals will be considered when the EIS documents have been submitted. The stages of the review following submission of these documents to the Panel are outlined

below. The Panel shall submit its final report(s) on these two proposals within 18 months of receipt of the proponent's EISs.

Review of Information:

- a) Review of the available information on the environmental, health, safety and socio-economic impacts of the uranium mining industry in Saskatchewan to date. The information and any related reports prepared would be made available to the public.
- b) Review of the past performance of the uranium mining industry in providing employment and socio-economic opportunities to northern residents. The information and any related reports prepared would be made available to the public.
- c) Review by the Panel of Environmental Impact Statements (EIS) submitted by the proponents. The EISs will also be made available to the public for review and written comment.
- d) The Panel may draw on proponents, technical agencies from within federal or provincial governments, independent experts and the public for available information.

Should the Panel, after reviewing the above information and considering public comments, deem an EIS deficient it may request additional information from the project proponent.

Once the Panel is satisfied with the information provided, it will announce public hearings for the project in question. If appropriate, the hearing may be structured to address more than one project.

For the purposes of promoting public awareness and facilitating public comment, the Panel will hold meetings and/or hearings in the appropriate northern communities, Regina, Saskatoon and in such other Saskatchewan communities as the Panel may think necessary.

When the Panel is in a position, following the completion of public hearings, to provide a report on its findings, conclusions and recommendations relevant to a specific project, it will submit the report to the federal Ministers of the Environment and of Energy, Mines and Resources and to the Saskatchewan minister of Environment and Public Safety.

The Panel should, to the extent possible, ensure that the timely review of a specific project is not jeopardized by delays in the review of another project included in its mandate.

Linkage to other policy processes

The Panel is not expected to interpret its mandate so as to duplicate the work of other public inquiries and policy processes or to focus on national or international issues, which are not directly related to the impacts of the proposals.

However, the public, may raise concerns, which extend beyond the impacts of direct concern to the Panel, and in such cases the Panel will ensure that the public is provided a reasonable opportunity to express these concerns.

Schedule A

EIS submitted:

- 1) Dominique-Janine Extension (COGEMA Resources Inc. – operator).
- 2) South McMahon Lake Project [Midwest Joint Venture] (Minatco Limited – operator).
- 3) McClean Lake Project (Minatco Limited – operator).

EIS to be prepared

- 1) McArthur River Project (Cameco Corporation – operator).
- 2) Cigar Lake Project (Cigar Lake Mining Corporation – operator).

(From Annex I, Wh95)

Annex 2

EVOLUTION OF STAKEHOLDER ORGANISATIONS IN NORTHERN SASKATCHEWAN

In response to the need for the involvement of members of the northern communities that are potentially effected by uranium mine development various new stakeholder organisations were established. These include the: Athabasca Working Group, Environmental Quality Committees and Northern Mines Monitoring Secretariat and the Community Vitality Coordinating Committee.

- The Athabasca Working Group (AWG) was founded in March 1993. The Group consists of 2 representatives each from the 7 communities most impacted by the uranium operations, together with 2 representatives each from Cameco Corporation and COGEMA Resources Inc. The Group focuses its work on the major concerns identified for the region: employment; training and business; environmental protection; and benefits to the communities. (At01).
- Northern Saskatchewan's Environmental Quality Committees (EQCs) were formed in 1995 in response to recommendations of the joint Federal-Provincial Panel on Uranium Developments in Northern Saskatchewan. In 2000 the 3 originally separate committees were consolidated in one administrative entity, with regional sub-groups, each with its own chair. EQC members are nominated by the chiefs or mayors and councils of the 30 communities designated as impact communities by the Human Resource Development Agreements (HRDAs) of the various mines.

The Vision Statement of the Environmental Quality Committees is: An Environmental Quality Committee, composed of trusted and knowledgeable people each nominated by his/her community, is a bridge between Northerners, government and the uranium mining industry. A bridge built upon a solid foundation of mutual trust and respect. An Environmental Quality Committee is not vested with regulatory responsibilities, but rather is a structured to provide a forum, which will ensure consideration for the concerns and recommendations of northerners on the way in which uranium development occurs in northern Saskatchewan. Through informed dialogue and communication, government, the uranium mining industry and the people of the north, together, will strive to ensure that all uranium mining activity takes place in a manner which considers the needs and aspirations of those people most directly affected, the people of northern Saskatchewan”.

The task of the EQC representatives is to learn about and monitor developments in the uranium mining industry and to transfer that information to the communities. The EQCs are administered and supported by the Northern Mines Monitoring Secretariat (NMMS), an arms-length organization funded through the Ministry of Saskatchewan Northern Affairs. The NMMS is headquartered in La Ronge, with a full-time manager and a contracted part-time communications coordinator. (En01)

- The Community Vitality Monitoring Partnership Process began in late 1998. Cameco Corporation, COGEMA Resources Inc. and the Cigar Lake Mining Corporation fund the process. The Northern Mines Monitoring Secretariat (NMMS), the northern regional Health Boards, Environmental Quality Committees (EQCs) and other northern organisations also provide assistance.

The initiative to assess community vitality (the social well being and quality of life of residents) results directly from the guidelines and recommendations of the Panel. As a result of the Panel's review and reports, the revised surface leases for northern uranium mining projects require that companies participate in a community vitality monitoring program. The scope and definition of the program, however, are developed on a partnership basis with the NMMS, the northern regional Health Boards and other northern organisations. At a workshop in 1999, northern participants identified the following five topics as priorities for information gathering: a) environment and land; b) health; c) economic, social and infrastructure; d) communication dynamics and relationships; and e) special topics (youth, outward migration and poverty).

The vision for activities over the next few years is “to show that monitoring information related to uranium mining impacts and other community influences can be used to address and act upon issues of priority to northern communities.”

“The goal is to identify and track indicators that provide insight into community vitality such that stakeholders can use that knowledge to improve and maintain the quality of life in northern Saskatchewan, focusing in particular on the following:

- Providing information related to uranium mining impacts on community vitality that is useful to northern community stakeholders;
- Encouraging partnerships that will work cooperatively on specific community vitality monitoring activities of common interest; and
- Developing communication activities that will assist northern community stakeholders to use community vitality monitoring information to improve and maintain the quality of life in northern Saskatchewan.” (CO01)

Annex 3

HOW CLEAN IS CLEAN ENOUGH?

The McArthur River and Cigar Lake projects are the world's two largest, highest-grade uranium ore deposits. As a consequence of the high grades, mining of these deposits raised potentially significant issues for environmental assessment and regulation, particularly radiological occupational health and safety and management of tailings resulting from the milling of the high-grade ores. (HJ98) The McArthur River ores are processed at Key Lake and tailings are disposed of in a former open pit mine. Ores from Cigar Lake are to be processed at both the Rabbit and McClean Lake mills. Tailings will be disposed of at the respective sites.

Once concerns about worker health and safety have been addressed, the principal radiological issue is management of mill tailings, both during and following operations. Given the persistent nature of both the radiological and the associated heavy metals, consideration of very long term (up to 10 000 years) effects have become commonplace. As indicated by Clifton and others, decommissioning of tailings has evolved from being ignored to being the central component of a long-term management scheme. Furthermore a key component in building support for uranium operations in Saskatchewan was emphasis on planned decommissioning to ensure long-term safety and security of the waste management facilities. (C102)

Because of Canada's extensive experience designing and managing tailings impoundments, its policy and technology for managing tailings is among the most advanced, providing a high level of environmental protection for both the short and long term. The Canadian expertise was developed through design, operation and closure of several tailings sites in northern Saskatchewan, as well as with the closure of several sites in the Elliot Lake area, Ontario.

The initial distinction for any mill site or mine is whether it is active or is an inactive or abandoned (i.e. "legacy site"). The challenge faced in managing or decommissioning a previously utilized site is different from a tailings impoundment that is being planned or is use. Canada has examples of all three types. This discussion relates primarily to the currently active sites in Saskatchewan.

One of the principal challenges is to close out tailings impoundments in such a way that both radiological and non-radiological constituents do not leave the tails and enter ground or surface water. The preferred management option for achieving the protection goals involves site-specific conditions, including the characteristics of the tailings.

Some of the considerations contributing to Canada's best practice involve community consultation, proper planning, improved design, and long term monitoring, including:

- Completing an environmental assessment, including public hearings, during initial planning of a site.

- Including public stakeholders in consultation and monitoring activities for all projects from the environmental impact assessment process through operations, closure and long-term surveillance.
- Centralizing milling of the ores from several mines at one location reduces environmental damage.
- In-pit tailings disposal facilities provide better environmental protection than do above ground facilities. Therefore the Government of Canada recommends, that in the future all tailings should be placed in mined-out pits. (However, in some cases this may not be possible. An engineered surface impoundment may then be required.)
- Designing new projects to minimize impacts and with consideration given for final decommissioning. This “best practice” also helps to reduce decommissioning and closure costs.
- Designing mill processes to provide the most stable and least intrusive tailings and other wastes.
- Pre-operational modeling of tailings disposal and other activities such as ground water flow, followed by verification of modeling once an operation is underway.

Canada’s policy

The elements of Canada’s comprehensive *Radioactive Waste Policy Framework* consist of a set of principles governing the institutional and financial arrangements for disposal of radioactive waste-by-waste producers and owners. The Government of Canada will ensure that the disposal of radioactive waste is carried out in a safe, environmentally sound, comprehensive, cost-effective and integrated manner. The federal government has the responsibility to develop policy, to regulate, and to oversee producers and owners to ensure that they comply with legal requirements and meet their funding and operational responsibilities in accordance with approved waste disposal plans. The waste producers and owners are responsible, in accordance with the *Polluter-Pays Principle*, for the funding, organization, management and operation of disposal and other facilities required for their wastes. It is recognized that arrangement may differ for nuclear fuel waste, low-level radioactive waste, and uranium mill tailings.” (Go98)

Financial assurance for tailings impoundments

- Canadian law assures the project operator is responsible for all financial assurance for environmental costs including project closure and decommissioning, as well as perpetual monitoring, should that be required.
- Perpetual monitoring of decommissioned tailings management facilities and potential acid-generating waste rock depositories will be necessary. A self-sustaining fund should be designated for the cost of monitoring and any required mitigation.
- Perpetual monitoring including providing the funding or financial assurance to assure institutional controls and monitoring of tailings and acid-generating waste rock depositories in perpetuity, or until it is judged this is no longer necessary. In developing a

contingency fund for perpetual care of tailings: The mining company – not taxpayers – should ensure that funds are available for long-term monitoring and any required mitigation.

Monitoring includes local stakeholders

- The Government of Canada agrees that the northern communities should participate in the monitoring of decommissioning, reclamation and post-decommissioning activities. (Go97)
- Financial support must be made available to cover the costs incurred by local stakeholders in taking part in monitoring activities.
- Cumulative effects monitoring is necessary on a regional scale to assess the potential spread of contaminants from multiple mines. It is important that adequate funding continue to be provided to the Cumulative Effects Monitoring Working Group (CEMWG).
- Acid drainage is potentially one of the greatest problems for many mine sites. Providing disposal sites for acid-generating waste rock (both uranium bearing and non-uranium bearing), that is a potential source of acid drainage.
- All mine rock wastes that have the potential to be acid generating should be protected from oxygen exposure. This can be achieved by using them for fill when underground mines are decommissioned or by placement in mined-out pits. Underwater disposal in existing lakes is an option that should be considered only if no suitable mined-out pits are available.

Research

- Scientific research can suggest approaches that will improve the profitability of the industry, while at the same time providing greater environmental protection. Governments, in co-operation with the industry, should promote such research at the Saskatchewan Research Council and the universities.
- Establishment of a research fund to find ways to improve technology to reduce impacts, such as the volume of effluents, and research to determine the best way of decommissioning at the time of closure.

Flexibility in planning

Because of the ongoing monitoring, investigations and flexible environmental regulations designed to meet changing conditions and new considerations that may emerge, each closure plan is kept flexible. For example, the Province of Saskatchewan is guided by its policy on decommissioning which is to “use best available technology at the time of decommissioning in support of the objective of best possible environmental protection.” Placement of the tailings in the impoundment may take 15 to 20 years or more, and therefore new policies or technologies may evolve. (Sa93)

McClellan Lake's JEB Tailings Management Facility (TMF) example

At the McClellan JEB Tailings Management Facility (TMF) there was concern that in addition to radionuclides (principally radium), arsenic could potentially seep from the tailings to contaminate the surrounding environment. Two strategies are used to reduce this risk. They include chemical and physical isolation. The chemistry of the process circuit was designed to deposit both radionuclides and arsenic in a very insoluble, inert compound. As a result the concentrations of both radionuclides and arsenic in the pore fluids of the tailings are so low that releases by the diffusion process over the long term are environmentally acceptable.

The tailings are deposited in a mass that has a very low hydraulic conductivity, approximately two orders of magnitude less than the surrounding sandstone. For the long term, under these conditions the consolidated tailings occur as a relatively impermeable plug and groundwater flows around the tailings mass. The slow diffusion process driven by the contaminant concentration gradient between pore water of the tailings mass and the ground water of the surrounding host rock then dominates contaminant release from the tailings.

A specific condition of the amendment to the McClellan Lake approval requires detailed monitoring, analysis and reporting on the performance of the JEB TMF. The Minister indicated that environmental monitoring programs will allow regulators to determine that the facility performs as expected (based on performance modeling) and he is satisfied the developments can proceed without undue impacts on the environment. In its 1997 support for approving use of the JEB TMF for toll milling Cigar Lake ore, the Panel indicated the JEB TMF is believed to have advantages as it uses subaqueous deposition (providing enhanced worker protection); avoids engineered barriers which may fail in the long term; the minimization of weathering problems; and protection of the contents of the pit from scarification by glaciers during the next ice age.

In this impoundment design the tailings are placed in a below surface pit and have an aqueous cover which remains in place for the long term. The additional strategies are required to keep potential contaminants from leaving the tailings.

However, at the time, the Panel affirmed there are critical site-specific technical concerns that must be resolved before this particular tailings management facility could be recommended. The most critical concern is the need for convincing evidence that operation of the TMF would not result in contamination of nearby Fox Lake in the long term. One of the proposals made to help assure this does not happen is to monitor the site in perpetuity, and financial resources be retained to mitigate any undesirable impacts.

Monitoring results during the first few years of operation indicate the objectives are being met. (Ro02)

Annex 4

REPRESENTATION OF NORTHERNERS IN STAFFING OF GOVERNMENT AGENCIES

Among the outcomes of the Panel Review process was criticism of the fact that the Governments of Canada and Saskatchewan include low numbers of northern participants on their own staff. As a result it is the recommendation (number 17) of the Joint Panel Report on The McArthur River Uranium Mining Project that “Government agencies and departments providing services in northern Saskatchewan should adopt human resources objectives similar to those applied in the uranium mining industry, that would lead to a substantial increase in northern participation on their staffs.” The Government of Canada responded it is “strongly committed to employment equity. A new *Employment Equity Act* and regulations came into force on October 24, 1996. The intent of this legislation is to achieve equitable participation of designated groups, including Aboriginal peoples, in the federal public service and the federally-regulated private sector, by eliminating barriers to employment, promoting equal access to jobs, and upholding the merit principle. Federal regulatory agencies employ very few staff exclusively to regulate uranium mines in Saskatchewan, and the limited number of positions requires a considerable degree of scientific understanding and technical competence to perform complex regulatory functions. Full consideration will be given to staffing positions with qualified northerners as vacancies arise.” (Go97)

Table I. New Saskatchewan Uranium Mining Projects
(as of 1995, with subsequent changes indicated)

PROJECT/OPERATOR ¹	PROJECT TYPE	OWNERS ² (SHARE %)
Dominique-Janine Extension/ COGEMA Resources Inc.	Mine Extension	COGEMA Resources Inc. (100)
Midwest Project/ Minatco Limited/ (COGEMA Resources Inc. became operator in 1994)	New Joint Production Centre (see McClean)	COGEMA Resources Inc. (56)_(54.8) Denison Mines Limited (19.5)_(0) Uranerz Exploration and Mining Limited (20)_(0) OURD (Canada) Co., Ltd (4.5)_(4.5) Redstone Resources Inc. (0)_(20.7) Tenwest Uranium Inc. (0)_(20.0)
McClean Lake Project/ Minatco Limited (COGEMA Resources Inc. become operator in 1994)	New Joint Production Centre	COGEMA Resources Inc. (70) Denison Mines Limited (22.5) OURD (Canada) Co., Ltd (7.5)
Cigar Lake/Cigar Lake Mining Corporation/ (Cameco Corporation became operator at end of 2001)	New Production Centre	Cameco Corporation (48.75)_(50.025) COGEMA Resources Inc. (36.375)_(37.1) Idemitsu Uranium Exploration Canada Ltd (12.875)_(7.875) Korea Electric Power Corporation (2)_(0) TEPCO Resources Inc. (0)_(5)
McArthur River Project/ Cameco Corporation	New Mine / {Milling at Key Lake}	Cameco Corporation (53.991)_(69.805) Uranerz Exploration and Mining Limited (29.775)_(0) COGEMA Resources Inc. (16.234)_(30.195)

1. Where project operators changed subsequent to 1995 the new operator is identified.
2. The first number following a company name indicates percentage project ownership in 1995. The second number identifies ownership in 2002 (for only those projects where ownership changes have occurred). (Table After Whillans, 1995, p. 145; and/or modified by author to reflect subsequent changes).

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