Decision **2002-014**

TransAlta Energy Corporation

900-MW Keephills Power Plant Expansion
Application No. 2001200

February 2002

Alberta Energy and Utilities Board

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TRANSALTA ENERGY CORPORATION

900 MW KEEPHILLS POWER PLANT EXPANSION

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1 THE APPLICATION AND HEARING

1.1 The Application

TransAlta Energy Corporation (TransAlta) applied on July 6, 2001, to the Alberta Energy and Utilities Board (EUB) and Alberta Environment (AENV) for approval to construct and operate two 450 Megawatt (MW) generating units (Keephills 3 and 4) at its existing Keephills coal-fired power plant site, which is located some 70 kilometres (km) west of Edmonton, in Sections 36, Township 51, Range 4, west of the Fifth Meridian, southeast of Lake Wabamun, as shown in Figure 1.

TransAlta prepared and submitted to the EUB Application No. 2001200 to construct and operate the proposed expansion under section 9 of the *Hydro and Electric Energy Act*[1] (HEE Act).

1.2 The Hearing and the Participants

On August 30, 2001, the Board issued a Notice of Pre-hearing Meeting and Hearing for TransAlta's application to construct Keephills 3 and 4. In response to the Notice a number of interveners registered submissions to the Application. A list of parties who appeared at the hearing is shown in Appendix A.

The Board held a pre-hearing meeting on September 21, 2001, before M. N. McCrank, Q.C. (Presiding Member), R. G. Lock, P. Eng. (Board Member), and G. J. Miller (Board Member). A number of matters were reviewed, including the issues to be addressed at the hearing, the identification of local interveners, and the request from interveners for an adjournment of the commencement of the hearing. The Board's Memorandum of Decision, issued on September 28, 2001, is attached to this report as Appendix B.

The EUB considered the application at a public hearing held in Stony Plain from October 30 to November 15 of 2001. The Board members who presided over the pre-hearing meeting heard the Application. Final argument was submitted orally on November 15, 2001. Accordingly, the Board considers that the evidentiary portion of the application was concluded on that date.

1.3 Existing Plant

The Board approved the construction of the first two units at the Keephills Plant (Units 1 and 2) in March 1977. These units commenced operation in 1983-1984. Each unit consists of a boiler, turbine, generator, a condenser, feed-heating plant, hydrogen-cooled generator, and all necessary

[1] The HEE Act was consolidated at the time this report was being prepared. Therefore, sections of the HEE Act referred to in this report still correspond to the sections of the HEE Act before its consolidation.

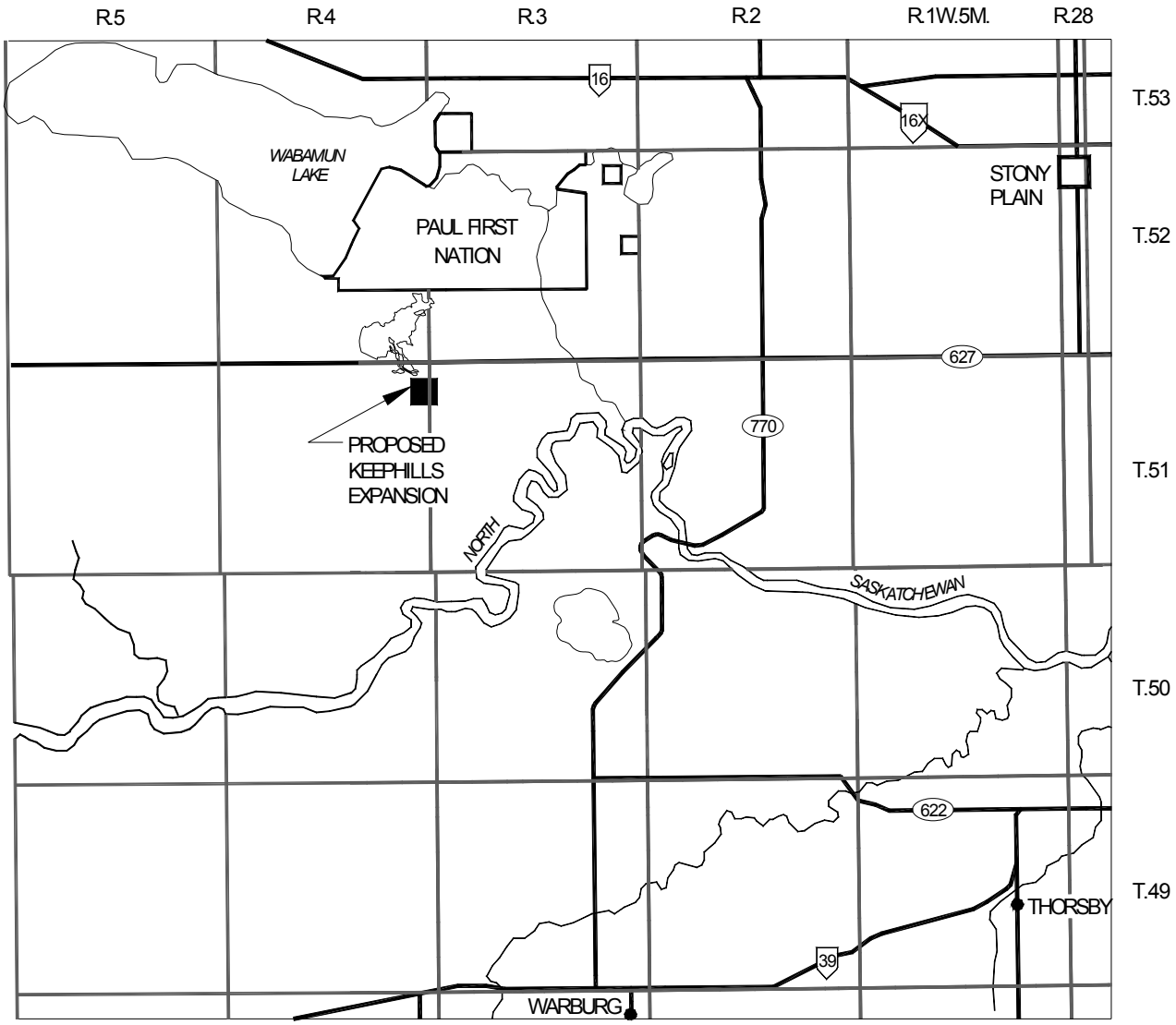

Figure 1 KEEPHILLS AREA

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auxiliaries. A cooling pond and circulating water pumps provide cooling water for each turbine generator condenser as well as for auxiliary equipment. The boiler backend control equipment includes an electrostatic precipitator for fly ash removal. The flue gases from the two boilers discharge to a single common stack via the backend equipment on each unit.

TransAlta, at the time of designing Units 1 and 2, included plans for two additional units that would eventually be installed; the site is therefore designed to support Units 3 and 4. In addition, the Highvale Mine has sufficient coal reserves in place within the existing mine permit boundary to supply both the existing units and proposed units. The water requirements for the operation of Units 3 and 4 can be met using the North Saskatchewan River (NSR) intake structure and water diversion license in place for Units 1 and 2.

1.4 Project Summary

The proposed Units 3 and 4 would be installed at the existing Keephills generating station. Each unit would include a boiler, turbine generator, condenser, generator transformer, as well as substation and associated auxiliary equipment. Both of the units will discharge into a common stack. The proposed plant would have the following additional equipment:

- flue gas desulphurization (FGD) units for sulphur dioxide (SO_2) control;
- bag houses (fabric filters) on each unit to remove particulates;
- low nitrogen oxide (NO_x) burners to control NO_x;
- a dry ash disposal system;
- dedicated cooling towers;
- coal handling facilities including a second coal stacker, a new live coal pile, conveyors to move coal from the live coal stockpile to Units 3 and 4; and,
- an expanded electrical substation for connecting the new units.

TransAlta expects to construct the project during 2002 to 2005 and to operate the plant for at least 30 years.

Keephills 3 and 4 will share existing facilities with Keephills 1 and 2, including the river water intake structure, pump house, flow lines, sewage treatment facilities, cooling pond, and an expanded boiler water treatment system. Most of this land was improved during construction of Units 1 and 2 in anticipation of constructing Units 3 and 4. The new cooling towers will be located on a small portion of land immediately east of the existing units. Units 3 and 4 will be located on the site adjacent to, and east of, the existing Units 1 and 2.

Keephills 3 and 4 are designed for base load (full load with 93% availability), daily load cycling and low load operation.

Coal for the proposed power plant will be transported by mine-haul truck to the site from the nearby Highvale Mine. It will be crushed, stacked in an outdoor storage area, and moved by a conveyor belt system to a line of coal-bunkers adjacent to each boiler. The coal will then be fed from the bunkers into mills, which pulverize the coal prior to burning in the boiler.

Bottom ash and pulverizer rejects from each boiler will be conveyed to bottom ash storage silos. Fly ash from the FGD systems, bughouses, air heater hoppers, and economizer hoppers will be pneumatically transported to fly ash storage silos. Ash from the silos will be loaded into trucks and transported to the existing approved ash disposal site within the coal mine.

Water from the NSR would be pumped to the existing raw water pond, to the existing cooling pond and to cooling towers. The raw water pond supplies water to the boiler water treatment plant and to the general service water system.

1.5 Review and Participation by Federal Government Agencies

Environment Canada, the Department of Fisheries and Oceans, and the Canadian Environmental Assessment Agency (the Federal Agencies) participated in the review of the Keephills 3 and 4 application.

The review included participation with the Provincial regulatory review teams in identifying and requesting supplementary information requirements. The Federal Agencies also participated at the EUB hearings by filing submissions with the EUB; conducting cross-examination of other hearing participants; sitting a panel of experts at the hearing who gave testimony on issues directly related to the matters under consideration by the EUB; and, by making recommendations on certain issues of concern to the Federal Agencies for the Board's consideration.

2 ROLE AND AUTHORITY OF THE BOARD REGARDING APPLICATIONS FOR ELECTRIC GENERATION PLANTS

Need and Cost

With the enactment of the *Electric Utilities Act*[2] and amendments to the HEE Act, the Legislature expressed its clear intention that electric generation in Alberta is to be developed through the mechanism of a competitive, deregulated electric generation market and not through the former regulatory regime which required the Board to determine the need and cost of such facilities as well as the price of electricity. Under section 9 and 2.1 of the HEE Act and section 2.1 of the *Energy Resources Conservation Act*[3] (ERC Act), the responsibility of the Board is to consider whether the construction and operation of a proposed power plant is in the public interest. The Board must take into account a number of factors including the social, environmental, and economic effects of the project, the economic, orderly, and efficient development of electric generation, as well as the creation of an electric generation sector guided by market forces.

The issue of public health and safety is a fundamental component of the public interest when reviewing power plant applications. An applicant must satisfy the Board that the construction and operation of its electric generation plant will not jeopardize public health and safety in order to gain approval.

[2] SA 1995, Chap. E. –5.5, with amendments thereto
[3] RSA 1980, Chap. E-ll, with amendments thereto

The determination of whether a project is in the public interest requires the Board to assess and balance potential negative and beneficial impacts. The existence of regulatory standards and guidelines and a proponent's adherence to these standards are important elements in deciding whether potential adverse impacts are acceptable. Where such thresholds do not exist, the Board must be satisfied that reasonable mitigative measures are in place to address the impacts. In many cases, the Board may also approve an application subject to specific conditions that are designed to enhance the effectiveness of mitigative plans. The conditions become an essential part of the approval; breach of them may result in suspension or rescission of the approval.

In the Board's view, the public interest will be largely met if applications are shown to be in compliance with existing provincial health, environmental, and other regulatory standards in addition to the public benefits outweighing negative impacts.

Parties in the present proceeding have argued that the Board must consider whether the Province needs the proposed Keephills 3 and 4 power plant. They contend that the citizens of Alberta will not require the electric energy produced by Keephills 3 and 4 when it comes on stream and that the electricity is intended for export markets. Such a scenario, they submit, cannot be in the public interest because other jurisdictions will enjoy the power leaving Albertans with the unacceptable impacts resulting from plant construction and operation.

The Board's view is that this matter is essentially one of need and that it is not a factor to be considered in an application under section 9 of the HEE Act, although, the impacts on public health, safety, and the environment created by an export plant would, of course, be of central relevance. The legislative changes referred to above, replaced the Board's authority to determine future demand for electricity with the mechanism of a competitive electric generation market.

The Board's position on the relevance of the need for a power plant is explained in Decision 2001-111 (EPCOR Genesee 3), Decision 2001-33 (EPCOR Rossdale), and Decision 2001-101 (AES).

Impact on Area Transmission System and Upgrades

The Board received submissions from participants concerning the necessity of reviewing provincial transmission system cost impacts as part of the section 9 HEE Act application. Parties maintained that the Board must ensure the economic, orderly, and efficient development and operation of electric energy under section 2(a) of the HEE Act. The Board must take into account evidence regarding potential impacts such as congestion management and system wide costs on the Alberta Interconnected Electric System (AIES) as an integral part of the power plant proceeding. These interveners argued that the Board must be able to appreciate the economic impacts to the AIES that may be triggered by the approval of a new plant in order to make a decision that meets the public interest.

The Board acknowledges the importance of the potential economic impacts on the AIES that may be triggered by the approval of a power plant. However, the Board does not accept that this issue must be considered as part of an application to approve the construction and operation of a power plant. Approval of a power plant does not automatically result in an approval to connect

the plant to the transmission system. A separate application under section 17 of the HEE Act is required.

All interested stakeholders will be afforded an opportunity to advance their positions on the principles, which should govern the terms of access to the AIES when transmission congestion is triggered. This will take place in a Board proceeding presently scheduled for the spring of 2002. The outcome of this review, including the framework for the potential allocation of costs resulting from the impact of a new plant's load on the AIES, may or may not be commercially acceptable to a successful approval holder. This is a risk borne by the approval holder.

Shared Facilities and Common Costs

The Board received submissions from participants concerning the issue of existing facilities to be shared between Keephills 1 through 4 and the treatment of their associated common costs. In this respect, the Board notes that the Department of Energy is reviewing and will recommend a process and methodology for determining Common Costs payable to the Balancing Pool. The process is applicable when additional capacity is added to existing generating sites subject to Power Purchase Agreements. The Department of Energy will develop and implement a Common Cost Regulation that will address this matter. The process is anticipated be complete early in 2002. Therefore, the Board is of the view that matters raised respecting common/shared facilities are to be dealt with via the Common Cost Regulation; the Board need not deal with them any further as part of this decision.

3 ISSUES

The Board views the issues related to this application to be:

- Human Health Impacts
- Environmental Effects of the Proposed Power Plant:
    - Air Quality
    - Surface Water
    - Fish and Other Biota
    - Ground Water
    - Terrain, Soils and Reclamation
    - Terrestrial and Wetland Vegetation
    - Wildlife
    - Noise
    - Traditional Land Use
- Socio Economic Issues, including Public Consultation, Local Landowner Issues, and Economic Benefits
- Technology Selection and Environmental Performance of the Proposed Power Plant.

4 HUMAN HEALTH

4.1 Views of the Applicant

TransAlta recognized the importance of human health as an issue in its Environmental Impact Assessment (EIA) and responded to the regional health concerns expressed by commissioning a detailed human health risk assessment (HHRA). TransAlta stated the HHRA concepts and protocols implemented for acute and chronic exposure scenarios were comprehensive, conservative and endorsed by relevant provincial and federal regulators. TransAlta evaluated three separate groups of individuals, encompassing those most sensitive, exposed through four potential pathways to 21 airborne chemicals of concern within a defined 60 km x 65 km area surrounding the existing Keephills power plant (local and regional study areas). TransAlta modelled four emission scenarios, including that which considered all future regional power generation facilities in the area, to predict incremental and cumulative human health consequences for Keephills 3 and 4. TransAlta employed data sources which included predicted air quality data for the criteria and toxic chemicals of concern examined in this EIA, existing historical information (monitoring reports, past EIA studies), as well as, current limited site-specific soil, surface water, and fish tissue data gathered for this EIA.

Based on the results of the HHRA completed with data available, TransAlta concluded Keephills 3 and 4 presented neither short nor long-term human health risk. TransAlta reported that, except for SO_2, methylmercury, and the carcinogenic form of arsenic, the concentration ratios (CR) or exposure ratios (ER) (ratios of estimated exposure doses to health-based exposure limits) of all other chemicals of concern were less than the critical risk characterization value of 1.0.

TransAlta reported that in scenario 2 (all existing facilities) the acute SO_2 CR value for the 1-hour and 24-hour maximum air concentration were 1.51 and 2.00, respectively. TransAlta stated the air quality modelling conducted for this EIA showed that the incremental contribution of Keephills 3 and 4 to these maximum regional SO_2 concentrations was negligible. In addition, these maximum concentrations were expected to occur for only 1-hour every five years and much lower concentrations were expected for the majority of the time. TransAlta concluded acute health risks associated with SO_2 concentrations attributable to Keephills emissions were highly improbable.

TransAlta stated the acute SO_2 CR values for the 1-hour and 24 hour maximum air concentration were 1.53 and 2.0, respectively for scenario 4 (all existing and future power facilities). TransAlta, following an analysis of these values above the critical risk characterization ratio of 1.0, concluded the incremental contribution of Keephills 3 and 4 to these maximum ambient regional SO_2 concentrations was again negligible and acute health risks associated with SO_2 concentrations attributable to Keephills emissions were highly improbable.

TransAlta noted, in the baseline case (risk due to power plant emissions plus background environment), the methylmercury ER values for all four-development scenarios were 2.02 for the farmer receptor. TransAlta, upon analysis of these values above the critical risk characterization ratio of 1.0, concluded power plants alone would not contribute to the baseline ER value. TransAlta noted this finding was consistent with predicted ground level concentrations for mercury from Keephills 3 and 4, expected to be less than 1% of the Texas Natural Resources

Conservation Commission screening levels accepted by AENV. TransAlta reported the ER values for the four baseline scenarios were 100% attributable to the chemical exposure from eating fish. TransAlta concluded the source of mercury contaminating the fish was unclear.

TransAlta reported, in the baseline case, carcinogenic arsenic ER values for all four-development scenarios were approximately 30 for the farmer receptor. TransAlta noted the primary exposure pathways contributing to these estimated risks were through local dairy milk consumption (23%) and fish consumption (65%). TransAlta stated power plant emissions alone contributed very little to the baseline risk, with a maximum ER of 0.55 for scenario four. TransAlta believed neither the addition of Keephills 3 and 4 nor the cumulative regional power plant emissions are expected to increase arsenic exposure over what would be typically found in background areas.

TransAlta stated, in the baseline case, carcinogenic arsenic ER values for all four-development scenarios, ranged from 7.81-8.02 for the non-farmer receptor. TransAlta reported power plant emissions alone, again, contributed very little to the baseline risk, with a maximum ER of 0.011 for scenario four. TransAlta noted the primary exposure pathway contributing to the estimated carcinogenic arsenic risk was consumption of local fish (79%).

Given the conservative assumptions embodied in the modelling, TransAlta conducted a model sensitivity analysis to examine the significance of ER values greater than the critical risk characterization ratio of 1.0. The sensitivity analysis confirmed that reducing concentrations of chemicals of potential concern (COPC) in environmental media from the upper 90th percentile to average concentrations produced an average reduction in ER values of 18%. Reducing consumption rates in country foods and fish resulted in the most significant reductions in risk. As part of the sensitivity analysis, TransAlta also predicted and compared "realistic" risk related to COPC for a typical non-farming resident living in the vicinity of the Keephills plant versus an identical resident living at a rural Alberta location unimpacted by industrial activity. In these scenarios, TransAlta considered lower consumptions rates of country foods, average soil and fish COPC concentration and background air quality concentrations. For arsenic assessed as a carcinogen, TransAlta concluded ERs were about three for both the Keephills and the rural Alberta resident.

TransAlta noted local stakeholders expressed health concerns related to exposure to chemical mixtures. TransAlta stated health risks associated with chemicals were estimated very conservatively at actual receptor locations. Maximum 24-hour average concentrations for COPC were assumed to occur simultaneously at individual receptor locations. CRs were summed to estimate potential health risks associated with exposure to the chemical mixture. TransAlta indicated this approach was in accordance with that recommended by Health Canada. TransAlta stated the CRs for chemical mixtures were less than 1.0 for all four scenarios and at all locations.

TransAlta stated an agreement had been reached with Alberta Health and Wellness (AHW), Capital Regional Health Authority, and Westview Regional Health Authority, to conduct a community exposure and health effects assessment study in the Wabamun Lake – Genesee area. TransAlta committed to participate in this study and pledged financial support ($100,000).

4.2 Views of the Interveners

The Intervener Group

The group of interveners formed by Karen and George Gray, the Summer Village of Kapasiwin, George Jones, the Lake Wabamun Enhancement Protection Association, Linda Duncan, Edith Mould, the Mewassin Community Action Group, the Clean Energy Coalition, Barbara Henderson, Annette and Jim McClelland, Brian Mitchell, and Bill Mustard, (the Intervener Group) presented the following joint arguments:

The Intervener Group believed the regional study area established for the assessment of human health effects (60 km by 65 km) was too small to adequately examine secondary pollutants. The Intervener Group noted secondary pollutants were most likely to result in public health effects and to adversely affect the greatest number of people. The Intervener Group stated that the emissions dispersion modelling conducted by TransAlta focused almost entirely on the zone of maximum impact for primary pollutants and failed to consider secondary pollutants that are formed outside this zone. Secondary pollutants increase in concentration at distances greater than 25 to 30 km away from the source of primary pollutant compounds. To further support its view, the Intervener Group reported 90% of primary pollutants emitted were deposited or interacted outside the small study area considered. The Intervener Group discounted the view by TransAlta that sulfates and nitrates could serve as possible surrogates for monitoring other secondary pollutants such as ozone, particulates, and condensable organics. The Intervener Group noted that coarse particulate matter (PM_{10}) is a declared toxic under the *Canadian Environmental Protection Act* and that ground level ozone is a chemical undergoing evaluation under the Canada Wide Standards[4] (CWS) process.

The Intervener Group expressed concern regarding the data employed to derive predictive HHRA conclusions. The Intervener Group noted the HHRA was based upon inputs largely from emission dispersion modelling (modelling results were employed by the HHRA which involves additional modelling and mathematical treatment of the input data). The Intervener Group stated valid health predictions were dependent on the adequacy of air quality modelling and the quality of environmental input data. It indicated the input data for the predictive human health assessment did not include potential for the formation of ozone and secondary particulate matter.

The Intervener Group stated the HHRA conducted by TransAlta was not state of the art. It cited a recent accepted approach to HHRA (Levy et al 1999. ES&T), which incorporated a larger geographic study area, utilized state of the art toxicity models, integrated formal uncertainty analysis in addition to accommodating secondary pollutant production, secondary formation of particulates, and ozone formation.

The Intervener Group disagreed with the HHRA approach conducted by TransAlta, which employed concentration and exposure ratios to predict human health impacts from emissions and other exposure pathways. It stated this approach assumes human health impacts occur discreetly, whereas in reality the latter occurs on a continuum. The Intervener Group noted adverse human health effects occur from particulate matter, ozone, and mercury at very low concentrations; safe thresholds have yet to be determined. It stated that the CWS for fine particulate matter ($PM_{2.5}$)

[4] Exhibit 303 – Appendix E

and ozone are not necessarily protective of human health; effects do occur at levels lower than the published criterion of 30 nanograms per cubic meter. The Intervener Group understood the CWS were set taking into account achievability, implementation, as well as, economics.

The Intervener Group expressed concern for the health of residents in the Lake Wabamun-Keephills-Genesee region exposed to power plant emissions. The Intervener Group provided detailed anecdotal observations and personal accounts of their experiences and concerns. The Intervener Group testified as to high levels of multiple sclerosis, cancer, and pulmonary disease in the area, as well as, the occurrence of other neurological disorders. It asserted that these anecdotal observations were supported by health statistics published by the Westview Regional Health Authority. The Intervener Group also testified as to acute mental and psychological health problems arising from prolonged stress.

The Paul First Nation

The Paul First Nation stated its concerns for power plant impacts on its community health, natural environment, and traditional way of life remained unresolved. The Paul First Nation reported a loss of traditional lifestyle and diet because of contaminated traditional foods and medicinal plants. It expressed concern regarding contaminated sources of drinking water and believed its members are experiencing an increased incidence of asthma, kidney, and liver diseases. A health assessment has not been conducted despite the fact reserve members have been living in close proximity to the power plants during 40 plus years of operation.

The Paul First Nation questioned the claim that the HHRA conducted by TransAlta was very conservative. It believed the Canadian and American consumption and exposure rates used in the HHRA were not likely to be very applicable to the band members and their lifestyles. The Paul First Nation stated its health status had not been assessed and hence unaccounted in the HHRA conducted by TransAlta. It noted the HHRA failed to employ site-specific data relevant to The Paul First Nation (for example consumption preferences for fish and game, soil, air, drinking water quality, fruits, berries, medicinal plants quality).

The Paul First Nation noted the highest average 24 hour acute exposures and annual chronic exposures for SO_2 occur within the Wabamun Lake area west of the reserve and on the south end of the reserve. It stated SO_2 predicted maximum values exceeded the threshold exposure limits for 1-hour acute exposure at the Wabamun power plant site just west of the reserve lands. The Paul First Nation expressed concern regarding adverse impacts since its reserve lands lie in close proximity to these areas predicted to experience SO_2 maximums.

Government of Canada

The Government of Canada concluded that there is a direct correlation between mortality, hospital admissions and emergency visits with exposure to elevated levels of particulate matter and ozone. It stated the CWS for $PM_{2.5}$ and ozone were based on weight of evidence of this nature. The Government of Canada noted there is no apparent lower threshold for the effects of particulate matter and ozone on human health and asserted that the CWS for $PM_{2.5}$ and ozone may not be fully protective of human health and may need to be revisited at some future date.

The Government of Canada agreed with the Intervener Group regarding the need to increase the regional air and human health regional study area.

Government of Alberta

The Government of Alberta confirmed the announcement to conduct a community exposure and health effects assessment study in the Lake Wabamun-Keephills-Genesee area.

The Government of Alberta stated it has received a preliminary indication from Health Canada that it would consider cooperation in any such provincial government-led initiative. The Government of Alberta expected this cooperation to enable inclusion of the Paul First Nation into the community health study. It stated that AHW would be the lead agency in the community exposure and health effects assessment project. The Government of Alberta expected the project's design, goals, objectives, and protocols to be consistent with other health assessment initiatives conducted by AHW. It concluded that community health concerns that were repeatedly expressed should be answered by this study.

4.3 Views of the Board

The Board agrees the prospective assessment approach taken by TransAlta to examine human heath concerns arising from Keephills 3 and 4 was appropriate and valid. The Board believes, within the limits of available data quality, the HHRA conducted was conservative, detailed, comprehensive, and expertly conducted following currently accepted assessment and predictive protocols. The Board, therefore, accepts the general conclusion of the HHRA that neither short-term nor long-term health risks are predicted with the construction and operation of Keephills 3 and 4.

The Board strongly endorses and supports the planned community exposure and health effects assessment study announced. The Board agrees with the Intervener Group that such a baseline health study is both warranted and over-due, in light of the extent of existing and planned industrial activity in the Lake Wabamun-Keephills-Genesee area. The Board directs TransAlta to fulfill its commitments to participate in and provide financial support in the amount of $100,000 for a community exposure and health effects assessment, to be led by AHW and the Westview and Capital Health Regional Health Authorities. The Board recommends the regional health study include members of the Paul First Nation and that the respective health jurisdictions collaborate, plan, lead, and implement such a comprehensive assessment in cooperation with regional public and industrial stakeholders.

The Board notes current site-specific soil, surface, and groundwater quality measurements employed in the HHRA were limited. Consequently, the Board agrees with the Intervener Group that a degree of uncertainty exists in the calculated concentrations of COPC in consumed foods (for example local fruits and vegetables, cereal grains, dairy products, meat from livestock and game, fish) and regional drinking water. The Board believes additional direct measurements of COPC concentration in representative samples of regional study area soil, vegetation, as well as surface and groundwater will improve the confidence in estimated COPC levels in consumed foods and will validate and enhance the confidence in results of the HHRA conducted. The Board views the compilation of this kind of information as part of an existing need to develop a regional baseline database, establishing current concentrations of COPC in key media (air, soil,

surface water, groundwater and varied ecological receptors). The Board directs TransAlta to initiate, plan, and undertake, in partnership with other regional industry operators, an assessment and consolidation of all relevant existing information and new data gathering, as required, to address this information deficiency to the satisfaction of AENV.

The Board notes the significant concerns of Health Canada and the Intervener Group regarding the generation, fate and health effects of secondary pollutants, specifically particulate matter, and ozone. The Board understands that insufficient research is available to comprehend the formation, dynamics, and health impact of these toxic chemicals in an Alberta setting. The Board directs TransAlta to participate in and fully support current initiative(s) led by AENV and (or) Environment Canada to investigate secondary pollutants resulting from precursors found in power plant emissions. Example of these initiatives include:

- provincial spatial inventory of criteria pollutants – particulate matter and ozone formation in central Alberta;
- CASA's particulate matter and ozone implementation team; and,
- AENV's amending of Alberta ambient air quality guidelines.

The Board believes information of this nature is necessary to establish appropriate monitoring strategies for both these pollutants and their health impacts. The Board recommends TransAlta act in partnership with its regional industrial partners and assume a leadership role by identifying priority health needs, organizing and assembling necessary resources, and by implementing, managing, and communicating to the public the results of such research. Given the health effects related to ozone and particulate matter and given the uncertainty regarding the size of regional study area required to study these compounds, the Board recommends AENV review guidelines for the modelling of ambient air quality for suitability to address formation and dispersion of secondary pollutants.

5 ENVIRONMENTAL EFFECTS OF THE PROPOSED POWER PLANT

5.1 Air Quality

5.1.1 Views of the Applicant

TransAlta submitted that it had assessed air emissions from the proposed Keephills 3 and 4 project following AENV modelling guidelines and noted that uncertainties can appropriately be addressed by monitoring programs. It asserted that its evaluations demonstrated that maximum concentrations of criteria and toxic pollutants would occur within a 60 by 65 km study area.

TransAlta noted that its predicted 99.9 percentile one-hour average SO_2 concentration would be 204 micrograms per cubic meter ($\mu g/m^3$) which was significantly below the 450 $\mu g/m^3$ Alberta Ambient Air Quality Guideline[5] (AAAQG). It noted that the highest predicted SO_2 ground level concentration of 678 $\mu g/m^3$ would occur at the Wabamun plant; this prediction resulted from building downwash effects upon the emissions plume.

[5] Exhibit 202, Appendix 1. Also, Exhibit 34.

TransAlta submitted that its highest predicted nitrogen dioxide concentration in the Keephills area, outside immediate plant site, was 160 $\mu g/m^3$, which was also significantly below the 400 $\mu g/m^3$ AAAQG.

TransAlta also testified that the maximum predicted 15 $\mu g/m^3$ total suspended particulates was substantially less than the 100 $\mu g/m^3$ AAAQG. Further, it noted that the predicted maximum $PM_{2.5}$, assuming no future implementation of improved emission controls on mine equipment, associated with the Keephills plant were 2.7 $\mu g/m^3$ relative to monitored background levels of 12 $\mu g/m^3$ and the CWS of 30 $\mu g/m^3$ that is to be achieved by 2010. It said that secondary organic particulates related to the project would be negligible.

TransAlta stated that its estimates of toxic pollutants, including volatile organic compounds (VOCs), metallic oxides, dioxins, furans, radionuclides, poly-aromatic hydrocarbons (PAHs), halides, and mercury were well below levels deemed acceptable by AENV.

With respect to mercury, TransAlta noted that the predicted ground level concentrations would be less than 1% of the Texas Natural Resources Conservation Commission screening levels accepted by AENV. It said that the mercury evaluation was conservative in that mercury emissions reductions related to its planned use of low NO_x burners, dry FGD, and bag house particulate controls were not taken into account. TransAlta stated that acid deposition and mercury deposition associated with the project would have an insignificant impact on aquatic life.

TransAlta relied on the province-wide acid deposition management framework developed by the Clean Air Strategic Alliance (CASA) and said that levels of acid deposition in the Keephills area are and will continue to be well below levels that might be deemed harmful to the environment. It noted that the potential acid input (PAI) was approximately 30% of the critical load for sensitive soils and concluded that acidification would not be a problem. TransAlta proposed to partake in observational studies of acid deposition in the Keephills area for the purpose of confirming the theoretical predictions.

TransAlta submitted that Alberta meteorology is not conducive to ozone formation and that monitoring in the province shows ozone decreases with increasing NO_x concentrations. It further stated that monitoring in the region has found ozone levels to be less than the AAAQG over 99.95% of the time, and said that there was no evidence of ozone effects on soils, vegetation, or humans in the area. It concluded that Keephills 3 and 4 emissions would have no adverse effect on ozone levels.

TransAlta stated that it was a recognized world leader with respect to climate change programs. It committed to the implementation of a voluntary offset program to ensure that carbon dioxide emissions from Keephills 3 and 4 would be equivalent to emissions from a combined-cycle natural gas facility of the same capacity. TransAlta noted that this commitment amounted to a 63% reduction relative to what the greenhouse gas emissions would otherwise be.

5.1.2 Views of the Interveners

The Intervener Group

The Intervener Group submitted that TransAlta's application did not provide enough information for this Board to assess the environmental effects. It said that this was evidenced by the amount of monitoring and assessment that is being required by AENV and recommended by the Federal Agencies, and it was also evidenced by the limited information in the EIA. It noted the need for assessment of soils to determine potential acidifying emissions effects, studies of lichen for the potential effects of acid rain, and accurate measurement of mercury and assessment of its impacts on the ecosystem.

The Intervener Group expressed concern that 90% of the pollutants emitted would be deposited outside of the EIA study area used by TransAlta and that the assessment did not address the fate of pollutants and toxins that would be transported through Edmonton and into Saskatchewan, with some, such as mercury, reaching Arctic lakes and elsewhere in the world.

The Intervener Group noted TransAlta's prediction that the SO_2 ambient air quality guidelines and potential acid deposition critical loads could be exceeded. It stated that the air quality assessment did not provide an accurate or comprehensive understanding of the air quality impacts. The assessment also failed to address some toxic and other pollutants of concern; it did not consider geographic areas of concern such as where the secondary pollutants would likely be formed.

The Intervener Group also submitted that the modelling, and consequently the air assessment, did not deal with secondary air pollutants, namely ozone and particulate matter including organics and condensables that are the pollutants most likely to have public health effects.

With respect to ozone, the Intervener Group noted Environment Canada's evidence of exceedances of CWS at four monitoring sites in Edmonton that were supported by modelling evaluations. It said that this theoretical and observational data demonstrated that the addition of NO_x from anthropogenic sources would likely increase ozone and that this issue had not been addressed by TransAlta on the theory that ozone formation is not a problem or does not exist in Alberta.

The Intervener Group did not agree with TransAlta's interpretation on the use of the RELAD Model. It said that the model was used for long-range transport and was not appropriate for local conditions. It argued that local predictions of high PAI should have resulted in a local assessment of soil sensitivity, instead of the provincial scale soils data that were used in the EIA. The Intervener Group did not believe that such a scale was appropriate. It stated that there was not sufficient information to assess PAI to verify inputs and to assess potential ecosystem response.

The Intervener Group observed that TransAlta had provided model estimates of PAI, but without actual deposition measurements for sulphates, nitrates, or the base cations to verify the modelling. Further, it said that there was no ecosystem monitoring to decide whether exposure to that amount of sulphate, nitrate, and base cations could be harmful. It asserted that the results of TransAlta's work were not reliable for assessing whether there would be deleterious impacts of acid deposition in the study area.

The Intervener Group stated that a primary concern was the increase in NO_x emissions. It noted international work that had found a counterintuitive response when SO_2 emissions were reduced without concurrent NO_x reductions that could result in increased particulate matter concentrations.

The Intervener Group noted that the Keephills 3 and 4 expansion will more than double mercury emissions for which there is no safe level of exposure. It further noted that mercury did not break down and approximately half of it would be deposited locally. It said that thermal power plants are the largest single source of industrial mercury in Canada and Alberta's contribution to Canadian mercury emissions would increase to 40% from thermal plants if the Keephills 3 and 4 and EPCOR's Genesee 3 projects are approved. The Intervener Group believed that TransAlta neglected mercury emissions reductions in the design of the plant, the benefits of mercury removal as part of FGD evaluations, and it did not commission a report or specifically evaluate mercury control technology. It pointed out that the elimination of mercury is a goal of the Canadian Environmental Protection Act. It suggested that the time is ripe to reduce, not increase, mercury pollution.

With respect to compliance with Alberta standards, the Intervener Group stated that Alberta is a signatory to the CWS for ozone and particulate matter and, as such, should require pollution prevention and use of best-available technology. The Intervener Group stated that AENV's evidence was neither cogent nor compelling as to why its source emission standards were not consistent with best-available demonstrated technology or even with the findings of the Alberta Research Council report that AENV had commissioned. It submitted that the emission source standards are neither law nor regulation, but are merely policy and not a very good policy. It urged the Board not to rely on the Alberta standards to determine the public interest.

The Interveners Group submitted that the proposed plant would be a major source of greenhouse gases. It noted that one-half of Canada's greenhouse gases were produced in Alberta and that 78% of Alberta's contributions came from coal-fired electrical generation

Paul First Nation

The Paul First Nation stated that total emissions from all of the proposed coal-fired generations facilities are large. It argued that the Board should not sacrifice the environment in a situation where Albertans will be paying a price based on natural gas fueled electricity for Keephills 3 and 4 electricity while TransAlta pockets the profits of lower cost coal-fired energy based on lower emission standards. It noted that the proposed project would have much greater pollution than gas-fired generation, 125 nanograms per joule (ng/J) of NO_x versus 20 ng/J of NO_x for gas turbines. It further noted that the project could achieve 50 ng/J for NO_x using best-available technology for coal-fired generation. It said that the matter was important to the Paul First Nation as when NO_x emissions are reduced, so are acid rain, smog, particulates, and air toxics.

The Paul First Nation submitted that Alberta source emissions standards are mere guidelines, not law, and more stringent federal standards are expected in the near future. It was concerned regarding testimony on the process used by AENV to develop its recent emissions standards and the apparent influence TransAlta had on the current guidelines. Paul First Nation supported Environment Canada's recommendations on best-available technology for the reduction of SO_2,

NO_x, and mercury emissions. It maintained that any approval should be conditioned to require that TransAlta, at the very least, match the SO_2 emission levels proposed by EPCOR's Genesee 3 project as well as utilizing best available technology for NO_x.

The Paul First Nation observed that TransAlta had only monitored ambient levels of $PM_{2.5}$ and PM_{10} one day a week in the Wabamun area since 2000. It expressed concern that this limited monitoring was not effective in understanding the true ambient levels of toxic particulates. Paul First Nation noted that the predicted maximum SO_2 values exceeded the one-hour guidelines at the Wabamun power plant site just west of reserve lands, and that the highest average 24-hour and annual exposures also occurred near the Keephills plants and Lake Wabamun area west of the reserve and on the south end of the reserve. It contended that Keephills 3 and 4 would undoubtedly contribute to these exposure levels. It submitted that emission data during upsets may give better insight into the short-term exposure to air toxics. The licensed emissions rate may not represent the highest emissions rates, casting into doubt the assumptions used by TransAlta in its EIA.

The Paul First Nation testified that wind rose evidence clearly showed that winds from the southwest would carry the pollution from Keephills 1 and 2, and potentially from 3 and 4, to reserve lands adjacent to Lake Wabamun. It observed that the Ironhead monitoring site recorded calm conditions for 6.7% of the time, however data for calm conditions recorded by the seven other monitoring stations were one or two orders of magnitude less. Paul First Nation said that the inconsistency led it to believe that TransAlta's dispersion modelling results were flawed and not representative of what the Paul First Nation members would experience on their reserve lands.

Government of Canada

Environment Canada submitted that all signatories to the CWS, including Alberta, committed to achieving the CWS standards for particulate matter and ozone. It expected the Government of Alberta to utilize its regulatory regime to ensure that these commitments were honoured, particularly the commitment to "keeping clean areas clean" through the application of best-available technology and continuous improvement. Environment Canada submitted that polluting "up to a limit" was not acceptable.

Environment Canada testified that evidence exists which demonstrated a direct correlation between mortality, hospital admissions, and emergency visits with exposure to elevated levels of particulate matter and ozone. It further noted that there is no apparent lower threshold for the effects of particulate matter and ozone on human health.

Environment Canada believed that the meteorological conditions conducive to ozone formation were not exceptional and may be expected to occur from one to several times each summer in Alberta. The theoretical and observational evidence indicated occasional ozone formation due to anthropogenic emissions of NO_x and VOCs. Environment Canada said that its predicted ozone levels from two photochemical models compared reasonably well with observed ozone values, which provided confidence in the validity of the models and their applicability to Alberta. The model results indicated potential for increased ozone formation resulting from increased power plant emissions of NO_x.

Environment Canada submitted that a regional approach to address the cumulative impacts on regional air quality would require cooperation between all stakeholders in the region. In regards to ground-level ozone, Environment Canada recommended the pursuit of opportunities to reduce NO_x emissions as a means of progress towards the goals of pollution prevention and keeping clean areas clean in accordance with the CWS for particulate matter and ozone. It stated that stakeholders within this region should collectively review ozone and precursor modelling and monitoring needs with the aim of better defining the nature and magnitude of the ozone issue in central Alberta.

In regards to particulate matter, Environment Canada recommended that $PM_{2.5}$ inventories, modelling, and monitoring within the Edmonton-Wabamun region be enhanced, and an assessment of the potential for longer-range transport be completed. For acid deposition, Environment Canada recommended the installation of a monitoring system that includes measures to determine atmospheric components and ecosystem effects of acidification within the Edmonton-Wabamun region. It also noted that modelling with a longer meteorological data set is needed to substantiate potential impacts in Saskatchewan due to long-range transport.

Government of Alberta

AENV submitted that modelling information provided by TransAlta led it to conclude that ambient concentrations of primary air emissions from the project will meet the AAAQG. It said that existing particulate matter, $SO_{2,}$, and NO_x monitoring would need to continue if Keephills 3 and 4 are approved. Reconfiguration and/or supplementation of TransAlta's current air quality monitoring stations may be required.

AENV stated that ozone monitoring, with additional downwind (eastern) locations between EPCOR and TransAlta power plants, would be essential to verifying that future ozone levels remain within acceptable levels.

AENV also testified that TransAlta's air quality model inputs into the CALPUFF Model were conservative and the model results likely over-estimated the future acid deposition load. It noted however, that the results suggest the need for a program to accurately quantify acid deposition load, evaluate the environmental significance to terrestrial and aquatic systems, and take action to reduce the load if necessary. AENV further stated that monitoring and acid deposition issues could be addressed during the *Environmental Protection and Enhancement Act* (EPEA) approval process for Keephills 3 and 4.

AENV indicated that it would continue cooperative action with Environment Canada and the Government of Saskatchewan to address the issue of long-range transport of acid deposition. It noted that the Alberta Acid Deposition Management Framework included the periodic application of interprovincial scale predictive modelling, monitoring as appropriate and an adaptive management approach that tracks, and could respond to any significant potential for long-term impacts in Alberta or Saskatchewan.

AENV also submitted that it took voluntary greenhouse gas reduction commitments very seriously. It supported the use of emission offsets as a component of a voluntary action plan for greenhouse gas emission reductions. It would require TransAlta to report annually on greenhouse

gas emissions (direct emissions, net emissions that incorporate offsets, and the offsets themselves) from the Keephills plant as a condition of any EPEA approval for Keephills 3 and 4, should one be issued.

5.1.3 Views of the Board

The Board accepts that the AAAQG and other reference criteria utilized by AENV are the current appropriate benchmarks for assessing the impacts that the proposed project will have on air quality. That is, the Board finds that the standards, guidelines, and other environmental and health protection criteria define the maximum predicted environmental effects that would be currently permissible. The Board is of the view that emissions reductions or other mitigation efforts would have to be incorporated into the project if significant exceedances of the criteria are predicted. In this case, the Board accepts TransAlta's evidence that incremental emissions from Keephills 3 and 4 will not result in exceedances of the AAAQG and other air quality reference criteria outside the immediate industrial facility sites. Exceedance values of SO_2 predicted at the Wabamun plant, should they occur on site, will be subject to occupation health and safety regulations. The Board, therefore believes that Keephills 3 and 4 could be approved on the basis that it would not result in unacceptable air quality when considered with other cumulative emissions in the region.

The Board notes that there is no mercury emission standard applicable to the project, however, development of a mercury CWS is in progress. The Board accepts the evidence of TransAlta that predicted mercury emissions represent exposure risks well below screening standards that are generally accepted by AENV. These include the Effects Screening Levels of the Texas National Resource Conservation Commission (0.25 $\mu g/m^3$ short-term and 0.025 $\mu g/m^3$ long-term). The Board also recognizes that deposition of atmospheric mercury emissions are of concern and recognizes the importance of minimizing related emissions. The Board expects CWS standards for mercury to be adopted in the near future in addition to revised federal emission standards for coal-fired power plants. Therefore the Board recommends that AENV determine how pending CWS for mercury will apply to Keephills 3 and 4 in its approval process.

The Board accepts testimony of Health Canada that increased levels of particulate matter are correlated with increased health effects. The Board believes that it is desirable for proponents to contribute to keep areas clean by implementing reasonable measures to minimize cumulative effects on air quality. The Board notes that Keephills 3 and 4 have been designed to meet existing regulatory guidelines and standards. The Board accepts the recommendations of AENV that effects of air emissions are generally acceptable provided mitigative measures and monitoring programs are adopted.

The Board heard different views regarding the interpretation of Alberta's acid deposition management framework. The Board does not agree with TransAlta's view or its method of assessment. Nevertheless, the Board accepts AENV's recommendation to require additional measurement of acid deposition and ecosystem effects by TransAlta. Acid deposition target loads are intended to apply on a 1º latitude by 1º longitude grid cell (about 111 km by 60 km) basis as regulatory objectives. That is, if cumulative contributing acidifying emissions result in exceedances of the target load for such a grid cell, then mitigation is required. The target load objectives, however, are not intended to be applied as regulatory standards for proposed projects

based on predictions for local study areas. Rather, the target and critical loads are reference benchmarks indicating the need for more detailed evaluation of predicted local acid deposition impacts.

Notwithstanding CASA evaluations[6] of provincial acid deposition that indicated the calculated acid deposition in Lake Wabamun area grid cells was below target and critical loads, the Board views that the CASA study in itself is not sufficient to draw conclusions with respect to local acid deposition impacts from the proposed project. The methodology used by CASA does not have the sensitivity to assess local deposition from specific emission sources; computer models suited to small-scale (local) airsheds must be used. If predictions of local acid deposition exceed the benchmarks, more detailed investigation of actual sensitivity of local terrestrial and aquatic systems as part of environmental impact assessment evaluations is necessary to define protection and monitoring priorities based on the ecological or agricultural significance of acid sensitive areas that could be impacted by the proposed project.

In order to address potential local acid deposition issues, the Board directs TransAlta to take steps to verify acid deposition predictions with its monitoring programs. Further, the Board recommends that AENV in its approval process define requirements for TransAlta to investigate the acid deposition sensitivities of the areas predicted to receive acid deposition at rates in excess of the monitoring load for sensitive areas (0.17 keq $H^{+}ha^{-1}yr^{-1}$) and to identify protection priorities and action plans (if required) for receptors where the predicted acid deposition rates exceed target or critical loads.

With respect to long-range and trans-boundary transport of acidifying emissions, the Board recognizes AENV's co-operative efforts with other jurisdictions to address related issues in the modelling of air quality with Environment Canada and acid deposition initiatives with the Government of Saskatchewan. The Board believes that AENV's processes are appropriate responses to related concerns raised at the hearing.

The Board accepts the evidence of Environment Canada and others that power plant SO_2, NO_x, and other emissions can contribute to increased particulate matter and ozone levels in the Lake Wabamun-Keephills-Edmonton region. The Board, therefore, supports improved monitoring of particulate matter and ozone, as well as precursor emissions in the region to assess air quality and to verify predictions of industrial emissions impacts on ambient air quality. The Board directs TransAlta to the satisfaction of AENV, and singularly or in cooperation with other organizations such as the West Central Airshed Society (WCAS), to define additional air quality needs in the Lake Wabamun-Keephills-Edmonton region. The Board notes that monitoring related to Keephills 1 and 2 is currently required by the respective EPEA approvals, and the Board directs that TransAlta support and implement further regional ambient air quality and effects monitoring to the satisfaction of AENV.

Regardless of whether an existing airshed region such as WCAS can be modified to address the Lake Wabamun-Keephills-Edmonton region or whether a new region specific to the power plant

[6] Application of Critical, Target, and Monitoring Loads for the Evaluation and Management of Acid Deposition, Alberta Environment, Edmonton, Alberta

operators in the area needs to be formed, the Board recommends TransAlta take a lead role in creating such a forum for monitoring regional air quality.

The Board notes that Keephills 3 and 4 represent a significant source of greenhouse gases. The Board appreciates the position taken by AENV regarding the role played by voluntary greenhouse gas reduction efforts in the Province. The Board encourages reduction of greenhouse gas emissions and supports the use of emission offsets. TransAlta has steadfastly committed to offset greenhouse gas emissions so that carbon dioxide emissions from Keephills 3 and 4 will be equivalent to emissions from a combined-cycle natural gas facility of the same capacity. The Board directs TransAlta to fulfill its commitment in that regard. The Board further directs these offsets to be adjusted so they correspond to any reasonable foreseeable future changes in emissions standards for a coal-fired power plants or a corresponding gas-fired power plant. The Board notes AENV's intention to consider the introduction of emission objectives related to greenhouse gases as part of its post 2005 emission standards. Given the potential for disagreement on emission offset accounting, the Board recommends TransAlta and AENV use a third party audit process to verify the offsets.

5.2 Surface Water

5.2.1 Views of the Applicant

TransAlta assessed impacts to water resources within a local study area that included local receiving waterbodies, the existing cooling pond, and reach of the NSR receiving cooling pond discharges. It asserted that since Keephills 3 and 4 would not remove or discharge waters to Lake Wabamun, it would not affect the water level or runoff to the lake. Nevertheless, since water levels in Lake Wabamun were an issue for interveners, TransAlta indicated it was committed to implement mitigative measures for its other operations. These included actions to expand the Wabamun Lake Water Treatment Plant no later than September of 2002. TransAlta would offset historical and ongoing effects to lake water levels by water replacement pumped into the lake no later than the end of 2006.

TransAlta provided an environmental assessment of impacts related to Keephills 3 and 4 and concluded that there were no significant impacts to water resources. TransAlta admitted that Keephills 3 and 4 would affect surface runoff in a localized area due to additional surface disturbances and construction activities primarily within the plant site boundary. However, TransAlta asserted that these would be mitigated by the construction and operation of storm water retention ponds with periodic pumping to the cooling pond.

TransAlta predicted changes to the existing cooling pond water balance as a result of Keephills 3 and 4. It submitted these changes would be minimized by adjusting makeup and blowdown rates to maintain historic water levels in the cooling pond and freeboard for a 1 in 100 year flood event. The project was designed with two cooling towers to further limit effects on the cooling pond. TransAlta stated that weekly monitoring of cooling pond water levels was already occurring and that water quality monitoring would be implemented to comply with any regulatory requirements.

TransAlta explained that makeup waters for the cooling towers would be pumped from the NSR with no increase to licensed withdrawal limits of AENV. For 10 months of the year the water

would be pumped from the river to the cooling towers with storage waters pumped to the cooling pond. For 2 months of the year, during spring, with low flow conditions, makeup waters would be taken from the cooling pond and not pumped directly from the river. TransAlta would develop an operational plan to minimize water withdrawal and blowdown effects to the NSR. Operation of the two cooling towers for Keephills 3 and 4 would result in continuous blowdown to the cooling pond with an equivalent blowdown rate to the river of 0.33 cubic meter per second (m^3/s).

TransAlta submitted that water withdrawals from the NSR were expected to decrease mean monthly river flows by 0.64 m^3/s or 0.5% and asserted that this effect was predicted to be negligible with appropriate mitigation. TransAlta committed to suspend water withdrawals should the 10 year 1-day or 10 year 7-day low flows be reached. TransAlta explained that both makeup and blowdown rates to the river would be adjusted operationally by means of real time flow data from the NSR and water management protocol. TransAlta committed to monitor water quality and conduct biological sampling (benthic invertebrates) of the NSR.

TransAlta concluded from its EIA that total mercury concentrations in water and sediment from the Keephills cooling pond were within background ranges reported for surface water in Alberta. Based on data collected since 1996, TransAlta found that mercury concentrations in waters of Lake Wabamun were in compliance with water quality guidelines for protection of aquatic life based on US Environmental Protection Agency (1999) and the Canadian Council of Ministers of the Environment (CCME; 1999).

Highest mercury concentrations in sediments were recorded from Isle Lake and Lake Wabamun at 2,520 and 990 micrograms per kilogram (μg/kg) by dry weight. This compares to the guideline value of 170 μg/kg for protection of aquatic life. TransAlta submitted that the small increase of mercury deposition from Keephills 3 and 4 was predicted to have a low impact upon surface waters and sediments. However, TransAlta admitted that there was insufficient data to quantitatively estimate effects of Keephills 3 and 4 mercury emissions upon regional water and sediment quality. Measurable increases of mercury concentrations in surface water columns were not predicted as a result of emissions from Keephills 3 and 4 and the expanded Genesee plant.

TransAlta indicated that sediment data from regional lakes indicated exceedance of sediment quality data for selected metals. Hasse Lake sediments were low in total mercury with exceedance of arsenic and zinc guidelines. Jackfish Lake exceeded sediment guidelines for arsenic, chromium, and lead. Arsenic and chromium sediment guidelines were exceeded for Mink Lake. These were referenced to Canadian Freshwater Sediment Quality Guidelines for the Protection of Aquatic Life.

TransAlta stated that with naturally occurring processes, guideline exceedance under baseline conditions for water and sediment were common in Alberta surface waters. Exceedance values indicated concentration levels for comparative purposes and were not necessarily associated with the effects of human activity. Nevertheless, TransAlta indicated it would implement sediment monitoring of Lake Wabamun and selected other lakes, in cooperation with AENV, to address the low availability of mercury data. TransAlta also committed to complete a high-resolution sediment core study in Lake Wabamun.

TransAlta submitted that no acid sensitive waterbodies were identified in the area surrounding Keephills 3 and 4 and that the predicted cumulative acid deposition for Lake Wabamun was less than one-third of the calculated critical load for acid deposition. Both the project and cumulative effects of acid deposition upon surface waters were predicted to be negligible.

TransAlta assessed other cumulative effects within a regional study area. The regional hydrologic study area included streams to be affected by future mining of the Highvale mine and receiving waters of the NSR between Keephills and Edmonton. TransAlta planned additional studies or assessments to those streams affected by future mining at the time of mine license and EPEA approval applications. Cumulative effects of the Genesee, Sundance, and Keephills power plants upon flows and water quality of the NSR were predicted to have low impacts.

5.2.2 Views of the Interveners

The Intervener Group

The Intervener Group identified several areas where it believed the Keephills 3 and 4 application contained insufficient information. One of these related to the cumulative effects of mine operations upon water levels and water quality that were not contained in the EIA. The Intervener Group stated that the Keephills cooling pond and some mining activity associated with Keephills 3 and 4 were situated within the watershed of Lake Wabamun. It contended that environmental baseline data and environmental effects upon Lake Wabamun were inadequate. The Intervener Group recommended a follow-up study to understand possible interactions between the Keephills cooling pond and Lake Wabamun. It was thought cooling pond contaminants were able to migrate to Lake Wabamun via groundwater flows. In addition, the Intervener Group requested the applicant provide a detailed water management plan to address local and regional effects of TransAlta plant operations, effects of climate change upon water levels, and the impacts to local residents as a result of TransAlta facilities.

The Intervener Group questioned several EIA findings on the grounds that they were based on the inadequacy of past and present environmental monitoring programs, such as insufficient numbers of chemical or biological samples to identify baseline conditions. Some chemical analyses for water quality (for example, total mercury, arsenic) were not precise enough to establish compliance with guidelines since detection levels were above guideline concentrations.

The Intervener Group also stated that TransAlta's conclusions that contaminant cycling and accumulation in regional surface waters would not have measurable impacts (past, present or future) were unsubstantiated due to limited historical data and the long term inability to measure mercury in water.

The Intervener Group questioned the use of atmospheric models within the EIA with limited baseline data from regional waterbodies to validate conclusions about water resources. It used its own research findings to challenge the size of the modelling domain and regional study area of the EIA and stated that the closest waterbodies to Keephills 3 and 4, such as the cooling pond and Lake Wabamun, might not be receiving the highest depositional impacts from emissions.

The Intervener Group recommended that a larger regional study area be used to determine effects from atmospheric transport upon water resources for an acceptable assessment of cumulative effects. Based on the high-resolution sediment results of the interveners, the three control lakes at intermediate distances from Keephills used in the EIA were likely receiving atmospheric deposition from local or regional industrial sources. Therefore, more distant waterbodies should have been used to represent reference conditions in assessing impacts.

The Intervener Group indicated that, although its sediment core research was still preliminary, without actual dating of mercury in sediment layers or calculating depositional rates, nevertheless it suggested long term increases in atmospheric deposition of mercury and PAHs from regional lakes that were sampled. It identified future research plans to determine the contributions of human versus natural sources and local, regional versus global sources of mercury and PAHs.

The Intervener Group stated that the use of long term averages for river flows, cooling pond evaporation, water extraction, and climatic conditions in the EIA would underestimate impacts of water diversion and blowdown due to Keephills 3 and 4. It recommended analysis of synergistic changes in water supply to better estimate future impacts to the NSR.

To address uncertainties about future blowdown impacts to the NSR, the Intervener Group recommended that TransAlta monitor water quality both downstream and upstream of the blowdown discharge. Also, it identified the need to monitor blowdown temperatures entering the river as well as water intake temperatures.

The Intervener Group objected to Keephills 3 and 4 on the grounds that the Lake Wabamun ecosystem and the health of persons using the lake would be directly and adversely affected. Expanded coal mining associated with Keephills 3 and 4 would compound historical decreases in the water level of Lake Wabamun. It asked TransAlta to assess cumulative effects of both surface water diversions and disruption of groundwater aquifers in determining its offset water debt to the lake based on historical and on-going operations.

With declining water levels in Lake Wabamun influenced by TransAlta's activities, the Intervener Group stated concentrations of contaminants in the lake were likely to increase, posing risks to public safety and the quality of fish. The Intervener Group asked the EUB not to grant approvals for Keephills 3 and 4 or any other thermal facility in the watershed, so that expansion of coal mining would not occur. This would help alleviate detrimental and severe impacts to the watershed according to the Intervener Group.

The Intervener Group emphasized the importance of a watershed management plan and asked the Board not to approve further industrial developments affecting the Wabamun watershed until a comprehensive watershed management plan and mitigation strategy had been completed.

The Intervener Group provided evidence of high-resolution sediment core analysis that suggested measurable long-term increases of priority pollutants, PAHs, and mercury, had occurred in sampled lakes of the regional airshed. It asserted that this information was contrary

to that of TransAlta, which concluded no measurable impacts to waterbodies would occur within or beyond the regional study area.

Based on insufficient sampling for mercury in waterbodies, the Intervener Group did not support the conclusion of TransAlta that mercury in regional waterbodies most likely occurred from natural sources. Regarding water supply from the NSR and cooling pond blowdown, the Intervener Group questioned the absence of information concerning model accuracies, sensitivities and data based validations.

The Intervener Group submitted evidence of increased mercury loading in the environment as a result of Keephills 3 and 4 and other planned expansions. The Intervener Group noted increasing levels of mercury in fish and surface waters from the Keephills area. The Intervener Group also cited the research of Drs. Schindler and Donahue, which indicated an increase of methylmercury in Lake Wabamun and its lake sediments. The Intervener Group attributed to mercury the risks to human health and the environment for which there was no clear link between safe or allowable mercury and environmental or health impacts.

Consequently, if the EUB were to find that mercury abatement technology was not currently or imminently available for Keephills 3 and 4, the Intervener Group requested the application be denied. The Intervener Group also recommended that, if the Board approved the application, TransAlta should be required to implement mercury abatement consistent with US regulatory initiatives (for example, Environmental Protection Agency implementation of mercury emission criteria).

The Paul First Nation

Although the Paul First Nation did not support the project, it identified several approval conditions for EUB adoption, should approval be granted. One of these recommended that the EUB require TransAlta to implement a community based research and environmental monitoring program. Such a program would include establishment of water quality and water monitoring stations along Lake Wabamun. The program was proposed as a cooperative partnership with TransAlta, part of a broader socio-economic bi-lateral agreement.

The Paul First Nation expressed concerns regarding the quality of water and fish in Lake Wabamun as a result of TransAlta's operations and planned expansions. It stated that the health of reserve residents was being adversely affected as well as traditional uses of resources. The Paul First Nation also supported the recommendations advanced by Clean Energy Coalition (CEC) and the Mewassin Community Action Group (Mewassin). It also made references to previous evidence submitted by the Paul First Nation during the EPCOR Genesee 3 Hearing in respect to cumulative effects, water and fish resources, sustainable development, and technology.

Government of Canada

The Department of Fisheries and Oceans (DFO) noted that potential water quality issues (for example, mine drainage and discharge) arose in the review of TransAlta's application and the applicant's commitment to follow-up monitoring. DFO also supported the continuation of water temperature monitoring at the existing plant outlet and recommended the inclusion of additional periodic monitoring in the NSR to validate thermal conditions and verify predicted impact on

fish and fish habitat. DFO committed to on-going work with TransAlta to ensure mitigation of potential impacts relevant to the Fisheries Act. DFO neither supported nor opposed the project.

Environment Canada provided evidence that emissions from Keephills 3 and 4 had the potential for long-range transport and deposition. In addition, SO_2 emissions were predicted to increase significantly with the addition of Keephills 3 and 4 and Genesee 3. Together with increased NO_x emissions, acid deposition in the Wabamun-Edmonton region would increase. Environment Canada indicated that from TransAlta's EIA data and its own RELAD modelling, it concluded there was potential for local exceedance of the critical load for acid deposition and potential exceedance of the monitoring load for water and soils within the Wabamun region. Therefore, Environment Canada recommended installation of monitoring systems with measures to determine atmospheric components and ecosystem effects of acidification within the Wabamun-Edmonton region.

Environment Canada believed that effects due to long-range transport into Saskatchewan were below harmful levels. However, it suggested additional modelling and the use of longer term meteorological data to substantiate its finding. Environment Canada recommended that stakeholders collectively identify suitable performance indicators and feedback mechanisms to monitor progress on emissions reductions and observe changes in ecosystems on a local, regional, and longer-range spatial scale.

Among its several recommendations regarding mercury deposition, Environment Canada suggested that regional stakeholders identify indicators for potential mercury accumulation in aquatic and terrestrial ecosystems within a long-term mercury monitoring program.

Environment Canada concluded that water resources in Alberta might be influenced adversely (for example, long term decline in river flows) by global climate change. Potentially power plants discharging to rivers could require enhanced treatment of process waters to minimize thermal pollution. Environment Canada recommended that in the design and evolution of adaptive management strategies applicable to Keephills 3 and 4, that effects of different climate change scenarios be analyzed.

Government of Alberta

With respect to TransAlta's position that large-scale changes in water quality were not predicted as a result of the project, AENV stated there was some uncertainty associated with the assessment due to the limited history of blowdown to the NSR. Subject to project approval, it would recommend biological and water quality monitoring of the river. Similarly for the thermal effects of water discharges to the river, AENV recommended that TransAlta validate its conclusion of localized effects upon benthic invertebrates by monitoring the cumulative impact of water discharge upon those organisms. It also recommended monitoring by TransAlta to further identify boundaries of the thermal discharge zone within the river.

Regarding effects of acidification upon Lake Wabamun, AENV recommended that a monitoring program with appropriate management responses be established to quantify the acid deposition load and evaluate its significance to aquatic systems. This could be the subject of EPEA

licensing by AENV. AENV recognized the need for improved baseline water quality data to address spatial variation within or among waterbodies of the study area.

To address the issue of mercury emissions and effects upon aquatic systems, AENV intended to incorporate a mercury monitoring and management program within the EPEA approval for Keephills 3 and 4 should one be issued. Program elements might include accurate quantification of mercury emissions, water quality, sediment, soil, and bio-receptor monitoring with appropriate response actions. AENV emphasized the importance of considering cumulative effects of multiple air emission sources in the airshed for protecting surface waters and involving multiple stakeholders.

AENV stated that since the Keephills cooling pond was not being expanded as a result of the project, no further reduction in the drainage area of the Lake Wabamun would occur due to Keephills 3 and 4. AENV noted that no changes to TransAlta's existing water licenses were required. Furthermore, no changes to surface water hydrology or quantity were anticipated for either the NSR or Lake Wabamun watershed. The Government of Alberta did not object to the TransAlta application provided the EUB were to find it in the public interest and recommended mitigations were addressed.

5.2.3 Views of the Board

The Board is of the view that TransAlta provided satisfactory evidence from its environmental assessment that surface water resources were not likely to be significantly affected by the proposed Keephills 3 and 4. The Board notes that TransAlta proposed, as mitigative measures, completion of an operational plan for blowdown, additional monitoring of the Keephills cooling pond, NSR, sediment monitoring of Lake Wabamun, and other lakes in the area. The Board directs TransAlta to complete the above commitments to the satisfaction of AENV and Alberta Sustainable Resource Development (SRD) and where applicable in cooperation with DFO.

The Board notes that for purposes of the Keephills 3 and 4 environmental assessment, proposed surface mining of coal occupies a limited surface area of approximately 57 hectares within the Lake Wabamun watershed. However, the Board's pre-hearing Memorandum of Decision defers consideration of coal mining effects from the Highvale mine. The Board directs TransAlta to undertake environmental studies, including cumulative effects of related coal mining activity, at the time it applies for amendments to the mine license and EPEA approvals.

In the matter of existing mine drainage waters, the Board notes the regulatory powers of AENV within existing Water Act licenses. At such time as TransAlta applies for EUB licenses and AENV approvals for its new mining operations, the Board directs the applicant to address the need with other stakeholders for a Watershed Management Plan applicable to Lake Wabamun. The Board finds intervener issues concerning TransAlta's water treatment plant on Lake Wabamun and calculation of historical water debt to restore lake levels are best determined through Water Act licensing by AENV.

The Board attributes high importance to the recommendations of AENV, SRD, and DFO to further address the protection and management of water resources in the context of Keephills 3

and 4. Examples include the provision of additional baseline and assessment data for water and sediment quality of streams, lakes, the NSR, and the Keephills cooling pond.

The Board believes that a mercury monitoring and management program is mandatory for any approval of Keephills 3 and 4 and, thus, the Board directs TransAlta to establish such a program with AENV and SRD prior to commissioning of Keephills 3 and 4.

The Board believes that preliminary sediment core data submitted by CEC and the Lake Wabamun Enhancement Protection Association (LWEPA) regarding total mercury and PAH sediment concentrations from selected regional lakes may not establish that mercury deposition has increased in regional lakes. The Board feels further actions are warranted due to the uncertainties surrounding mercury deposition, preliminary findings of lake sediment cores, and known hazards of mercury bio-accumulation and toxicity. It signals the urgent need and high priority for additional research to understand the transport and cycling of mercury emissions in the regional and local environment. The Board recommends that TransAlta, with the cooperation of other stakeholders, support high resolution analyses of lake sediment cores and other emission receptor studies, which may necessitate future mitigative measures for the management of regional emissions. To avoid limitations of some past environmental baseline data, the Board recommends that AENV establish with TransAlta appropriate sampling frequencies, analytical protocols, and reporting methods, including the analyses of trace elements within EPEA and Water Act Licenses.

Not withstanding the findings of the EIA, the Board recognizes considerable efforts are needed by the proponent and other stakeholders to establish a framework for monitoring environmental effects upon regional waterbodies. Detailed information of this nature is generally lacking and should be collected in conjunction with regional air monitoring programs. The Board understands that regional environmental monitoring is a multi-stakeholder responsibility, representative of industrial and non-industrial activities present in the Lake Wabamun-Keephills-Genesee region. To this end, the Board directs TransAlta to participate and contribute to baseline and effects based monitoring of surface waters and sediments within a regional framework, to the satisfaction of AENV and SRD. Through its on-going public consultation process and establishment of regional environmental monitoring, the Board expects TransAlta to involve affected stakeholders.

The Board acknowledges the advice of AENV that effects upon water resources are acceptable provided that recommended monitoring and management programs are addressed by Water Act and EPEA approvals. Furthermore, the Board recommends AENV employ adaptive management techniques for integrating TransAlta's future environmental monitoring and management programs.

5.3 Fish and Other Aquatic Biota

5.3.1 Views of the Applicant

TransAlta stated that the key issues for fisheries were the effects of the project on aquatic life in the NSR, Wabamun Lake, and the Keephills cooling pond. As such, TransAlta's EIA considered alterations in the water and sediment quality, and in the thermal regimes of both the cooling pond and the NSR. It also considered alterations of flows in the NSR, fish entrainment in both the

cooling pond and NSR water intakes, as well as considering altered water and sediment chemistry in surface waterbodies from acid deposition and mercury deposition.

TransAlta stated that the changes in water quality and water temperature in the cooling pond due to the project would be small and would have a negligible effect on fish. It stated that the changes in flow, water quality, and temperature in the NSR would be small, and would also have a negligible impact on fish. TransAlta said that waterbodies in the surrounding area of the project were not sensitive to acid deposition and impacts on fish in these waterbodies would be negligible.

With regards to mercury deposition, TransAlta indicated that the project would not alter any of the factors (for example sulphate-reducing bacteria, temperature, or low dissolved oxygen conditions) that affect the methylation of mercury in waterbodies, a biological process known to transform mercury to its more toxic form, which is also more readily available to aquatic biota. As such, TransAlta argued, the impact of the project would have a negligible impact on mercury concentrations in fish tissue. It used the example of Lake Wabamun to illustrate its point. TransAlta determined that background "global sources" contributed 23 micrograms per square meter per year ($\mu g/m^2/yr$) of mercury to Wabamun Lake. It stated that the existing Keephills plant contributed another 5 $\mu g/m^2/yr$ of mercury to the lake and predicted that the proposed plant would also contribute another 5 $\mu g/m^2/yr$ of mercury. TransAlta stated that the Sundance Plant contributed 10 $\mu g/m^2/yr$ of mercury to the lake, and that another 5 $\mu g/m^2/yr$ were deposited from the Wabamun and Genesee Plants combined.

TransAlta argued that although there was some deposition of mercury from the power plants, the existing Keephills 1 and 2 and proposed Keephills 3 and 4 would contribute negligibly to mercury in the regional aquatic environment. TransAlta also contended that mercury concentrations in fish from Lake Wabamun were low, despite many years of power plant operation, such that average concentrations were below subsistence consumption guidelines, maximum concentrations were below occasional consumption guidelines, and concentrations fell within the range of concentrations reported for other waterbodies throughout Alberta. TransAlta noted it would continue to monitor mercury concentrations in fish from Wabamun Lake as a condition of its approval for its other plants.

TransAlta testified that it did not measure fish tissue concentrations for mercury or other contaminants for the EIA, but instead relied on historical information dating from 1983 to 2001. It did not test fish from the reference lakes for mercury concentrations or other contaminants. It noted that mercury levels in fish taken from the cooling pond ranged from 0.3 to 1.7 milligrams per kilogram (mg/kg), whereas consumption guidelines are 0.5 mg/kg. TransAlta noted that the higher mercury concentrations in fish from the cooling pond were likely the result of elevated water temperatures, due to warm water discharges from the plant. The higher water temperatures were believed to enhance mercury methylation and promote higher growth rates in fish, factors thought to contribute to the higher mercury concentrations in fish. TransAlta believed that the higher water temperatures in the cooling pond set it apart from other waterbodies in the region.

TransAlta stated that it was planning to put a fish screen, or other appropriate fish exclusion measures, at the intake from the NSR but not on the blowdown pipe to the river. The potential

for cooling pond fish to migrate to the NSR was believed to be small and the environmental consequences of such an event did not warrant screening.

TransAlta indicated that Lake Wabamun would receive the highest level of mercury deposition because of its proximity to the power plants. It noted that if the power plants were significantly affecting mercury levels in the region, it would manifest in the fish.

TransAlta stated that the primary cause of mercury toxicity in humans was due to consumption of fish and seafood, not as a result of mercury inhalation of the ambient air. TransAlta also stated that it used conservative assumptions for both mercury concentrations in fish and for levels of fish consumption in its human health assessment. It also assumed that methylmercury concentrations in fish would not increase as a result of power plant emissions. It stated that the outcome of its analysis illustrated that there was no risk to people eating fish.

With respect to mercury levels in the aquatic environment, TransAlta acknowledged that the reference lakes used were subject to depositional impacts from the power plants, but indicated that those lakes received less mercury than others. TransAlta maintained that the mercury levels of water, sediment, and fish in the regional study area were low and were similar to levels found elsewhere in the country. Furthermore, it argued that the proposed project would not influence the factors that affect the methylation of mercury, although it did note that the warmer temperatures caused by operations of the plant was one factor that was correlated with a higher rate of mercury methylation. TransAlta did not include the cooling pond in its initial comparison, and indicated that if it had been included, the cooling pond would have exceeded the provincial guidelines for the protection of aquatic life, and that fish from the cooling pond exceeded consumption guidelines set by the province.

TransAlta noted that Wabamun and Isle Lakes supported commercial and recreational fisheries, and that the reference lakes might also support fisheries.

TransAlta acknowledged that it did not undertake a study of invertebrate communities for the EIA. However, TransAlta used benthic invertebrate monitoring information from the NSR, and ponds in the vicinity of the cooling pond, from surveys conducted in 1997. It also included a survey of invertebrates inhabiting the cooling pond in the EIA. It believed that the discharge of blowdown water into the NSR was the only potential impact on invertebrates. TransAlta committed to conducting such a study before and after commissioning of the project, to confirm EIA predictions.

5.3.2 Views of the Interveners

Clean Energy Coalition

CEC indicated that several areas of TransAlta's EIA and Cumulative Environmental Assessment were lacking in the area of aquatic resources. The most critical deficiencies involved the lack of established baseline information, and insufficient monitoring to determine the impacts of existing, and future, operations on regional freshwater resources. In addition, it expressed some concern that the information used in the EIA was dated and that more current data would only be available in the future.

With regards to baseline data, CEC stated that there was little or no assessment of the status of fish, invertebrates, or algal populations in any of the regional waterbodies, nor was an inventory of fish habitat conducted. It suggested that a satisfactory fish assessment would have provided distributions of fish size and lengths, weights and ages, and an indication of breeding populations. CEC indicated that sample sizes were too small to determine whether statistically significant changes had occurred in the past, or would occur in the future, and noted the overall lack of statistical information.

CEC pointed out that TransAlta's study area did not cover both upstream and downstream areas of the NSR, making it impossible to evaluate the impacts of blowdown on freshwater resources. Furthermore, it stated that TransAlta failed to consider the interactions of contaminants or processes, and their impacts on freshwater resources. CEC concluded that as a result of a lack of information, the current status of aquatic resources in regional waterbodies was not known, and thus the incremental impacts caused by the proposed project would not be understood either. It stressed the importance of implementing substantially improved monitoring programs to determine baseline conditions and the incremental impacts resulting from the project.

With respect to the framework of an appropriate monitoring program for aquatic systems, CEC testified that adequate sampling would include statistically established samples sizes, and sampling would be conducted frequently enough to assess comparative differences between impacted and unimpacted sites, seasonal and inter-annual trends. It used the example of aquatic invertebrates to emphasize the need for appropriate sampling frequency, as these biota demonstrate natural variation in community structure correlating to seasonal and environmental changes, which could be confounded if sampling were to take place every five years, as proposed by TransAlta. CEC also recommended that TransAlta be required to investigate food chain effects and the potential impacts on fish resulting from the increased deposition of contaminants.

CEC questioned the validity of TransAlta's conclusion that mercury levels in fish from Lake Wabamun were comparable to fish from other Alberta waterbodies. CEC established that the data presented by TransAlta depicting total mercury in northern pike from Alberta waterbodies did not take into consideration fish size or age structure, factors that were agreed upon to be significant in determining mercury concentrations in fish. The data did not consider other important factors that influenced mercury body burdens in fish, including fish diet, or concentrations of available methylmercury in the water and in the sediment. It did not consider bio-geographical differences between lakes, reservoirs, and rivers with respect to background mercury content. Furthermore, the data failed to illustrate trends in the mercury concentrations of fish from Wabamun Lake over time.

CEC presented the findings from its analysis of mercury and PAHs from sediment core samples taken from Wabamun Lake, Isle Lake, and Lac Ste. Anne. The results of the study strongly suggested a long-term increase of mercury deposition over time. CEC noted that mercury deposited at the surface of a lake did not concentrate in the water itself, but would be either quickly incorporated into the aquatic food web, or would bind to particulates and settle out to the lake bottom sediments. Mercury deposited in the sediments would be subject to methylation, thus further impacting aquatic biota. The research challenged TransAlta 's theory that elevated

mercury burdens in fish were solely the result of temperature differences, and not, in part, due to increased mercury deposition from air emissions or higher sediment concentrations.

CEC noted that the work presented in its submission regarding sediment analysis in surrounding waterbodies would be continued and expanded, to investigate food chain impacts, water dynamics of mercury, invertebrates, algae and fish. Its experts noted that the most important factors in fish tissue concentrations were attributable to factors such as the fish's level in the food chain, its food source, age and size, as well as the biogeochemistry specific to the aquatic system. CEC made reference to other studies being undertaken by academic and government researchers to understand the implications of mercury cycling in aquatic systems and mercury in fish, including the Northern Rivers Basin Study, which substantiated this theory.

CEC submitted that the U.S. National Academy of Science stated in its report that mercury was bioaccumulating in the food chain, entering the human species through fish consumption, and subsequently impacting fetuses as a result of consumption of contaminated fish by pregnant women. It noted that 41 of 50 states in USA had fish consumption advisories.

CEC acknowledged TransAlta's explanation that levels of mercury in the cooling pond fish were high, and attributed to enhanced mercury methylation caused by warmer temperatures of the pond. Nevertheless, CEC challenged TransAlta's conclusion that levels of mercury in the pond would not be significantly affected by the expansions of Keephills 3 and 4. It noted that TransAlta's argument failed to take into consideration the additional 126 kilograms (kg) of mercury that would be emitted if Keephills 3 and 4 were approved. Furthermore, CEC noted that Lake Wabamun was also subject to warm water discharges from the plant and indicated that it would also be susceptible to increased mercury deposition as well as enhanced mercury methylation. It believed that the reduction in water levels would make it more susceptible to these processes. As such, CEC believed that it was time to reduce, rather than increase, mercury pollution, particularly because the lake's existing commercial and sports fisheries.

Mewassin Community Action Group

Mewassin noted that neither its members, nor their family members, consumed local fish, but expressed concern that recreational anglers south of the plants who fished the NSR would catch and consume fish that had escaped from the cooling pond. Mewassin also indicated that there were no fishing advisory postings on the NSR and expressed concern with the interactions and synergistic effects between the emissions from the plant and the food that is consumed by people.

Lake Wabamun Enhancement Protection Association

LWEPA expressed concern about TransAlta's warm water discharges into Lake Wabamun, and the subsequent weed growth and impacts on fish. It made reference to the potential for irreversible damage as a result of such impacts.

The Paul First Nation

The Paul First Nation indicated that it pursued a traditional way of life, living on wildlife and on fish from Wabamun Lake. It referenced Wabamun Lake's commercial fishery and indicated

Band members no longer consumed fish from the lake due to the risks of pollution. Recent accounts were cited of the past abundance and quality of fish previously caught by Band members from Lake Wabamun. The Paul First Nation questioned the conservatism of TransAlta's health assessment given that specific information regarding its members' lifestyle was not incorporated into the assessment. The Paul First Nation suggested that the modelling may have underestimated the exposure and risk of its members to mercury toxicity from consumption of fish.

The Paul First Nation stated that it endured the day-to-day effects of the power plants, and observed the effects over time, first hand. As a result of the environmental effects caused by the power plants, its members had been forced to change the way they utilized resources, such as fish resources, compared to historical traditional use.

With respect to mercury, the Paul First Nation noted that the concentrations of mercury in fish from Wabamun Lake were high, and expressed concern about the effects of mercury on its members, and the effects of the bioaccumulation and biomagnification of mercury, especially as fish comprised a large portion of their diet. The Paul First Nation stated that historically, fish accounted for about 25% of its member's diet, and that most of that fish was from Wabamun Lake. Once they stopped fishing that Lake, the proportion of fish comprising their diet dropped substantially.

Government of Canada

DFO indicated it became involved in the project because the likelihood of potentially adverse effects on fish and fish habitat was significant enough to trigger the federal review process. DFO had engaged in continued dialogue with TransAlta with the view towards either ensuring the mitigation of potentially adverse effects on fish or fish habitat, or towards developing appropriate compensation for destroyed fish habitat, as per DFO's policy guidelines. It believed TransAlta 's EIA demonstrated that fish habitat was not likely to be harmfully altered, disrupted, or destroyed as a result of Keephills 3 and 4. Consequently, DFO withdrew as a Responsible Authority pursuant to the *Canadian Environmental Assessment Act*.

However, DFO stated it continued to have regulatory responsibilities for the project pursuant to the *Fisheries Act*. As such, DFO indicated that it would continue to be involved in discussions with TransAlta regarding the following matters:

- fish screens at the water intakes at both the generating plant and the river water supply facility,
- super-saturation gas levels within the cooling pond outlet canal and the subsequent gas bubble disease potential in fish,
- verifying the predicted impacts of the thermal discharge into the NSR from TransAlta, and,
- in addition to addressing a number of water quality issues.

DFO did not advocate any position before the Board with regards to the proposed project.

DFO noted that it was continuing to work with TransAlta regarding some residual issues. DFO noted that TransAlta had committed to certain follow up measures to address these concerns. With the implementation of appropriate mitigation measures, follow up and monitoring, it was determined that the potential impacts on fish and fish habitat resulting from the project could be mitigated.

DFO noted that if mercury levels in fish were high enough to adversely impact fish, and the power plants in the region were identified as the source, mercury being deposited into the aquatic environment would be considered a deleterious substance. DFO stated that the *Fisheries Act* prohibited the deposition of deleterious substances and it would be obligated to halt such deposition.

Government of Alberta

SRD confirmed that there were a number of fish species present in the Keephills cooling pond, including sport fish, and it supported a local recreational fishery. Both Lake Wabamun and the NSR were also provincially important recreational fisheries, and additionally, Lake Wabamun was noted to support a domestic and commercial fishery. SRD stated that TransAlta directly and indirectly affected fish and aquatic resources by introducing warm water into the cooling pond, which in turn was discharged into the NSR. Furthermore, as a result of taking water from and discharging to the NSR, TransAlta was also believed to affect fish and aquatic biota. In addition to monitoring and investigating fisheries resources within Lake Wabamun, SRD recommended a monitoring program in the condenser outlet canal, the cooling pond, and the NSR to ensure that fish and aquatic biota were not affected by high temperatures, gas super saturation or other factors. SRD recommended that mitigative measures be addressed at the time that impacts to aquatic resources were demonstrated.

AHW stated that mercury was one of the two contaminants the department had residual concerns with. The calculated exposure to mercury exceeded the health protection threshold used in the assessment. (Mercury concentrations of fish tissues from the Keephills cooling pond and NSR exceeded recommended safe levels for human consumption. Secondly, predicted worst case mercury exposures of residents consuming fish resulted in elevated exposure ratios for mercury above the reference concentrations recognized as protective of human health.) The consumption of fish by the First Nations people was identified as the primary exposure pathway resulting in elevated mercury exposures. AHW stated that although TransAlta did not believe power plants emissions contributed to mercury levels in fish in the area, it viewed this conclusion as subject to some uncertainty. It also recognized the global sources, both natural and anthropogenic, played a substantial role in human exposure to mercury in the environment. AHW supported the mercury management actions discussed by AENV. In the interim, it believed that the fish consumption advisory in place on the NSR and the cooling pond provided acceptable public health protection in this matter. However, AHW indicated it would lead a community exposure and health effects assessment project. AHW believed the health of the public would not be compromised by the development of TransAlta's proposed project.

AENV stated that there was a need to strengthen the baseline data pertaining to freshwater resources to obtain a better understanding of spatial and temporal variability as it exists now, and to understand any changes that might occur in the system in the future. AENV also noted that it

would suggest a program to assess the cumulative impacts of discharge on benthic invertebrates in the NSR, and monitoring of gas bubble disease and thermal shock, which were noted as potential adverse effects associated with coal fired power generation.
AENV also acknowledged the link between stack emissions of mercury and the accumulation of mercury in fish and in water. It indicated the provincial government would be concerned if an increase in mercury levels in lakes and fish were established. Although AENV stated that it would support a monitoring program specific to mercury, such a program was not yet designed at the time of the hearing. However, it indicated that there was a need to collect meaningful samples from the various components of aquatic ecosystems, including sediments, water, and aquatic biota such as fish. It stated that it had required TransAlta to collect more meaningful data relating to mercury in fish tissue since 1996, and it had required TransAlta to conduct such analysis every year since 2000.

When questioned about the significant monitoring recommended by AENV in its submission to manage uncertainties regarding potential impacts on water quality and aquatic resources, and the value of such monitoring, AENV responded that monitoring programs recommended in the past were not as extensive as those proposed for this project. Such monitoring was in response to a growing awareness and regard to environmental matters over time. AENV fully supported the research conducted by CEC's experts.

AENV noted that there were fish consumption guidelines for the protection of human health, but no Alberta mercury guidelines to protect fish health. SRD indicated that if the project were granted approval, it would recommend monitoring as noted above. Should the monitoring suggest any adverse effects to fish population structure and density, the Alberta Government had the ability to require the proponent to investigate the cause and to propose mitigative measures.

With regard to some of the data that was presented in the EIA, and subsequently discarded by TransAlta, AENV asserted that there were legitimate reasons to suspect the validity of the discarded data. With respect to the exceedance of mercury guidelines for the various aquatic parameters (for example, fish tissue, water and sediment quality), AENV stated that such exceedance raised a flag, and an attempt was made to differentiate between natural and anthropogenic causes. However, it noted that non-point sources of mercury were difficult to discern from background sources. AENV stated that safety factors were generally incorporated into guidelines, such that if there was an exceedance in the guideline, it did not necessarily follow that there would be a measurable effect on the aquatic ecosystem. However, AENV did emphasize that the mercury guidelines referred to the toxicity of mercury and did not incorporate the bioaccumulation factor for mercury. That is, chronic and acute toxicity levels can be defined, and the guidelines were derived from those levels, however mercury also accumulates and magnifies up the food chain, and that aspect of mercury is not addressed in the existing guidelines.

AENV indicated that global sources of atmospheric mercury emissions constitute approximately 4000-5000 tonnes per year, 50% of which comes from human sources. The main sources are smelters, coal fired power plants and waste incinerators. In Alberta, emissions from coal fired power generation are the dominant source of mercury. AENV noted that the impacts of anthropogenic mercury sources versus naturally present mercury to levels of mercury in fish

were unclear. Alberta viewed mercury emission reduction and monitoring as appropriate management actions to respond to the state of our current understanding relative to mercury emissions.

5.3.3 Views of the Board

The Board notes the commitments made by TransAlta to improve fish exclusion methods at the plant intake from the cooling pond, and to monitor the benthic invertebrate community in the NSR, and supports these initiatives.

The Board appreciates the participation of DFO and SRD in the hearing process, and acknowledges TransAlta's commitment to continue to work with these government agencies to ensure that federal and provincial requirements for protecting fish and fish habitat are met to the satisfaction of the regulatory authorities.

With regard to mercury concentrations in the aquatic environment, the Board notes that mercury levels in fish in the waterbodies surrounding the proposed project are, at times, above guidelines adopted by Alberta (Canadian Food Inspection Agency mercury criteria of 0.5 mg/kg) pertaining to fish consumption by humans.

The Board acknowledges that the mercury data provided by the applicant contained a high level of uncertainty. However, in comparing the most reliable data provided, it remains that the Keephills cooling pond, Wabamun Lake and the other potentially affected regional waterbodies such as Lac Ste. Anne, have elevated levels of mercury in fish compared to some other regional waterbodies that are less likely to be affected by the proposed plant.

Furthermore, the cooling pond appears to be enhancing mercury methylation, as a result of the higher water temperatures discharged from the power plant into the cooling pond, potentially exacerbating the availability and uptake of mercury by aquatic organisms. The Board heard evidence demonstrating that the fish from the cooling pond had elevated mercury concentrations in their tissue relative to some other affected waterbodies, which was attributed largely to enhanced mercury methylation.

The Board also heard evidence that there was a possibility of fish migrating from the cooling pond to the NSR. In order to preclude this possibility, and avoid the potential human health impacts associated with this, the Board directs TransAlta to develop and install a fish exclusion device on the blowdown pipe from the cooling pond to the NSR, in co-operation and compliance with the requirements of DFO.

The Board heard evidence that the existing plant has contributed very little to deposition of mercury to such waterbodies, and that TransAlta maintains its position that the proposed plant will also contribute an insignificant amount of mercury to the aquatic environment. However, the Board notes that TransAlta's existing and proposed plants combined would contribute almost 50% more mercury to Lake Wabamun compared to background levels of global sources of depositional mercury. Keephills 3 and 4 alone would contribute more than 20% of the background levels. Total mercury deposition from all of the power plants, including the proposed Keephills 3 and 4, would more than double background levels.

The Board observes that TransAlta's EIA states current mercury emissions from the existing Keephills plants total 115 kilograms per year (kg/yr). The proposed plant would add another 126 kg of mercury per year, bringing the total mercury emissions from the entire facility to approximately 240 kg/yr. With the significance given to mercury by CCME, and in light of the fact that the prime pathway for toxicological impacts on humans is through fish, it is essential for industry to make every reasonable effort to reduce anthropogenic sources of mercury.

The Board recognizes that Keephills 3 and 4 will increase the amount of total anthropogenic mercury emitted to environment. In order to address potential impacts of this increased deposition of mercury or methylation of mercury on fish, the Board directs TransAlta, in consultation with other regional industry operators, to develop and implement a detailed study of mercury in fish tissue for the regional waterbodies. Sample sizes and methodologies must facilitate statistical analysis of the results, however sampling must not jeopardize natural fish populations. Sampling must be commenced prior to the commissioning of Keephills 3 and 4 to determine an acceptable measure of baseline conditions, and must continue at appropriate intervals to facilitate inter-annual trends over the life of Keephills 3 and 4. Fish of the same species and of comparable size should be analyzed in parallel to facilitate a scientifically defensible investigation.

The Board places high significance upon the recommendation of AENV to require TransAlta to implement a mercury monitoring and management program for Keephills 3 and 4. The Board believes scientifically sound ongoing monitoring and research are essential for the management of localized and regional environmental effects from mercury. The Board recommends TransAlta contribute in a meaningful way (for example, financial support, participation, collection and contribution of data) to establishing a regional mercury database for the Lake Wabamun-Keephills- Genesee region. The Board also recommends TransAlta continue to strengthen its research efforts regarding:

1) cleaner coal burning technology, and
2) the processes and pathways of TransAlta's sources emissions of mercury in the local and regional environment.

With regards to the effects of thermal discharge on aquatic biota, the Board supports TransAlta's commitments to undertake a study of the benthic community in the NSR. The Board directs TransAlta to also examine the effects of thermal discharges on algal communities, as part of regional monitoring efforts. Details of such a study must be developed in cooperation with AENV and SRD, but the Board expects that enough samples will be taken to allow statistical analysis of the results, and to allow for analysis of inter-annual trends. The study should be undertaken prior to the start up of Keephills 3 and 4 and continue at intervals determined by AENV and SRD.

The Board supports DFO's recommendations to monitor gas bubble disease in fish, in the cooling pond, the condenser outlet canal, and the NSR, to ensure that fish and other aquatic biota are not affected by high temperatures or gas super saturation, as was predicted by the applicant. The Board directs TransAlta to work in conjunction with DFO and SRD to develop and

implement an appropriate study. Although the study design and methods must be acceptable to the responsible authorities, the Board expects samples sizes that will facilitate statistical analysis of the data, and the analysis of inter-annual trends.

The Board recognizes the position of AENV and SRD in recommending the TransAlta application proceed to the next step of EPEA and Water Act licensing. The Government of Alberta did identify opportunities for TransAlta to collect additional environmental data prior to start-up of Keephills 3 and 4. In this way uncertainties identified in the EIA could be addressed through terms and conditions applicable to EPEA and Water Act approvals.

The Board notes that AENV, SRD and DFO found the potential environmental effects of Keephills 3 and 4 including the cumulative effects of mercury, were acceptable in light of their on-going regulatory processes. The Board was assured by AENV's use of an adaptive management strategy to implement corrective actions for TransAlta based upon future mercury monitoring and management programs. The Governments of Alberta and of Canada further committed to appropriate regulatory actions, should adverse impacts of mercury from Keephills 3 and 4 be detected in the future. In considering the evidence before it, the Board finds that with proposed mitigations, the residual risks of adverse effects from the proposed project are acceptable. The Board further relies upon the Governments of Alberta and Canada, as well as TransAlta to adaptively manage mercury emissions in an effective manner that reduces overall effects to the environment.

5.4 Groundwater

5.4.1 Views of the Applicant

TransAlta identified three aspects of Keephills 3 and 4 that have the potential to impact groundwater:

- ash disposal,
- continued use or expansion of the ash lagoon and cooling pond, and
- changes to groundwater flow as a result of Highvale Mine expansion.

In all three instances, TransAlta argued that its project would have no appreciable impact on groundwater.

Leachate analysis conducted by TransAlta indicates that contaminants may be released from waters infiltrating into the ash disposal site. However, TransAlta believed that proper closure practice, coupled with emplacement of the ash at least 1.5 meters above the predicted restored water table would minimize the amount of contaminants migrating downwards to the water table. TransAlta argued that any contaminants that reach the water table and enter the groundwater system would be locally immobilized by natural processes (natural attenuation) in the ground within the span of decades. TransAlta based this conclusion on the results of a probabilistic contaminant fate-and-transport computer model. TransAlta felt that these probabilistic simulations of ash leachate demonstrate that, on the balance of probability, no adverse impact of the ash fill on groundwater would occur. TransAlta noted that for the purpose of the model, it was assumed that the subsurface could be represented by a simple geologic model, consisting of

homogenous and isotropic equivalent porous media, although it acknowledged at the Hearing that the Keephills site and the Highvale Mine areas are situated in a more complicated geologic situation, possibly consisting of fractured glaciolacustrine clay containing sand lenses of unknown interconnectivity and glacially thrust bedrock blocks. However, TransAlta believed that its use of a simple geologic framework in its model was acceptable, as the model over-predicted contaminant concentrations in groundwater, where such data existed to validate it.

TransAlta stated that another instance where Keephills 3 and 4 may impact groundwater is through continued use or expansion of the ash lagoon and cooling pond at the Keephills site. TransAlta noted that Keephills 3 and 4 would not result in expansion of these facilities. It also stated that existing groundwater monitoring has shown no adverse impact on local groundwater chemical quality from the ash lagoon or cooling pond. Therefore, TransAlta concluded that Keephills 3 and 4 would have no incremental impact on groundwater from existing facilities.

The third instance that TransAlta identified where Keephills 3 and 4 may impact groundwater is though changes in groundwater flow to Wabamun Lake, particularly through expansion of the Highvale Mine to service the needs of the Keephills 3 and 4. TransAlta stated most of the incremental expansion and related dewatering of the Highvale Mine is outside of the Wabamun Lake watershed. Thus, TransAlta believed Keephills 3 and 4 would have minimal quantity or quality impacts on groundwater flowing to Wabamun Lake.

TransAlta stated that monitoring a subset of indicator parameters would provide a sufficient notice of any change to groundwater quality.

5.4.2 Views of the Interveners

Mewassin Community Action Group and Clean Energy Coalition

Mewassin and CEC expressed concerns over a lack of baseline data on groundwater, the impacts of increased mining activities on levels in Wabamun Lake, the impact of mine activities on groundwater quality, and the impacts of increased ash disposal on groundwater chemical quality.

With respect to TransAlta's use of a computer model that predicted that ash disposal will have no adverse impact on groundwater because of local natural attenuation, Mewassin and CEC stated that predictive simulations of arrested contaminant plumes will only be valid so long as the hydrologic system stays in the state assumed by the modeller, and that only ongoing future monitoring will be able to ascertain if such a plume remains immobilized. Furthermore, they argued that the potential for impact on Wabamun Lake via groundwater from Keephills 3 and 4 and the expected Highvale mine expansion could not be discounted on the premise that these activities are, for the most part, in a different surface watershed. Mewassin and CEC noted that groundwater flow directions could be different from surface drainage directions and that more subsurface mapping is needed to ascertain directions of groundwater flow and potential contaminant pathways.

Committee on Keephills Environment

The Committee on Keephills Environment (COKE) noted that it has entered a collaborative process with TransAlta to review groundwater monitoring and concerns. It indicated that

TransAlta agreed to, within reasonable limits, to contain the ash disposal area to reduce runoff potential and reduce the size of the active disposal area and that TransAlta would review groundwater monitoring in terms of scope, frequency, and methodology.

In the course of the hearing, COKE questioned the suitability of the coal mine for disposal of TransAlta's waste ash that might be generated by Keephills 3 and 4. COKE requested clarification from AENV panel members whether the ash was being adequately classified as a hazardous or non-hazardous waste material suitable for the method of dry disposal proposed by TransAlta for the Highvale Mine. This issue was related to COKE's concern for groundwater protection.

The Paul First Nation

The Paul First Nation expressed concern about the need to protect groundwater from ash leachate at the proposed ash-disposal site. It was also concerned about contamination of groundwater used for drinking water.

The Parkland County

The Parkland County stated that it is satisfied that TransAlta will meet and exceed the environmental standards set for Keephills 3 and 4.

Government of Alberta

AENV noted that TransAlta has a comprehensive network of groundwater-monitoring wells in the plant site area. AENV stated that data from these monitors has not shown impact to groundwater chemical quality or quantity from the existing TransAlta's Keephills Plant. Furthermore, AENV advised that it regularly reviews the monitoring program and results, and if detrimental effects are discovered, mitigative actions will be taken. AENV acknowledged that the site is geologically complex, but is satisfied that TransAlta's modelling efforts can be further validated through ongoing monitoring-data review and data-gathering exercises initiated through regular EPEA approval processes.

AENV was satisfied that monitoring a subset of groundwater geochemistry indicator parameters in TransAlta's monitoring wells would provide sufficient notice of any changes in groundwater chemical quality, and that ongoing comprehensive geochemical analyses of a full suite of groundwater chemical constituents was not warranted.

Regarding the dry ash disposal occurring in the Highvale Mine from existing operations and proposal ash disposal from Keephills 3 and 4, AENV provided evidence of the low concentrations of trace elements of the ash and ash properties that were likely to limit its leaching ability to groundwater. The classification of coal ash as a waste material by AENV and the issue of coal mine disposal methods were subject to on-going technical discussions.

5.4.3 Views of the Board

The Board believes that the data presented at the hearing supports TransAlta's opinion that the existing ash lagoon and cooling pond are not impacting groundwater quality. However, the Board is concerned that the model used to estimate possible future groundwater contamination

from ash disposal in the Highvale mine did not explore a reasonable range of geological scenarios possibly occurring at Keephills. The Board raises this issue because the model is used as a guide for the placement of monitors and interpretation of results. It is the Board's opinion that it requires additional assurances that current and future monitors are or will be appropriately located. Therefore, the Board recommends to AENV that TransAlta extend and enhance the probabilistic modelling of the ash disposal area to explore a more representative range of geological complexity. The Board recommends that AENV adopt suitable timing and reporting requirements for TransAlta on this issue, such that results of the assessment are forwarded to the EUB.

If the results of this assessment indicate that insufficient data exists to verify that groundwater will be protected by natural attenuation under all reasonable geological scenarios, then the Board recommends AENV require TransAlta to develop a field investigation program. The investigation might involve surface and subsurface geological and geophysical techniques. The techniques will be appropriate to gathering sufficient quality data to demonstrate that geological scenarios not providing adequate natural attenuation protection do not occur at Keephills. If the results of the enhanced probabilistic modelling and/or any additional field investigation results indicate that natural attenuation of leached ash constituents is not likely to prevent unacceptable impacts on groundwater chemical quality under all reasonably possible geological scenarios, the Board recommends AENV require TransAlta to modify its ash disposal plan and seek the appropriate approvals from AENV accordingly.

With regard to the question of whether Keephills 3 and 4 or the anticipated Highvale mine expansion will impact groundwater linked to Wabamun Lake, the Board is not satisfied that the evidence presented demonstrates that the surface watershed divide acts as a subsurface groundwater-flow divide. Therefore, the Board recommends that AENV require TransAlta to place sufficient additional groundwater monitoring-wells between Lake Wabamun, the Keephills Plant site, the Paul First Nations land, and the anticipated Highvale mine expansion to resolve this uncertainty. It is expected that TransAlta would adapt its monitoring network accordingly, including installation of nested piezometers to examine changes in vertical groundwater flow. The Board recommends to AENV that suitable timing and reporting requirements be established for TransAlta to establish baseline conditions, prior to the introduction of any stresses on the groundwater flow system associated with the proposed expansion. The Board recommends that results of any additional baseline data gathering by TransAlta be communicated to the EUB and the interveners.

The Board acknowledges that AENV allows for the use of indicator parameters in place of comprehensive geochemical analyses in groundwater chemical-quality monitoring programs, particularly after a trial period of comprehensive analysis establishes baseline trends. In light of the interveners' concerns, the potential for cumulative effects of groundwater contaminants from a multitude of regional point sources, and cost-reductions in commercial analyses over the last decade, the Board recommends that AENV require TransAlta to reinstate complete groundwater geochemical analysis of its waste facility monitoring wells at a frequency of at least twice per year to validate the use of its indicator parameters in regular monitoring. The geochemical analysis might include a full suite of dissolved metals in appropriately filtered groundwater samples.

The Board also recommends that during EPEA and Water Act licensing for TransAlta, that AENV review the classification of coal ash for purposes of waste disposal within the Highvale Mine.

The Board encourages TransAlta to continue its policy of co-operation with regulators and neighbours, and to ensure that the groundwater concerns of neighbours and stakeholders are addressed.

5.5 Terrain, Soils, And Reclamation

5.5.1 Views of the Applicant

TransAlta examined historical information contained in reports, studies, previous applications, and corporate documents for the soils and terrain section of its initial EIA. A subsequent field sampling study was conducted and the report filed in October 2001.

TransAlta reported moderate impacts on soils and terrain in the EIA due to soil erosion, soil compaction, soil mixing, soil contamination, soil acidification, grading, and cut and fill activities. TransAlta stated that the equivalent land capability reclamation requirement by AENV and the corresponding reclamation certificate was achievable for all impacts in the local study area (LSA).

Moderate impacts were identified in the Cumulative Environmental Assessment as a result of soil removal and material removal from landforms associated with gravel pits. With input from stakeholders, TransAlta suggested that this matter could be resolved through agreement on an alternative land capability, and a reclamation certificate could still be issued. TransAlta noted that in all cases, mining and gravel extraction activities are provincially regulated, and reclamation to equivalent land capability is required.

The mineral soils in the local and regional study areas were found to be medium to neutral in pH and were considered to be well buffered. Using a small scale soils map (1:100,000) to estimate soil characteristics, the soils in the EIA were predicted to be low to moderately sensitive to PAI. Organic soils, predicted to be of high sensitivity to PAI, comprised less than 4% of the land area in the regional study area (RSA).

TransAlta described the areas of medium sensitivity soil within the predicted PAI monitoring, target, and critical threshold isopleths were 278, 142, and 345 hectares respectively, representing a combined total of about 2% of the RSA. Based on the definitions of monitoring, target, and critical thresholds, potential effects could occur over 245 hectares where predicted PAI values were predicted to be greater than the critical load. TransAlta stated that long-term effect on capability of medium-sensitive soils could therefore occur on 0.9% of the RSA as a result of cumulative emissions. This was considered to be a minor impact by TransAlta.

TransAlta's EIA showed that elevated levels of heavy metals were found downwind of the four power plants near Wabamun Lake, particularly at locations within 15 km to 20 km of most power plants in the area. Loading of heavy metals was calculated to be very low compared to the background levels in the soil.

TransAlta stated that because PAI estimates in the LSA and RSA were above the monitoring, target, and critical loads for moderately sensitive soils, a monitoring program would be implemented. TransAlta made the assumption that particulate deposition would occur in the same areas as the predicted acid deposition, and noted that there is a lack of information available on the accumulation of organic and inorganic contaminants in soil from air emissions, as well as the effects of acidic deposition greater than the critical load. TransAlta committed to a monitoring program to be conducted in conjunction with other operators and stakeholders in the RSA. A soil-monitoring program was established and described in Exhibit 11 in order to address the deficiency in soil contaminants data and to establish a baseline from which to monitor incremental changes due to deposition of PAI and metals. TransAlta indicated that soil sampling for the purpose of monitoring contamination would occur every 10 years and be coordinated within the WCAS process.

5.5.2 Views of the Interveners

Mewassin Community Action Group

As part of its submission, Mewassin spoke generally about large amounts of pollutants contaminating the soil, in addition to other aspects of the environment.

Committee on Keephills Environment

COKE presented its view that a 10 year monitoring program was a relatively short period of time in which to detect changes in metals in soils. COKE advocated sampling over a longer period of time.

Government of Canada

Environment Canada noted in its submission that according to RELAD modelling, the potential exists for exceedances of the monitoring load for soils and water in the Wabamun region at the present time. It stated that further developments would inevitably increase acidification through SO_2 and NOx emissions, and therefore recommended installation of a monitoring system that included measures to determine atmospheric components and ecosystem effects of acidification within the Edmonton-Wabamun region.

Government of Alberta

AENV described how the addition of NO_x, SO_2, and their oxidation products could result in acidification of terrestrial (and aquatic) ecosystems. Changes in the chemical properties of soil (and water) are known to occur if acidification exceeds buffering capacity. Such changes can modify the chemical and nutrient cycling and consequently the biological functioning of natural systems. AENV stated in its submission that air quality modelling used by TransAlta is conservative, and likely overestimates the future acid deposition load. Nevertheless, AENV was of the view that the results of the EIA indicated the need to accurately quantify the PAI, to evaluate the significance to terrestrial and aquatic systems, and to take action to reduce the load if necessary.

AENV stated that the soil monitoring program proposed in Exhibit 11 would not adequately assess the impacts of acid deposition load on aspects of the terrestrial ecosystem. AENV indicated that soil monitoring would need to be tied more specifically to air monitoring, and that details in terms of monitoring sensitive versus borderline soils would need to be determined. AENV indicated that if Keephills 3 and 4 were found to be in the public interest and an EPEA approval were subsequently issued, AENV might further recommend to its Director that a monitoring program of deposition and ecosystem response be conducted in the region downwind of the facility, be a condition of approval. This monitoring would either occur alone or through TransAlta's participation in WCAS. AENV added that TransAlta should minimize NO_x emissions wherever possible.

AENV also stated in its submission that soil monitoring would be one component of its mercury monitoring and management program, which it intended to incorporate in the EPEA approval if the project was approved.

5.5.3 Views of the Board

The Board notes that substantial soil survey work has occurred in the RSA historically, and that TransAlta made efforts to use that information to the extent possible in both the EIA and in assessing cumulative effects. The Board also notes that some field sampling was done to establish a baseline for future deposition monitoring. Due to the predicted high buffering capacity and conservative estimates provided by air dispersion modelling, the Board concludes that potential acidification impacts resulting from Keephills 3 and 4 on soils are of the order that can be mitigated effectively, should impacts be detected during the monitoring program.

However, the Board believes that a program is needed to accurately quantify acid deposition load, evaluate the environmental significance to terrestrial as well as aquatic ecosystems, and take action to reduce the load if necessary. The Board recommends that AENV incorporate these requirements into its EPEA approval, as it has suggested. The Board recommends that soil monitoring should also consider heavy metals deposition, and recognizes that such monitoring may be fulfilled in part through the mercury monitoring and management program.

The Board also understands TransAlta's argument that monitoring soils every 10 years is valid for determining a measurable difference in soils. However, the Board supports the concept that more frequent sampling intervals (for example three years), could more effectively determine a trend in acid or metal deposition, allowing correlation to other environmental factors and more timely mitigative responses if required. Increased intervals of periodic monitoring should not shorten the overall monitoring in the long term. While WCAS may be one mechanism by which such monitoring could occur, the Board directs TransAlta to use suitable methodology for monitoring both acid deposition and heavy metals deposition on soils, whether singularly or in collaboration with other industry operators in the region to the satisfaction of AENV. Further details regarding the expectations of monitoring programs can be found in Section 9 of this report.

The Board believes that understanding soil exposure pathways is critical to the human health assessment, and believes that sampling for potential soil contaminants should be exclusively designed to fit the requirements of future human health risk assessment and monitoring. The

Board recommends to AENV and TransAlta that suitable sampling designs for both human health studies and studies of impacts directly on soils (for example, acidification) be carefully designed, and only coordinated where it will not jeopardize the quality of the analysis and results.

5.6 Terrestrial and Wetland Vegetation

5.6.1 Views of the Applicant

TransAlta presented information gathered from 1976 to 1978, which mapped, described, and analyzed vegetation in the region as part of the EIA. Ten major vegetation community types were identified within the regional study area. Non-vegetated areas (industrial and water) were also identified. Information on species composition and canopy cover was adapted from historical information, but a field survey was not conducted at the time the application was filed. TransAlta did conduct vegetation plot surveys and two rare plant surveys over the course of the summer of 2001, and subsequently filed that information as an addendum to its application.

TransAlta indicated that when the rare plant surveys were conducted, no rare plants were identified, however several plants were identified which may have been rare but were difficult to identify because of time of year, flowering stage or other reasons. It acknowledged that a one-time survey in a particular season might not reveal the existence of rare plants.

During the course of the 2001 fieldwork, vegetation survey sites were assessed for their suitability as monitoring sites. TransAlta identified 18 possible sites for using lichens to assess air quality within the RSA, but noted that future land use would have to be evaluated at those sites to determine whether vegetation communities could be monitored in the longer term. Since lichens grow very slowly, TransAlta recommended that monitoring at these sites should occur over three to five year intervals.

TransAlta stated that Keephills 3 and 4 could be constructed and operated with no significant impacts to the vegetation of the area. Some direct disturbance to vegetation would occur as a result of this project, but the area of that disturbance was described to be relatively small, and in areas where the vegetation was of common community types. TransAlta proposed to minimize the area disturbed to mitigate this concern.

TransAlta proposed to prevent chemical spills that could damage off-site vegetation through application of protective measures, implementation of chemical handling programs and emergency response plans. Potential impact to vegetation resulting from chemical spills was predicted to be negligible, however employee-training programs were identified as an additional mitigation measure to prevent such impacts.

TransAlta identified in its EIA that emissions such as SO_2, NO_x, and ozone had the potential to injure plant life through either high concentration over a short period or low concentrations over a longer period of time. TransAlta submitted the results of October 2001 observations on vegetation health and vigour subsequent to its main application filing. TransAlta reported that vegetation appeared to be progressing through normal development stages without obvious signs of stress. TransAlta also indicated that an appropriate vegetation health monitoring program

would be discussed with AENV, and that consideration would be given for placing some of the monitoring plots on Paul First Nation reserve land.

TransAlta stated that because SO_2 and NO_x emissions were predicted to be less than the guidelines for the total maximum annual ground level concentrations, the impact to vegetation would be negligible. Ash and coal dust emissions were also predicted to be below AENV guidelines, but local monitoring studies indicated some heavy metal accumulation and loss of vegetation vigour. The potential impact of dust emissions on vegetation was rated as "low".

TransAlta proposed that potential impacts of emissions on vegetation would be prevented or minimized through reduced emissions using project design aspects such as use of low sulphur coal, stack design, flue gas desulphurization, low NO_x burners, treatment of bottom and fly ash, and road-watering.

TransAlta also noted that appropriate mine reclamation and waste pit reclamation measures would be implemented, and appropriate species would be used when designing reclamation plans. TransAlta committed to vegetation monitoring to ensure appropriate management of terrestrial resources on a regional basis.

TransAlta identified potential cumulative effects on terrestrial resources in the RSA to include the alteration or loss of terrestrial and wetland vegetation communities (and associated wildlife habitat) resulting from combined surface disturbance, emissions, and acid deposition. TransAlta noted that potential cumulative impacts on vegetation from acidifying emissions would be monitored as part of the proposed vegetation health surveys proposed in its application. TransAlta also stated that because predicted annual average ground level criteria and toxic pollutant concentrations were within established guidelines designed to be protective of vegetation, negligible cumulative effects from emissions were anticipated.

5.6.2 Views of the Interveners

Lake Wabamun Enhancement and Protection Association

LWEPA criticized TransAlta's EIA for not fully assessing the current impacts of TransAlta's power plants on the health of the environment, one example being vegetation. LWEPA complained that communities that were potentially affected by mercury pollution, for example, had not been adequately informed about issues such as contamination of edible plants.

With respect to reclamation, LWEPA made the recommendation that land in the Highvale mine area be returned to the natural vegetation and contours present prior to the mining operation commencing in the early 1970's.

Paul First Nation

The Paul First Nation identified the protection of vegetation used by Paul First Nation members as one of its concerns with respect to Keephills 3 and 4.

Government of Canada

Environment Canada noted that among other adverse impacts, SO_2 had been linked to the necrosis (death of cells from chemical or toxic substances) of vegetation near significant point sources.

Government of Alberta

AENV pointed out that TransAlta continues to be a supporting member of WCAS, and would continue to participate in WCAS monitoring programs designed to measure biological parameters such as vegetation and soil acidification. AENV also indicated that it would be making recommendations to WCAS regarding how vegetation monitoring should be conducted. AENV indicated that, if the project was approved, it would likely recommend that long-term vegetation monitoring be carried out, and that specific plots throughout the region would be identified. AENV expressed the expectation that, in conjunction with other stakeholders, these vegetation plots would be maintained throughout the lifetime of the project. This would enable the ongoing monitoring to indicate impacts due to air emissions, as well as impacts on vegetation diversity and health within the region.

AENV also testified that NO_x may effect vegetation. It believed that existing NO_x monitoring must continue if Keephills 3 and 4 were to be approved. AENV also discussed the topic of ozone formation resulting from either NO_x or VOCs. It observed that major sources of VOCs in rural areas were natural emissions from trees and vegetation, but that the different species of VOCs have different reaction rates for the formation of ozone. AENV stated that it did not expect ozone levels to increase markedly if Keephills 3 and 4 were approved, but argued that monitoring for ozone would be essential to ensure that it remained within acceptable levels.

5.6.3 Views of the Board

The Board recognizes that in addition to evaluating the historical vegetation information available for the LSA and RSA, TransAlta conducted original fieldwork involving several detailed plot studies. Two rare plant surveys were conducted at different times during the growing season, and observations were made regarding vegetation health. TransAlta also examined appropriateness of various survey sites for the purpose of ongoing monitoring of vegetation health. For these reasons, the Board is assured that the potential cumulative effects on vegetation can be effectively mitigated and appropriately monitored.

The Board is aware of the concern regarding potential health effects on vegetation in this region, and believes that long term monitoring and reporting on vegetation health effects is warranted, both in the vicinity of Keephills 3 and 4 as well as in the region. The Board recommends to AENV and TransAlta that monitoring should incorporate suitable methods to detect potential changes to vegetation resulting from air emissions, ozone formation, acid deposition on soil having secondary effects on vegetation, metal uptake, changes in species diversity, and particularly impacts on sensitive species (for example, mosses and lichens) and/or rare plants.

The Board notes AENV's expectations to work with TransAlta and other stakeholders in this region to establish suitable long-term vegetation health monitoring plots. The Board recommends to both parties that this discussion occur promptly, so that plots may be established and baseline

information can be collected, allowing monitoring to commence in a timely fashion. The bio-monitoring associated with WCAS could be a suitable mechanism for ensuring that suitable monitoring of vegetation occurs, however the Board directs TransAlta, in cooperation with the other stakeholders in the region, to take a leadership role in ensuring that scientifically defensible monitoring programs suitable for understanding potential regional impacts from air quality both within and beyond the WCAS boundary are designed and implemented prior to commencement of operations of Keephills 3 and 4.

While the Board understands that no rare plants were found during the surveys conducted in the summer of 2001, the Board also notes that various conditions at the times of the surveys may have precluded the identification of rare plants. The Board recommends that TransAlta continue to identify rare plant species and incorporate them into monitoring programs as suitable, or implement suitable mitigation measures if it becomes necessary to directly disturb a rare plant or plant community. The Board recommends that TransAlta consult with rare plant experts at AENV on the probability of success of rare plant mitigation methods, and implement results of that consultation such that the potential for rare plant survival during construction and operations is maximized. Documentation of any rare plant findings should also be discussed with the appropriate department of AENV.

5.7 Wildlife

5.7.1 Views of the Applicant

TransAlta testified that it chose species at risk and of management concern as wildlife indicators. Potential impacts to wildlife arising from the proposed project were considered to be negligible after mitigation for habitat loss. Some minor impacts were identified for indirect habitat loss and wildlife mortality. TransAlta predicted that Keephills 3 and 4 would not have an impact on daily or seasonal movements of wildlife, and would not increase any conflicts with wildlife.

TransAlta proposed various mitigation measures for potential impacts arising from facilities construction and operation. For potential impacts to wildlife through habitat loss, alteration, and fragmentation, TransAlta proposed to minimize the clearing of natural habitat. For potential indirect habitat loss, sensory disturbance, and reduced habitat effectiveness, TransAlta proposed to coordinate construction activity to minimize disturbance during sensitive periods. In order to mitigate direct mortality from occurring, TransAlta planned to implement a traffic control plan, and proposed a ban on local hunting by construction personnel.

TransAlta discussed the potential impacts on wildlife resulting from coal mining associated with the proposed project. Impacts from indirect habitat loss, sensory disturbance, reduced habitat effectiveness, direct mortality, and obstruction of daily and seasonal movements were predicted to be minor, and no mitigation was proposed. Impacts from direct habitat loss, alteration, and fragmentation were predicted to be moderate. Proposed mitigation included reclaiming disturbed areas to Class 3 agricultural soil.

TransAlta also proposed a monitoring program to be conducted to ensure that minimal disturbance would occur to Peregrine Falcons nesting on the existing Keephills stack. Additional post-construction monitoring was proposed for the reclamation of construction and coal mining areas, with monitoring occurring at 5 year intervals.

TransAlta confirmed that a second amphibian study conducted in spring 2002 would be useful for comparison to the 2001 survey as reported in the EIA. Conversely, TransAlta believed that there was no justification to repeat the owl survey in 2002, despite a difference in the nocturnal owl survey methods reported in the EIA as compared to the SRD guideline for such methods. TransAlta was of the view that the methods used were sound for achieving reliable results for the reconnaissance-type survey conducted.

TransAlta reported that winter aerial census counts for ungulates and breeding season point-counts for songbirds were proposed to occur at 5-year intervals within the RSA. TransAlta proposed that collection of wildlife data be coordinated with efforts by EPCOR, and that data should be exchanged in order to develop a consistent and comparable regional database.

TransAlta filed a Breeding Bird Survey report and a Wetland Bird Survey report in September 2001 based on surveys that had been conducted within the RSA during the 2001 field season. No impact predictions were made specific to these surveys.

TransAlta indicated that it would address wildlife health questions through a direct evaluation of wildlife tissue chemistry. TransAlta planned to evaluate the level of tissue concentration from airborne pollutants in the LSA and RSA using Red-backed Voles as the indicator species. If elevated levels of pollutants were found in the voles, TransAlta stated that implications for wildlife health would then be examined. TransAlta indicated that it had initiated the Red-backed Vole tissue chemistry study by collecting samples, but that it was awaiting laboratory analysis for results. TransAlta indicated that it had collected samples from the Paul First Nation reserve lands, and planned to continue to do so as part of the ongoing tissue chemistry monitoring work. Consideration was being given to repeating the study at 5-year intervals to monitor potential changes in tissue chemistry. TransAlta stated that it would look to the development of a regional study in participation with other regional operators to monitor long-term trends. It suggested that monitoring continue long enough to indicate a reliable trend.

TransAlta identified coal and gravel mining operations as having the potential to impact cumulatively on wildlife. Impacts to wildlife from habitat loss over time were assessed to be negligible for 5 species of concern, minor for 12 species of concern and moderate for 8 species of concern. TransAlta noted that of the 8 species that may be subjected to moderate impacts, 6 are listed in the Province as “Yellow B” status species. (“Yellow B” is the provincial designation for naturally rare species not currently in decline; naturally rare species with clumped breeding distributions; or species associated with habitat elements that are or may be declining).

TransAlta identified potential cumulative effects on terrestrial resources in the study areas to include alteration or loss of vegetation communities and associated wildlife habitat from combined surface disturbance, emissions, and acid deposition. TransAlta stated that existing disturbance levels exceeded the threshold at which cumulative effects on forest-dependent species are believed to occur. TransAlta proposed to reduce potential project-specific and cumulative effects on terrestrial and riparian habitat by installing a dry ash disposal system that would allow previously disturbed mine areas to be used, and by construction and installation of cooling towers that would avoid the need for expansion of the existing cooling pond. TransAlta

also stated that loss of terrestrial habitat associated with the opening of new coal pits would be offset by reclamation of abandoned pits. TransAlta discussed the identification of native forest/wildlife habitat end land use objectives for some of the areas to be reclaimed, with consideration for the use of native species. TransAlta committed to continued work with representatives of the community, COKE, Parkland County, and AENV to develop reclamation plans that balance wildlife conservation and agricultural goals. TransAlta considered that potential cumulative effects on wildlife habitat in the RSA were moderate during the proposed project's operations phase.

5.7.2 Views of the Interveners

Lake Wabamun Enhancement and Protection Association

LWEPA noted health advisories (for human consumption) of wildlife in other areas. LWEPA also indicated a concern for the reclamation of mined lands solely to agricultural lands, rather than to any natural habitat that had existed prior to the mining operations. LWEPA expressed concerns for impacts on wildlife resulting from these reclamation objectives.

Paul First Nation

The Paul First Nation expressed concerns about the impacts of the existing and proposed power plants on the health and safety of wildlife for consumption.

Government of Alberta

AENV noted that air emissions from the Keephills (existing and proposed) plant have the potential to affect wildlife, and that TransAlta's EIA assessed potential wildlife impacts in the defined RSA through wildlife surveys and a literature review. AENV commented that the NSR was a valuable source of both aquatic and terrestrial wildlife habitat, and that AENV has monitored the water quality of the NSR for over 20 years.

AENV noted TransAlta's commitment to conduct a wildlife health assessment through a direct evaluation of wildlife tissue chemistry, and acknowledged TransAlta's proposed investigation of wildlife in the RSA and use of reclaimed lands. The monitoring would occur at 5 year intervals and the duration would be based on detailed progress reports and trends in data.

SRD was of the view that TransAlta should implement the ongoing monitoring program relative to tissue chemistry trends through examination of Red-backed Voles and potentially other wildlife species. It was SRD's opinion that monitoring only one species would not be sufficient to obtain a complete picture of potential pollutants related to air emissions in wildlife tissue in the region. SRD added that other species studied should also have small home ranges and should not be migratory species, so that potential pollutants could more easily be attributed to their source. SRD further stated that monitoring of tissue chemistry in wildlife should occur whether or not Keephills 3 and 4 were approved. Determining relatively high or low levels of various heavy metals in wildlife tissues would assist regulators in determining whether or not guidelines set for the protection of the environment from harmful air emissions were in fact effective.

In addition, SRD recommended ongoing wildlife based biodiversity monitoring to continue in the regional study area as identified in the EIA. SRD was of the view that these issues could be

addressed through the EPEA approval process, and suggested that such monitoring could include the examination of an array of species and habitat types over a period of years.

5.7.3 Views of the Board

The Board notes several commitments made by TransAlta in the Application to ongoing monitoring and mitigation for potential impacts to wildlife, and the Board commends TransAlta for proposing these activities. The Board directs TransAlta to honour the several monitoring (for example, falcons and amphibians) and mitigation commitments (for example, minimal clearing, timing restrictions and hunting controls) it has made with respect to wildlife, provided they are not in conflict with other recommendations made here or through further consultation regarding regional monitoring. The Board recommends that TransAlta implement reclamation objectives consistent with restoring wildlife habitat as well as agricultural land, and recommends that TransAlta discuss options for reclamation further with AENV.

The Board is particularly interested in the monitoring of wildlife health for potential impacts resulting from air emissions, and from substances that can bio-accumulate in the food chain. It is noted that AENV recommended continued monitoring and assessment of Red-backed Voles, and potentially other wildlife species. The Board believes that such monitoring should be a regional initiative, but directs TransAlta, in consultation with AENV and SRD, to ensure that such assessment and monitoring is adequately designed and implemented to effectively track potential trends in tissue chemical analysis, as well as serve as an indicator of potential regional impacts to wildlife health resulting from air emissions. Where feasible, water quality in the region should be examined for potential links to wildlife health.

TransAlta has indicated that wildlife health monitoring sites already established coincide with soil monitoring sites. The Board believes such links are necessary to more accurately depict any potential impacts from air emissions resulting from coal-fired generation on the environment, and encourages sampling protocols to continue to consider such coordination. While WCAS does not currently address wildlife health, the Board would expect that the results of wildlife tissue chemistry studies in this region could be effectively coordinated with the sampling efforts and results of the WCAS bio-monitoring program.

The Board recognizes that, without the existing Keephills stack, the ability of the Peregrine Falcon to successfully breed at that location might be compromised. Nevertheless, the Board supports ongoing monitoring of potential impacts to species at risk (for example, Peregrine Falcons), including efforts to maintain a minimum distance from the nest site, particularly during breeding season.

The Board is encouraged by TransAlta's recommendation to monitor ungulate and breeding bird populations in the region, and supports TransAlta's suggestion to coordinate these ongoing studies with EPCOR, as well as other operators in the region. The Board anticipates that such wildlife monitoring will help to fulfill AENV and SRD’s interest in monitoring wildlife biodiversity in the region.

Overall, the Board accepts the impact predictions made in the EIA, including for cumulative effects, and believes that any potential impacts are either acceptable, or can be mitigated.

5.8 Noise

5.8.1 Views of the Applicant

TransAlta testified it had conducted a Noise Impact Assessment as part of the project application and determined that, with noise mitigation, both the power plant and mine area would be in compliance with regulatory noise standards. TransAlta stated that part of the noise control plan at the proposed site would include addressing the expected sound levels from the cooling tower. Although early in the design phase, TransAlta is looking at various options for controlling this noise.

TransAlta stated that noise from the dragline ventilation systems associated with the mining operations, required mitigation through modification to the rooftop vents but that this is not a present concern given the existing mine boundaries. At each occasion of mine license renewals, TransAlta noted that it conducts a noise study to identify any new areas of concern.

TransAlta indicated that it is currently planning with the community organizations to hold another round of noise monitoring at some additional dwellings around the area, and following that up during the design process of the plant. TransAlta stated that it and community organizations would work with acoustical consultants to minimize noise from the plant to meet the EUB noise directive. The success of the noise control program would be determined by a follow up post-commissioning noise monitoring survey. To this end TransAlta stated that it is very proud of the memorandum of agreement struck with COKE in regard to a comprehensive noise monitoring and mitigation program. TransAlta believed the details of the agreement would assure full community involvement and engagement.

5.8.2 Views of the Interveners

Committee on Keephills Environment

Although noise from the plant and mine were an issue of concern for most of the interveners living in the area, COKE presented the majority of technical information related to this matter.

COKE submitted that its evaluation of TransAlta's Noise Impact Assessment resulted in the following conclusions:

- The baseline noise monitoring needed to be more extensive.
- The noise-prediction work conducted for the Keephills 3 and 4 project was greatly oversimplified for a project of this size.
- Noise control for the existing Keephills Units 1 and 2 was not considered.
- Noise-control engineering requirements for Keephills 3 and 4 were not specifically defined.
- The noise-control requirements to overcome cumulative effects were also not identified.
- The noise-control requirements to allow for a potential factor of safety between the expanded plants sound level contribution and the EUB's permissible sound levels were not identified.

- The proposed comprehensive noise-monitoring procedure was not totally technically adequate as proposed.

COKE advised the Board that following its review of the report, it entered into a Memorandum of Understanding with TransAlta that laid out the terms of further noise assessment work including, baseline monitoring, modelling and design phase, and compliance monitoring. COKE believed that if the Memorandum of Understanding was adhered to, acceptable noise control requirements would be identified and implemented. As additional assurance that the approach is appropriate and commitments are met, COKE requested that the EUB participate in the process.

Lake Wabamun Enhancement Protection Association

LWEPA argued that its members had no opportunity to participate in discussions with TransAlta about the alternative technologies and noise abatement programs.

5.8.3 Views of the Board

The Board is satisfied that noise related matters will be suitably addressed by TransAlta through its community consultation program, especially the comprehensive assessment process outlined in the Memorandum of Understanding between TransAlta and COKE. However, should the permissible sound levels be exceeded, appropriate enforcement action would be initiated by the Board.

5.9 Traditional Land Use

5.9.1 Views of the Applicant

TransAlta committed to fund and participate in a traditional land use study in cooperation with the Paul First Nation. At the time of its application for Keephills 3 and 4 the traditional land use study had not been initiated and information was not available regarding this land use. Discussions were on-going with the Paul First Nation to determine the scope of the study and schedule for completion. TransAlta was hopeful that progress would be made on the study by year end of 2001. It agreed to work cooperatively to see that the study commenced as soon as practical.

5.9.2 Views of the Interveners

The Paul First Nation was pleased that TransAlta had committed to assist with a traditional land use study although, it noted that no information was provided about TransAlta's plans to complete the study. The Paul First Nation stated that its members practiced a traditional life style, which had been affected by TransAlta operations. Difficulties in obtaining medicinal plants and fish due to environmental effects were identified as matters of concern. The Paul First Nation requested that the Board deny or defer TransAlta's Keephills 3 and 4 application until such time as a human health and traditional land use study were completed. The Paul First Nation argued that TransAlta must complete both studies prior to the project start-up, if the Board was to approve the construction of the power plants.

5.9.3 Views of the Board

The Board believes that the assessment of existing land uses has been adequately dealt with in the EIA submitted to both AENV and the Board in connection with the Application. The Board notes that Alberta Community Development has accepted the Heritage Resources Impact Assessment prepared by TransAlta. The proposed plants will occupy essentially the same land base as Keephills 1 and 2 which have been operating for almost 20 years and the impacts on land use will not be appreciably greater than those experienced as a result of the original plants.

Notwithstanding the above, the Board recognizes that there is mutual benefit to both TransAlta and the Paul First Nation, in completing a traditional use study and encourages the parties to commence its preparation.

6 SOCIO ECONOMIC ISSUES

6.1 Public Consultation

6.1.1 Views of The Applicant

TransAlta stated that its public consultation program was initiated with the public announcement of Keephills 3 and 4 in February 2001. The intent of the program was to work with stakeholders to identify and address potential issues and to share information about the proposed expansion. TransAlta believed this process would also strengthen existing working relationships with community groups.

TransAlta submitted that its public information program involved contact and follow-up with the stakeholder groups with whom TransAlta has had ongoing relationship in the area since the approval of the first two units at Keephills. These groups included COKE, the Paul First Nation, the Parkland County, and the Wabamun Lake Advisory Committee.

TransAlta indicated that it met directly with representatives of the above groups, attended regular meetings of associations, special interest groups, and municipal councils, and held an open house. In addition, TransAlta also held an EIA workshop on June 25, 2001, which provided attendees an opportunity to review the EIA and to contribute their input and recommendations to the project. TransAlta also stated that through the consultation program, issues that were identified by stakeholders and the company formed the basis of the EIA.

TransAlta asserted that the success of its public consultation program was highlighted by the agreement that was reached with COKE.

TransAlta testified it had reached agreement with the Paul First Nation, its closest neighbors to the plant and mine, with respect to the road that traverses reserve lands and that it has also agreed to participate and fund a traditional land use study. TransAlta indicated that it was committed to ongoing communication with the Paul First Nation about its operations and towards the development of business and employment opportunities for Paul First Nation members and the protection of the environment.

6.1.2 Views Of the Interveners

Mewassin Community Action Group

Mewassin indicated that TransAlta did not meet with Mewassin before the EIA was filed, despite the fact that TransAlta had consulted with Mewassin with respect to a project designed to increase the output of the Sundance power plant. Mewassin believed that public consultation should have included a concerted effort to understand each other's position and come to some agreement over differences that it contended had not occurred.

Lake Wabamun Enhancement Protection Association

LWEPA testified that TransAlta did not meet with LWEPA until the end of June 2001, when the EIA was prepared. LWEPA indicated that when it attempted to discuss the Keephills 3 and 4 project with TransAlta, the company simply advised LWEPA that the Keephills 3 and 4 plant would not affect the Wabamun watershed.

Both LWEPA and Mewassin testified that TransAlta's public consultation process was inadequate. They noted that the open house conducted by TransAlta was primarily an informational meeting where TransAlta had a number of displays with respect to the Keephills 3 and 4 project but where meaningful consultation and discussion did not occur.

Committee on Keephills Environment

COKE testified that it had entered into a Memorandum of Understanding[7] with TransAlta to resolve some of the issues affecting the Keephills community. Terms of the agreement obliged TransAlta to:

- provide funds to the Keephills Athletic Association that would help support existing infrastructure,
- consult with COKE's traffic engineer to design roads and to review many of the current and future safety and other road issues,
- participate in a subcommittee to achieve compliance with the EUB noise guidelines,
- address the community's concerns with respect to ash, dust, and groundwater monitoring, and
- re-examine its written land purchase policy.

COKE asked that the Memorandum of Understanding be attached as a condition to the approval.

The Paul First Nation

The Paul First Nation did not express concern with TransAlta's public consultation program however, it stated that it expected to be consulted on any other project that may affect its members lives in the future. The Paul First Nation indicated that it has not yet reached agreement with TransAlta respecting business and employment opportunities for Paul First Nation members and the protection of the environment.

[7] Exhibit 1103

6.1.3 Views Of the Board

It is the Board's view that TransAlta's public consultation process involved a concerted effort to identify those who TransAlta considered to be affected by the project and to engage them in a meaningful dialogue about the project, its potential impacts, local concerns, and possible mitigation measures.

The Board commends TransAlta and COKE's efforts for finding a resolution to satisfy COKE's concerns. The Board encourages TransAlta and the Paul First Nation to continue their negotiations in order to finalize an agreement to satisfy the Paul First Nation's concerns.

The Board notes that Keephills 3 and 4 received significant media coverage as early as February 2001 when the project was officially announced. The Board notes that although LWEPA and Mewassin were not contacted until June 2001, they were eventually involved in the public consultation program and were afforded opportunities to review the EIA and to provide their input and recommendations.

In summary, the Board is of the view that TransAlta's public consultation program was adequate.

The Board does not consider it necessary to attach the Memorandum of Understanding between TransAlta and COKE as a condition of the approval. The Board expects TransAlta to fulfill its commitment as outlined in the Memorandum of Understanding agreed to by COKE and TransAlta.

6.2 Landowner Issues

6.2.1 Views of the Applicant

In response to concerns over increased traffic on local roads and increased safety risks to the users of the roads, TransAlta stated that it was committed to working with area residents, the Paul First Nation, local municipalities, Parkland County, the RCMP, Alberta Infrastructure, the School Board and school bus operators to ensure that an effective traffic management plan would be developed and maintained. TransAlta testified that it had retained the services of a transportation planner to support the development of a traffic management plan.

With respect to fugitive dust, TransAlta explained that dust is generated from mining, coal storage, mine traffic on the coal haul roads, soil haulage routes and topsoil salvage areas during dry periods. Fly ash in the ash disposal site is also a source of fugitive dust. TransAlta submitted that, to control the dust from traffic areas, two 85-tonne water trucks are used to spray the traffic surface as required. Water for this use is obtained from Beaver Creek, the Sundance cooling pond, and in the future, from the Keephills cooling pond. TransAlta further submitted that other dust control practices at the mine include establishment and maintenance of vegetation on topsoil/subsoil stockpiles and on the dead coal stockpiles at Sundance and Keephills, revegetation of topsoil stripped areas and placement of a hood on the Keephills coal handling stacking-out system. Dust generation off the ash landfill is controlled by orientation of the dumping area, watering, and packing. Dust monitoring stations around the Wabamun, Sundance and Keephills plants consist of 40 dust fall stations, 8 high volume samplers and 7 fine particulate analyzers.

6.2.2 Views of the Interveners

Committee on Keephills Environment

COKE submitted that traffic and road safety were the most important issues with respect to the expansion of the Keephills plant. COKE highlighted a number of improvements that could be undertaken to improve road safety and submitted that road improvements should be completed in advance of construction activity to service construction traffic in a safe and efficient manner. COKE indicated it had reached an agreement with TransAlta on traffic and safety and while all issues were not addressed in the agreement, the two parties agreed to develop a sub-committee that would address these issues. Further, it was agreed that representation on the sub-committee would include, but would not be limited to: COKE representatives, TransAlta, Alberta Transportation, Parkland County, School Board, School Bus Operators and the RCMP.

COKE also submitted that its agreement with TransAlta also addressed means to reduce fugitive dust emissions.

The Paul First Nation

The Paul First Nation expressed concern over the potential for increased traffic on roads surrounding and crossing reserve lands. The Paul First Nation requested additional signage, crosswalks, and speed limit enforcement. The Paul First Nation indicated that it would like to discuss the dust control monitoring program and enhance the program if necessary.

Mewassin Community Action Group and The Summer Village of Kapasiwin

Mewassin and The Summer Village of Kapasiwin expressed concern about the impact on local roads and road safety arising from additional construction traffic and reduced visibility from fog generation. They also expressed concern over increasing traffic volumes on local roads used by school buses.

Porter Ranches

Porter Ranches submitted that TransAlta had not taken sufficient precautionary measures to minimize the problem of dust. Further, if the Board decides to approve Keephills 3 and 4, the dust problem would likely be compounded at the Keephills power plant location.

Government of Alberta

AENV confirmed that the conditions that form part of the existing EPEA approvals for both the Keephills power plant and the Highvale coal mine, address fugitive dust emissions. It stated that the EPEA process deals with the mine expansion concerns and that the existing EPEA approval contains conditions that control and monitor the environment.

AENV noted that the Board's pre-hearing Memorandum of Decision directed that impacts from current and future mining operations would be more properly addressed at the time of the application to renew the existing mine approvals or an application to expand the mine boundaries. AENV believed that the upcoming mine expansion application would provide another opportunity to collect additional data before Keephills 3 and 4 are commissioned which would benefit from cooperative stakeholder approaches.

6.2.3 Views of the Board

The Board is satisfied that the traffic and road safety concerns expressed by the local interveners will be addressed by the sub-committee that would be formed as a result of the agreement between COKE and TransAlta. All parties that have expressed concern over increased traffic and road safety are to be consulted and, to the extent possible, to have representation on the new sub-committee. In line with COKE's recommendation, the new sub-committee would include representation from Alberta Infrastructure, the RCMP, Parkland County, Paul First Nation, the School Board, and local school bus operators.

The Board notes that TransAlta will be applying for license amendments and EPEA approvals for the Highvale Mine in the mine areas to the south of Highway 627 that will meet the fuel requirements for Keephills 3 and 4. The Board is of the view that issues, such as surface and groundwater impacts, noise, dust and acid deposition, that arise as a result of current and future mining operations will be more properly addressed at the time of the mining application as discussed at the pre-hearing meeting.

The Board notes that the existing power plant operations are also a source of dust affecting local landowners, and especially Porter Ranches. The Board acknowledges that the expansion of the generating plant will most likely compound the dust problem. The Board concurs with AENV's submission that the existing EPEA approvals for the plant and mine contain conditions respecting fugitive dust control. Therefore, the Board considers that Porter Ranches should bring the dust problem forward to the Board separately as a complaint. The Board will then initiate appropriate actions and expects that the concerned parties will resolve this outstanding complaint as per the conditions of the mine operating licenses and EPEA.

The Board encourages a regional, multi-stakeholder approach that would draw on the cooperation and resources of the local community groups, local municipalities, local landowners, government agencies, and TransAlta.

6.3 Economic Benefits

6.3.1 Views of the Applicant

TransAlta submitted that the cost to construct Keephills 3 and 4 was approximately $1.5 Billion. It stated that construction spending on Keephills 3 and 4 would inject $420 million into the Alberta economy, creating 2700 person-years of direct employment, primarily for Albertans. The continuous operation of the new generating facilities would require an additional 75 workers at the plant and an additional 80 workers are expected to be hired at the mine to produce the coal required for the new units. The total wages and benefits paid to the new workers at the plant and mine would exceed $11.0 million.

TransAlta submitted that the new generating units would add to the industrial assessment in Parkland County resulting in an additional $5.0 to $7.0 million in new tax revenues to the municipality annually. Royalties paid to the Province from the increased coal mining activity to fuel the new units is estimated at between $2 and $3 million per year.

TransAlta asserted that the project benefits are substantial and must be factored into the public interest assessment of the application.

TransAlta explained that it has had a long and valued relationship with the Paul First Nation and that the two parties had met cooperatively to identify and record commitments that TransAlta was willing to make to the Paul First Nation with respect to employment opportunities, business opportunities, training and education. TransAlta also pointed out that it had retained a consultant to aid in the preparation of business plans that would help move the commitments forward to realization. The commitments were outlined in a draft comprehensive master agreement, which had not been finalized at the time of the hearing. TransAlta stated that it had recently requested that the parties renew their discussions.

6.3.2 Views of the Interveners

Parkland County

Parkland County stated that its Council unanimously voted to support the application by TransAlta to expand the Keephills power plant believing that the expansion would create significant economic benefits and employment opportunities for the County, local communities, and the Province.

Alberta Building Trades

The Alberta Building Trades submitted that projects like Keephills 3 and 4 in Alberta are key factors in providing continuous job opportunities as well as opportunities for apprentices to continue or complete their training, which in turn would help maintain a viable work force in Alberta.

Clean Energy Coalition

CEC stated that since construction of Keephills 3 and 4 would most likely displace the construction of other power plants in Alberta, the benefits associated with royalties, employment and taxes generated by Keephills 3 and 4 would likely be offset by the loss of similar benefits elsewhere in the province.

The Paul First Nation

The Paul First Nation submitted that it had worked with TransAlta to explore how the economic benefits of Keephills 3 and 4 might be shared with members of the Paul First Nation but, at the time of the hearing, an agreement had not been reached. The Paul First Nation indicated it did not want the fact that TransAlta offered to provide the Paul First Nation with socio-economic benefits to be used as justification for the approval of the Application. If the Board deemed the Application to be in the public interest, the Paul First Nation requested that the Board require TransAlta to enter into a comprehensive socio-economic agreement as a condition of the Board's approval.

6.3.3 Views of the Board

The Board acknowledges the substantial economic benefits to the region associated with Keephills 3 and 4 and the statements of support from the Parkland County and the Alberta Building Trades Council.

The Board has addressed the issue of economic benefits and opportunities arising from large industrial projects being made available to aboriginal communities on numerous occasions in past decisions.

It remains the Board's view that while it encourages companies to take an active role in supporting education, training, employment, and business opportunities for members of First Nations in the region, the Board is of the view that the comprehensive master agreement, notwithstanding the difficulties encountered in finalizing it, is a genuine step towards the resolution of mutual interests. The Board encourages the two parties to continue their negotiations in order to finalize the agreement.

7 TECHNOLOGY SELECTION AND ENVIRONMENTAL PERFORMANCE OF THE PROPOSED POWER PLANT

7.1 Views of the Applicant

TransAlta submitted that its selection of technology was based on an investigation of the various technologies available for Keephills 3 and 4 and applied the following screening criteria:

- compatibility with 450 MW size
- commercially proven technology
- acceptable business risk
- compliance with environmental and regulatory requirements
- cost
- safety

Based on the above criteria TransAlta selected pulverized coal combustion sub critical cycle technology and emission control technology consisting of low NO_x burners, dry FGD process for SO_2, and bag houses for particulate.

TransAlta explained that, in selecting pulverized coal combustion subcritical cycle technology it had also considered super-critical and ultra-supercritical technologies, fluidized bed technology, both atmospheric and pressurized, integrated coal gasification combined cycle technology, and indirect fired coal and gas cycle technologies. Of all these technologies, only the selected subcritical cycle technology met all the selection criteria. Super-critical technologies came in second place but were not selected because of unacceptable business risk and higher cost.

TransAlta admitted that the selected subcritical cycle technology would be about 3% less efficient than a same-size super critical technology but defended its decision stating that the expected down-time due to failures for a super-critical boiler could be as high as 6% to 7%, as

compared to just 2.6% for a conventional subcritical boiler. This posed unacceptable business risk for the company.

TransAlta submitted it considered the following commercially available technologies for NO_x control:

- low NO_x burners,
- selective non-catalytic reduction and
- selective catalytic reduction.

TransAlta explained that the low NO_x burner system functions by staging the combustion to reduce the formation of thermal NO_x. The technology has been commercially proven over the past decade and is considered to be the most cost effective way to achieve NO_x control. TransAlta stated that low NO_x burners systems are readily available and are capable of meeting the current standards for NO_x emissions of 125 ng/J. It selected this technology to control NO_x formation on the basis that it is a more effective way to control the formation of NO_x than selective catalytic reduction, which removes NO_x after its formation.

TransAlta stated that selective non-catalytic reduction technology involves a process where reagents are injected into the gas passages of the boiler at specifically selected locations where the gas temperature supports the reaction. The reaction occurs within a specific temperature range, which has a limiting effect on the flexibility of this process. The technology has some reliability impact on the overall plant due to its reliance on chemical reagent use. The reagents used have an incremental cost impact on the operation of the plant due to the storage and handling requirements. The capital cost and operating and maintenance costs for this technology are higher than low NO_x burners without an offsetting benefit. TransAlta rejected this technology for these reasons.

TransAlta explained that selective catalytic reduction technology employs a catalytic reactor typically located in the boiler economizer outlet where the gas temperature is suitable. The process involves the injection of ammonia into the gas stream to promote the reaction. This technology is commonly used in retrofit situations to complement the use of retrofitted low NO_x burners where the retrofit involves compromise on the low NO_x burners effectiveness due to original design restraints. Capital and operating costs for selective catalytic reduction technology are significantly higher than low NO_x burners. For these reasons, TransAlta did not choose selective catalytic reduction.

TransAlta testified that it reviewed In-Furnace Sorbent/Alkaline Injection, Sorbent Injection FGD, Lime Spray Dryer (dry FGD), and Wet Limestone Slurry (wet FGD) for reduction of SO_2 in the flue gas emissions. It eliminated In-Furnace Sorbent/Alkaline Injection as this process was not considered commercially proven in units larger than 100 MW. Also, the Sorbent Injection FGD Process was rejected because of a number of concerns regarding its reliability for application to units of 450 MW.

TransAlta maintained that wet FGD systems were most suitable for use on higher sulphur coals where the inlet SO_2 concentrations require a higher capture rate than is available from a dry FGD

system. The dry FGD is a commercially proven technology capable of meeting the project reliability criteria and also capable of meeting the current SO_2 emissions standards. TransAlta also stated that the dry FGD process was most suitable for use with low sulphur coals, such as the Highvale coal, and that the capital costs were lower than a wet limestone slurry system. Although the operating costs were higher than a wet process, the dry FGD system had the lowest evaluated cost for the application. Therefore, TransAlta selected this technology for SO_2 emissions control.

TransAlta submitted it assessed Bag House (or fabric filter) and Electrostatic Precipitator technologies for control of particulate emissions. It stated that both technologies were equivalent in their ability to meet the current standards and therefore the selection was driven by compatibility with the upstream components. TransAlta explained that its selection of a dry FGD to control SO_2 supported the use of a bag house for control of particulate matter.

In summary, TransAlta's design and technology selection was intended to meet the Alberta guidelines and, as such, the proposed plant would have the following environmental performance:

Substance	Design Emission (ng/J)	Mass Emissions (tonnes/yr)
Nitrogen Oxides (NO_x)	125	8,497
Sulphur Dioxide (SO_2)	180	12,264
Particulate Matter	13	307

TransAlta testified that, if and when new guidelines are adopted, it would make a decision on how to respond to new emission guidelines at that time. TransAlta defended its choice of technology on the grounds that it cannot make a business decision today on future emission guidelines that have yet to be defined.

7.2 Views of the Interveners

Clean Energy Coalition

CEC indicated that the net efficiency of the proposed Keephills 3 and 4 using sub-critical boiler technology would be 35.6%. This would be almost 3% less efficient than the EPCOR's proposed Genesee plant, which would be using super critical technology. This difference of 3% lower efficiency would translate into 8% or 9% higher level of emissions of pollutants and green-house gases per unit of heat.

With respect to SO_2 emissions, CEC stated that TransAlta was designing to a level of 168 ng/J and that was significantly higher than the 68 ng/J required by the most lenient standards in the United States. CEC submitted that TransAlta should have designed its plant to emit SO_2 below 70 ng/J. It further submitted that 70 ng/J was achievable and pointed out that EPCOR had designed its Genesee 3 plant to achieve that level. CEC argued that TransAlta could achieve 70 ng/J with a larger dry FGD and operating it in a more effective way. However, CEC indicated that a wet FGD system would be a better choice of technology.
The CEC further submitted that TransAlta should evaluate the combined control of mercury, SO_2, and particulate matter in an integrated manner. This may lead to the selection of wet FGD

over dry FGD, even if Highvale Mine low sulphur coal was used. CEC also pointed out that such technology would capture 5% more of SO_2 than the proposed dry FGD.

With respect to NO_x, the CEC asserted that low NO_x burners combined with selective catalytic reduction would result in less than half of the NO_x emissions proposed by TransAlta. It recommended that NO_x emissions be reduced to as low as 65 ng/J, the U.S. new performance standard. The CEC pointed out that some plants in the United States are required to reduce NO_x emissions to between 34 to 58 ng/J.

CEC submitted that TransAlta must use the selective catalytic reduction process for NO_x in combination with a wet FGD process, instead of a dry FGD. This combination of technologies would not only minimize the emissions of SO_2 and NO_x but also help lower mercury emissions.

The CEC submitted that TransAlta's proposal to use bag house for controlling particulate matter was appropriate. The CEC stated that although TransAlta concluded that electrostatic precipitators and fabric filters (or bag houses) were equivalent in their ability to meet the current standards, in the long run, bag houses would be more effective in controlling small particles. Further, bag houses provide a more effective means of mercury control. CEC disagreed, however, that TransAlta's proposed particulate level of 13 ng/J was appropriate. It argued that if the Genesee 3 plant was proposing to reach 8.6 ng/J, using a bag house, then TransAlta should be obliged to reach it as well.

CEC asked the Board to deny the application at the present time on the grounds that Alberta does not need the power at the moment and because there are new emerging technologies becoming available in the medium term that, if utilized, would produce significantly less pollution than the technologies proposed by TransAlta. However, if the Board decided to approve the application, the Board should require TransAlta to use the best available demonstrated technology.

CEC submitted that the best time to design and apply the best possible emission control technology in a most cost effective way is at the start of the project. It asserted that it is almost always technically more difficult and more costly to retrofit an existing power plant. The cost could be 20% to 50% higher for various technologies. Therefore, CEC recommended that TransAlta incorporate better emission control technology in its design, rather than retrofit later when more stringent emission standards are enforced, because once a plant is built, there is a reluctance to conduct retrofits, and grandfathering often takes place.

Paul First Nation

The Paul First Nation submitted that any approval should be conditioned to require that TransAlta use best available technologies to reduce NO_x and, at the very least, to match the SO_2 emission levels proposed by EPCOR's Genesee 3.

Government of Canada

Environment Canada recommended that the emission performance of Keephills 3 and 4 conform to the CWS through the use of best-available technology that is economically feasible. It noted that TransAlta selected a less-efficient sub critical boiler technology instead of the more efficient

supercritical boiler technology and stated that the latter, being more efficient, would have reduced emission rates for all pollutants including carbon dioxide.

Environment Canada testified that technologies commonly considered as best-available technology were:

- fabric filter for particulate control,
- lime spray dryer for SO_2 control, and
- selective catalytic reduction for NO_x control.

Environment Canada further explained that selective catalytic reduction technology has been overwhelmingly the preferred choice of utilities for meeting stringent NO_x emission performance requirements. It has been in common use for more than 15 years in Japan, Germany, and other western European nations and most recently in the U.S.. Environment Canada indicated that in Germany, there are now more than 140 installations of selective catalytic reduction technology on utility boilers to meet national emissions performance requirements. In the U.S., more than 80 existing coal-fired units representing over 50,000 megawatts of capacity have been committed to install selective catalytic reduction systems.

Environment Canada testified that best-available technology can do far better than the NO_x emissions performance range of 125 ng/J and the SO_2 emissions performance range of 180 ng/J proposed for the Keephills 3 and 4 project. Environment Canada identified, as an example, that national mandatory performance standards applied to new and existing plants in the U.S., Germany, and other western European nations demonstrated that best-available technology can deliver NO_x emissions performance within the range of 50 to 70 ng/J and SO_2 emissions performance within the range of 50 to 80 ng/J.

Environment Canada believed that, although emission performance requirements for mercury are uncertain pending the completion of the CWS it would be prudent to consider mercury best-available technology during the approvals process for any new plant. Environment Canada expressed the view that selective catalytic reduction was likely to have the additional benefit of enhancing mercury removal. However, Environment Canada emphasized that it was not recommending, endorsing, or prescribing any particular technology over another one.

Government of Alberta

The Government of Alberta stated that TransAlta's technology selection was capable of meeting Alberta's emission standards for new coal power plants published in June 2001. It further stated that these standards were designed to guide EPEA approval decision-makers in setting stack emission limits and that they were a timely and realistic improvement over the 1993 guidelines.

7.3 Views of the Board

The interveners asked the Board, if it decides to approve the application, to require TransAlta to install technology capable of meeting stricter emission standards expected in the future. However, TransAlta defended its choice of technology on the grounds that it cannot make a business decision today on future emission guidelines that have yet to be defined. TransAlta

testified that, if and when new guidelines are adopted, it would make a decision on how to respond to new emission guidelines at that time.

The Board is of the view that the selection of technology, as it directly affects the economics of the project, should be left to the decision of the proponent. This would be consistent with the intention of the legislation that the electric generation sector in Alberta should be developed through workings of a competitive market. It follows that a company's ability to remain competitive in the market would ultimately determine the choice of technology. For example, a company may select the latest technology, because of the higher efficiency, but it may not be competitive in the market because of its higher cost. Conversely, a company may select bottom-line technology, because of lower initial cost, but it may not be competitive because it is less efficient. These are just a few factors, among many others, that companies have to balance when deciding on a technology that would be competitive and which would survive in the electricity market.

The Board is satisfied that the technologies selected by TransAlta are capable of meeting the Alberta regulatory requirements and guidelines and would not represent a risk to the health and safety of the public. Therefore, the Board will not require TransAlta to change its proposed technologies.

Nonetheless, the Board notes that commercially proven technology alternatives are available that more closely approach the current state-of-the-art in terms of energy efficiency and pollution abatement. In that regard, the Board accepts that commercially proven approaches are available for achieving much lower emissions in the range of 50 to 70 ng/J for NO_x and 50 to 80 ng/J for SO_2 as recommended by Environment Canada and typical of the US NSPS[8] requirements. Certain data exists which suggests that these enhanced technologies also remove significant amounts of potential mercury emissions.

The Board considers that proponents of new power plants in Alberta need to be aware of reasonably foreseeable changes to current emission standards and need to incorporate flexibility in the design of the plants to facilitate retrofitting of improved controls should these become necessary.

The Board recommends that since changes to the current source emission standards are reasonably foreseeable, it is prudent for proponents of new power plants to incorporate flexibility into their projects so that compliance could be assured within a reasonable timeframe.

8 IMPACT ON AREA TRANSMISSION SYSTEM AND UPGRADES

8.1 Views of the Applicant

[8] United States Code of Federal Regulations, Title 40, Chapter 1, Subchapter C, *Part 60 – Standards of Performance for New Stationary Sources*.

TransAlta filed an application with the Transmission Administrator for generator interconnection in April 2001. The Transmission Administrator has completed a functional specification for the interconnection. TransAlta's interconnection plan included:

- Expanding the existing site and enlarge the 240kV switchyard to connect generating units 3 and 4.
- Increasing the transmission capacity by rerouting a transmission line (909L) from Sundance to Keephills. No new transmission lines would be required for this reconfiguration.

8.2 Views of the Interveners

The Transmission Administrator, ESBI, appeared at the hearing as a friend of the Board to provide a general overview of transmission issues resulting from the potential for new generation in the West Edmonton area. ESBI indicated that it is neither a proponent nor an intervener in this matter and as such does not support or oppose TransAlta's application.

ESBI indicated that the addition of Keephills 3 & 4 would result in unacceptable thermal loading, at maximum unit output, on the existing 240 kV lines from the plant to south Edmonton. To resolve this situation the existing transmission lines 1202L, 1203L and 1209L, which were originally constructed to 500 kilovolts (kV) standards but are currently energized at 240 kV, would be required to be converted to 500 kV operation.

ESBI indicated that in order to interconnect the Keephills 3 and 4 generation facilities to the AIES it would also be necessary to:

- build a new 500kV substation (Lindale 554S) to interconnect the two new generators to the existing transmission lines (1202L and 1203L);
- convert the existing transmission lines (1202L and 1203L) to operate at its design voltage (500 kV);
- convert the Genesee substation (300P) to operate at their design voltage (500 kV);
- add three new 1200 MVA power transformers (500/240kV) to the Ellerslie substation (89S);
- swap a number of circuit breakers due to the higher fault levels associated with the Keephills 3 and 4; and
- make various other changes as documented in the draft functional specification.

Keephills 3 and 4 would be integrated with the addition of the Lindale substation (554S), the conversion of Genesee substation (330P) to its design voltage and the expansion of Ellerslie substation (89S) to include 500 kV power transformers.

ESBI indicated that it did not have any outstanding concerns with the connection of Keephills 3 and 4 to the AIES.

8.3 Views of the Board

The Board notes that although precise details and discussion of the connection of Keephills 3 and 4 with the AIES were not presented at the hearing, that major additions to the transmission system, both in the West Edmonton and Calgary-Edmonton areas, would be required. The Board further notes that these matters will be dealt with in an upcoming congestion management proceeding as well as the connection application to be made pursuant to Section 17 of the HEE Act.

9 DECISION

The Board finds that approval of the proposed 900-MW expansion of the Keephills power plant of TransAlta Energy Corporation is in the public interest for the reasons set out in the previous sections of this report. Therefore, the Board approves Application No. 2001200 with the conditions, directions, and recommendations outlined below. The Board expects that TransAlta will adhere to all commitments it made during the consultation process, in the Application, and at the hearing on such matters as mitigation, monitoring, and bilateral agreements.

Monitoring

The Board notes that improved monitoring of potential impacts on human health and the environment were proposed by TransAlta or recommended by the interveners. The Board believes that WCAS may be an appropriate forum for that monitoring, and may be capable of addressing several of the issues raised during the Keephills 3 and 4 hearing, as well as the Genesee 3 hearing. If TransAlta can demonstrate to Alberta Environment that WCAS boundaries can be expanded and programs can be designed so they meet the environmental and health monitoring and evaluation requirements outlined in this report, then the Board believes that WCAS will be a suitable vehicle to address these requirements. Should expansion of WCAS not be feasible, or if WCAS consensus cannot be reached quickly regarding boundaries, monitoring locations, or responsibilities for additional funding, the Board directs TransAlta to support, fund, and implement additional independent monitoring to the satisfaction of AENV and SRD.

The Board directs that, at a minimum, improved monitoring will address the following:

1) Monitoring programs must be developed in advance of commissioning of Keephills 3 and 4, subject to ongoing changes due to adaptive management. Given that other monitoring programs are being established for the recently approved EPCOR Genesee 3, the Board directs TransAlta to cooperate with EPCOR, AENV, SRD, WCAS, and other regional stakeholders as appropriate to establish suitable and coordinated monitoring programs.

2) The monitoring standards must provide for reliable and conclusive assessments. Specific time periods for data collection and periodic assessment must be identified in consultation with relevant regulatory agencies. TransAlta, in cooperation with other industrial operators in the region as appropriate, will be required to report to AENV and the EUB any potential or measured adverse impacts on the environment revealed through monitoring or assessment. This reporting will take place following TransAlta's (or other operators') knowledge

of the adverse impacts in accordance with AENV's regulatory and approval requirements.

3) As environmental monitoring requirements are mandated by AENV and SRD, the Board looks to these regulators to determine effective, detailed reporting methods for TransAlta. Reporting must include appropriate notification to the Board on significant monitoring trends, cumulative environmental effects, or compliance issues.

4) In addition to item #3, a summary of TransAlta's general monitoring progress and results must be provided to the Board. This information is required every second year during the course of environmental monitoring, so that the Board may be actively informed of regional and adaptive management programs.

5) TransAlta must adjust monitoring programs or mitigation methods as required to obtain useful results and minimize impacts to the degree possible.

The Board is aware that the onus does not rest with any one company to fully assess and monitor the cumulative impacts of an entire region involving many industry players. However, the Board requires that TransAlta, along with other companies in the region, play a significant role in the development and maintenance of regional programs aimed at understanding and mitigating potential impacts to human health and ecosystems. The Board believes that participation in the regional health study and development of the WCAS bio-monitoring program, including one for an expanded or new airshed as required, could address this need. However, should it not be possible to establish a multi-participant regional monitoring program, the Board recommends that AENV address specific monitoring requirements for TransAlta in its approval process.

Source Emissions Standards/Grandfathering

The Board accepts that TransAlta's proposed Keephills 3 and 4 will meet current source emission standards as set by AENV. The Board, however, notes that a CWS for mercury is in development and that reviews of Alberta standards and Canadian guidelines for source emissions have been announced. In so much as new coal fired power generation projects such as the proposed Keephills 3 and 4 project may have operational lives measured in decades, the Board recommends that operators incorporate the flexibility necessary to meet new and reasonable foreseeable environmental and emission source standards.

In considering the long-term impacts of the operation of Keephills 3 and 4, the Board makes the following observations:

1) TransAlta's proposed facility will meet current Alberta source emissions standards and has selected technology that is commercially proven to meet these standards.
2) The Board notes that commercial proven technologies exists that could achieve greater reductions in source emissions.

3) The evidence suggests that the regulatory trend is for stricter source emissions from power plants than is presently the case and that standards for SO_2, NO_x and mercury are expected to change in the reasonably foreseeable future.

4) Mercury can have a significant negative impact on both human health and ecological biota and the issue is one of considerable importance to the Board. The CWS process for mercury is currently underway with a standard for mercury expected in 2002. It is foreseeable that there will be reductions in permissible mercury emissions in the near term.

5) Monitoring programs for mercury that specifically address mercury and metals in the environment have been recommended by TransAlta, the Government of Alberta, and the Government of Canada. Detection of mercury, identification of sources and the determination of changes in mercury levels in the environment over time will be integral components of air and biomonitoring programs in the region.

The Board concludes that it is desirable for Keephills 3 and 4 to take into account the likelihood of stricter environmental standards, and in particular, more stringent emissions source guidelines and standards, that are likely to be established in the near term by provincial and federal governments. In order to ensure that Albertans enjoy the cleanest environment possible within reasonable standards, the Board recommends that AENV give serious consideration to addressing the matter of power generation facilities being required to meet evolving standards. The Board believes that it is beneficial to minimize incremental air emissions to the extent practicable so that current air quality will either be sustained or improved.

The Board strongly recommends to AENV that its EPEA approval process for Keephills 3 and 4 define how reasonably foreseeable revisions to Alberta's emission standards, including mercury, are to be implemented by TransAlta, including appropriate compliance timelines.

The Board noted in its EPCOR Genesee 3 decision (Decision No. 2001-111) that exempting new coal fired power plants from future and stricter environmental standards (grandfathering) would not be appropriate. The Board believes this conclusion is also applicable in this Keephills 3 and 4 Application. The Board views that orderly implementation of expected revisions to source emissions and mercury standards is appropriate for the TransAlta's Keephills 3 and 4 project.

Summary of Directions and Recommendations

The following directions and recommendations drawn from previous sections of this report are meant to serve as a reference for the reader. This is not an exhaustive list, but rather a tool to assist the reader in finding key references within this report. Section numbers referring to sections of the report are provided at the end of each statement.
In the event there is any variance between the directions and recommendations below and those provided in the foregoing text of this decision, the text of the main document is to be relied on for the complete intent.

Directions

1) The Board directs TransAlta to fulfill its commitments to participate in and provide financial support in the amount of $100,000 for a community exposure and health effects assessment, to be led by AHW and the Westview and Capital Health Regional Health Authorities. (Section 4.3)

2) The Board believes additional direct measurements of COPC concentration in representative samples of regional study area soil, vegetation and surface and groundwater will improve the confidence in estimated COPC levels in consumed foods and will validate and enhance the confidence in results of the HHRA conducted. The Board views the compilation of this kind of information as part of an existing need to develop of a regional baseline database, establishing current concentrations of COPC in key media (air, soil, surface water, groundwater and varied ecological receptors). The Board directs TransAlta to initiate, plan, and undertake, in partnership with other regional industry operators, an assessment and consolidation of all relevant existing information and new data gathering, as required, to address this information deficiency to the satisfaction of AENV. (Section 4.3)

3) The Board directs TransAlta to participate in and fully support current initiative(s) led by AENV and (or) Environment Canada to investigate secondary pollutants resulting from precursors found in power plant emissions. (Section 4.3)

4) In order to address potential local acid deposition issues the Board directs TransAlta to take steps to verify acid deposition predictions with its monitoring programs. (Section 5.1.3)

5) The Board directs TransAlta to the satisfaction of AENV, and singularly or in cooperation with other organizations such as WCAS, to define additional air quality needs in the Lake Wabamun-Keephills-Edmonton region. The Board notes that monitoring related to Keephills 1 and 2 is currently required by the respective EPEA approvals, and the Board directs that TransAlta support and implement further regional ambient air quality and effects monitoring to the satisfaction of AENV. (Section 5.1.3)

6) TransAlta has steadfastly committed to offset greenhouse gas emissions so that carbon dioxide emissions from Keephills 3 and 4 will be equivalent to emissions from a combined-cycle natural gas facility of the same capacity. The Board directs TransAlta to fulfill its commitment in that regard. The Board further directs these offsets to be adjusted so they correspond to any reasonable foreseeable future changes in emissions standards for a coal-fired power plants or a corresponding gas-fired power plant. (Section 5.1.3)

7) The Board notes that TransAlta proposed completion of an operational plan for blowdown, additional monitoring of the Keephills cooling pond, NSR, sediment monitoring of Lake Wabamun and other lakes in the area as mitigative measures. The

Board directs TransAlta to complete the above commitments to the satisfaction of AENV and SRD and where applicable in cooperation with DFO. (Section 5.2.3)

8) The Board notes that for purposes of the Keephills 3 and 4 environmental assessment, proposed surface mining of coal occupies a limited surface area of approximately 57 hectares within the Lake Wabamun watershed. However, the Board's pre-hearing Memorandum of Decision defers consideration of coal mining effects from the Highvale mine. The Board directs TransAlta to undertake environmental studies, including cumulative effects of related coal mining activity, at the time it applies for amendments to the mine license and EPEA approvals. (Section 5.2.3)

9) At such time as TransAlta applies for EUB licenses and AENV approvals for its new mining operations, the Board directs the applicant to address the need with other stakeholders for a Watershed Management Plan applicable to Lake Wabamun. (Section 5.2.3)

10) The Board believes that a mercury monitoring and management program is mandatory for any approval of Keephills 3 and 4 and, thus, the Board directs TransAlta to establish such a program with AENV and SRD prior to commissioning of Keephills 3 and 4. (Section 5.2.3)

11) The Board understands that regional environmental monitoring is a multi-stakeholder responsibility, representative of industrial and non-industrial activities present in the lake Wabamun-Keephills-Genesee region. To this end, the Board directs TransAlta to participate and contribute to baseline and effects based monitoring of surface waters and sediments within a regional framework, to the satisfaction of AENV and SRD. (Section 5.2.3).

12) The Board directs TransAlta to develop and install a fish exclusion device on the blowdown pipe from the cooling pond to the NSR, in co-operation and compliance with the requirements of DFO. (Section 5.3.3)

13) The Board directs TransAlta, in consultation with other regional industry operators, to develop and implement a detailed study of mercury in fish tissue for the regional waterbodies . Sample sizes and methodologies must facilitate statistical analysis of the results, however sampling must not jeopardize natural fish populations. Sampling must be commenced prior to the commissioning of Keephills 3 and 4 to determine an acceptable measure of baseline conditions, and must continue at appropriate intervals to facilitate inter-annual trends over the life of Keephills 3 and 4. Fish of the same species and of comparable size should be analyzed in parallel to facilitate a scientifically defensible investigation. (Section 5.3.3)

14) The Board directs TransAlta to also examine the effects of thermal discharges on algal communities, as part of regional monitoring efforts. Details of such a study must be developed in cooperation with AENV and SRD, but the Board expects that enough samples will be taken to allow statistical analysis of the results, and to allow for analysis

of inter-annual trends. The study should be undertaken prior to the start up of Keephills 3 and 4 and continue at intervals determined by AENV and SRD. (Section 5.3.3)

15) The Board supports DFO's recommendations to monitor gas bubble disease in fish, in the cooling pond, the condenser outlet canal, and the NSR, to ensure that fish and other aquatic biota are not affected by high temperatures or gas super saturation, as was predicted by the applicant. The Board directs TransAlta to work in conjunction with DFO and SRD to develop and implement an appropriate study. Although the study design and methods must be acceptable to the responsible authorities, the Board expects samples sizes that will facilitate statistical analyze of the data, and to analysis inter-annual trends. (Section 5.3.3)

16) While WCAS may be one mechanism by which such monitoring could occur, the Board directs TransAlta to use suitable methodology for monitoring both acid deposition and heavy metals deposition on soils, whether singularly or in collaboration with other industry operators in the region to the satisfaction of AENV. (Section 5.5.3)

17) The bio-monitoring associated with WCAS could be a suitable mechanism for ensuring that suitable monitoring of vegetation occurs, however the Board directs TransAlta, in cooperation with the other stakeholders in the region, to take a leadership role in ensuring that scientifically defensible monitoring programs suitable for understanding potential regional impacts from air quality both within and beyond the WCAS boundary are designed and implemented prior to commencement of operations of Keephills 3 and 4. (Section 5.6.3)

18) The Board directs TransAlta to honour the several monitoring (for example, falcons and amphibians) and mitigation commitments (for example, minimal clearing, timing restrictions and hunting controls) it has made with respect to wildlife, provided they are not in conflict with other recommendations made here or through further consultation regarding regional monitoring. (Section 5.7.3)

19) It is noted that AENV recommended continued monitoring and assessment of Red-backed Voles, and potentially other wildlife species. The Board believes that such monitoring should be a regional initiative, but directs TransAlta, in consultation with AENV and SRD, to ensure that such assessment and monitoring is adequately designed and implemented to effectively track potential trends in tissue chemical analysis, as well as serve as an indicator of potential regional impacts to wildlife health resulting from air emissions. Where feasible, water quality in the region should be examined for potential links to wildlife health. (Section 5.7.3)

20) Should TransAlta propose to make any material changes to Keephills 3 and 4 or substantially vary the design, the construction schedule, and /or specifications of the plant from what was stated in the applications, evidence provided at the hearing, or what the Board has approved, TransAlta must obtain Board approval prior to proceeding with any such changes.

21) Commencing immediately, TransAlta will provide a current construction schedule, and start submitting quarterly construction reports to the Board detailing the progress for each quarter.

Recommendations

1) The Board recommends that the regional health study include members of the Paul First Nation and recommends that the respective health jurisdictions to collaborate, plan, lead and implement such a comprehensive assessment in cooperation with regional public and industrial stakeholders. (Section 4.3)

2) The Board recommends TransAlta act in partnership with its regional industrial partners and assume a leadership role by identifying priority health needs, by organizing and assembling necessary resources and by implementing, managing and communicating to the public the results of such research. (Section 4.3)

3) Given the health effects related to ozone and particulate matter and given the uncertainty regarding the size of regional study area required to study these compounds, the Board recommends AENV review guidelines for the modelling of ambient air quality for suitability to address formation and dispersion of secondary pollutants. (Section 4.3)

4) The Board expects CWS standards for mercury to be adopted in the near future and also revised federal emission standards for coal-fired power plants. Therefore the Board recommends that AENV determine how pending CWS for mercury will apply to Keephills 3 and 4 in its approval process. (Section 5.1.3)

5) The Board recommends that AENV in its approval process define requirements for TransAlta to investigate the acid deposition sensitivities of the areas predicted to receive acid deposition at rates in excess of the monitoring load for sensitive areas (0.17 keq $H^{+}ha^{-1}yr^{-1}$) and to identify protection priorities and action plans (if required) for receptors where the predicted acid deposition rates exceed target or critical loads. (Section 5.1.3)

6) Regardless of whether an existing airshed region such as WCAS can be modified to address the Lake Wabamun-Keephills-Edmonton region or whether a new region specific to the power plan operators in the area needs to be formed, the Board recommends TransAlta take a lead role in creating such a forum for monitoring regional air quality. (Section 5.1.3)

7) The Board notes AENV's intention to consider the introduction of emission objectives related to greenhouse gases as part of its post 2005 emission standards. Given the potential for disagreement on emission offset accounting, the Board recommends TransAlta and AENV use a third party audit process to verify the offsets. (Section 5.1.3)

8) The Board recommends that TransAlta, with the cooperation of other stakeholders, support high resolution analyses of lake sediment cores and other emission receptor studies, which may necessitate future mitigative measures for the management of

regional emissions. To avoid limitations of some past environmental baseline data, the Board recommends that AENV establish with TransAlta appropriate sampling frequencies, analytical protocols, and reporting methods, including the analyses of trace elements within EPEA and Water Act Licenses. (Section 5.2.3)

9) The Board acknowledges the advice of AENV, that effects upon water resources are acceptable provided that recommended monitoring and management programs are addressed by Water Act and EPEA approvals. Furthermore, the Board recommends AENV employ adaptive management techniques for integrating TransAlta's future environmental monitoring and management programs. (Section 5.2.3)

10) The Board recommends TransAlta contribute in a meaningful way (for example, financial support, participation, collection and contribution of data) to establishing a regional mercury database for the Lake Wabamun-Keephills-Genesee region. The Board also recommends TransAlta continue to strengthen its research efforts regarding cleaner coal burning technology, and the processes and pathways of TransAlta's sources emissions of mercury in the local and regional environment. (Section 5.3.3)

11) The Board recommends to AENV that TransAlta extend and enhance the probabilistic modelling of the ash disposal area to explore a more representative range of geological complexity. The Board recommends that AENV adopt suitable timing and reporting requirements for TransAlta on this issue, such that results of the assessment are forwarded to the EUB. (Section 5.4.3)

12) If the results of this assessment indicate that insufficient data exists to verify that groundwater will be protected by natural attenuation under all reasonable geological scenarios, then the Board recommends AENV require TransAlta to develop a field investigation program. The investigation might involve surface and subsurface geological and geophysical techniques appropriate to gathering sufficient, quality data to demonstrate that those geological scenarios, which do not provide adequate natural attenuation protection, are not occurring at Keephills. (Section 5.4.3)

13) If the results of the enhanced probabilistic modelling and/or any additional field investigation results indicate that natural attenuation of leached ash constituents is not likely to prevent unacceptable impacts on groundwater chemical quality under all reasonably possible geological scenarios, the Board recommends AENV require TransAlta to modify its ash disposal plan and seek the appropriate approvals from AENV accordingly. (Section 5.4.3)

14) With regard to the question of whether Keephills 3 and 4 or the anticipated Highvale mine expansion will impact groundwater linked to Wabamun Lake, the Board is not satisfied that the evidence presented demonstrates that the surface watershed divide acts as a subsurface groundwater-flow divide. Therefore, the Board recommends that AENV to require TransAlta to place sufficient additional groundwater monitoring-wells between Lake Wabamun, the Keephills Plant site, the Paul First Nations land, and the anticipated Highvale mine expansion to resolve this uncertainty. (Section 5.4.3)

15) The Board recommends to AENV that suitable timing and reporting requirements be established for TransAlta to establish baseline conditions, prior to the introduction of any stresses on the groundwater flow system associated with the proposed expansion. The Board recommends that results of any additional baseline data gathering by TransAlta be communicated to the EUB and the interveners. (Section 5.4.3)

16) The Board recommends that AENV require TransAlta to reinstate complete groundwater geochemical analysis of its waste facility monitoring wells at a frequency of at least twice per year to validate the use of its indicator parameters in regular monitoring. The geochemical analysis might include a full suite of dissolved metals in appropriately filtered groundwater samples. (Section 5.4.3)

17) The Board also recommends that during EPEA and Water Act licensing for TransAlta, that AENV review the classification of coal ash for purposes of waste disposal within the Highvale Mine. (Section 5.4.3)

18) The Board believes that a program is needed to accurately quantify acid deposition load, evaluate the environmental significance to terrestrial as well as aquatic ecosystems, and take action to reduce the load if necessary. The Board recommends that AENV incorporate these requirements into its EPEA approval, as it has suggested. The Board recommends that soil monitoring should also consider heavy metals deposition, and recognizes that such monitoring may be fulfilled in part through the mercury monitoring and management program. (Section 5.5.3)

19) The Board believes that understanding soil exposure pathways is critical to the human health assessment, and believes that sampling for potential soil contaminants should be exclusively designed to fit the requirements of future human health risk assessment and monitoring. The Board recommends to AENV and TransAlta that suitable sampling designs for both human health studies and studies of impacts directly on soils (for example, acidification) be carefully designed, and only coordinated where it will not jeopardize the quality of the analysis and results. (Section 5.5.3)

20) The Board is aware of the concern regarding potential health effects on vegetation in this region, and believes that long term monitoring and reporting on vegetation health effects is warranted, both in the vicinity of Keephills 3 and 4 as well as in the region. The Board recommends to AENV and TransAlta that monitoring should incorporate suitable methods to detect potential changes to vegetation resulting from air emissions, ozone formation, acid deposition on soil having secondary effects on vegetation, metal uptake, changes in species diversity, and particularly impacts on sensitive species (for example mosses, lichens) and/or rare plants. (Section 5.6.3)

21) The Board notes AENV's expectations to work with TransAlta and other stakeholders in this region to establish suitable long-term vegetation health monitoring plots in this region. The Board recommends to both parties that this discussion occur promptly, so

that plots may be established and baseline information can be collected, allowing monitoring to commence in a timely fashion. (Section 5.6.3)

22) The Board recommends that TransAlta continue to identify rare plant species and incorporate them into monitoring programs as suitable, or implement suitable mitigation measures if it becomes necessary to directly disturb a rare plant or plant community. The Board recommends that TransAlta consult with rare plant experts at AENV on the probability of success of rare plant mitigation methods, and implement results of that consultation such that the potential for rare plant survival during construction and operations is maximized. Documentation of any rare plant findings should also be discussed with the appropriate department of AENV. (Section 5.6.3)

23) The Board recommends that TransAlta implement reclamation objectives consistent with restoring wildlife habitat as well as agricultural land, and recommends that TransAlta discuss options for reclamation further with AENV. (Section 5.7.3)

24) The Board recommends that since changes to the current source emission standards are reasonably foreseeable, it is prudent for proponents of new power plants to incorporate flexibility into their projects so that compliance could be assured within a reasonable timeframe. (Section 7.3)

DATED in Calgary, Alberta on February 12, 2002.

ALBERTA ENERGY AND UTILITIES BOARD

<Original signed by>

M. N. McCrank, Q.C.
Presiding Board Member

<Original signed by>

R. G. Lock, P. Eng.
Board Member

<Original signed by>

G. J. Miller
Board Member

APPENDIX A –THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations Used in Report)	Witnesses
Alberta Building Trades Council	M. McCullough
Alberta Energy and Utilities Board Staff	D. Larder, Board Counsel P. Wickel C. Brown K. Eastlick J. Fujikawa P. Hunt W. MacKenzie D. Morris E. McKellar K. Parks G. Sankey R. Schroeder J. Soon
Alberta Environment, Alberta Sustainable Resource Development, and Alberta Health and Wellness (Government of Alberta) H. Veale R. Bodnarek	B. Lakeman A. Idriss R. Dobko B. MacDonald R. Ostertag A. M. Anderson P. Valupadas S. Spencer A. Mackenzie L.A Blair L. Cheng N. Sawatsky G. Leskiw R. George S. Cook M. Seneka J. Michel A. Lamb H. Wollis
Calpine Canada	A. L. McLarty
Capital Health Authority	A. Mak
Committee on Keephills Environment (COKE) D. P. Mallon K. M. McDougall	E. White K. Porter L. Morasch L. Frank G. Johnson

Principals and Representatives (Abbreviations Used in Report)	**Witnesses**
ENMAX Power Corporation and ENMAX Energy Corporation (ENMAX)	K.P. Reh L.A. Cusano D. Wood
Enron Canada Power Corporation (Enron)	R. Anderson E. Bossio K. Friesen
Environment Canada, Department of Fisheries and Oceans, and Health Canada (Federal Agencies) B. F. Hughson	M. Kellerhals M. Fairbairn G. Ross P. Blackall M. Kellerhais B. Jessiman. F. Goodarzi H. Sanei D. Majewski
EPCOR Power Development Corporation and EPCOR Generation Inc. (EPCOR)	M. K. Ignasiak
ESBI Alberta Ltd. (ESBI) P. J. LaFlair	D. Chestermen R. Stubbings
Fording Coal J. R. Thrasher J. H. Smellie	J. R. Thrasher J. H. Smellie
Lake Wabamun Enhancement Protection Association (LWEPA) The Summer Village of Kapasiwin (Kapasiwin) K. & G. Gray K. E. Buss R. J. Jeerakathil	L. Duncan T. Marr-Laing L. Boros G. Jones
Mewassin Community Action Group (Mewassin) Clean Energy Coalition (CEC) K. E. Buss R. J. Jeerakathil	K. McDonald B. Donahue J. Henderson E. Mewhinney P. Amar M. Brauer B. Mitchell B. Staszenski M. Griffiths H. Tyrrell R. Yanor-McRae A. Ford

B. Henderson A & J. McClelland B. Mitchell B. Mustard K. E. Buss R. J. Jeerakathil	
Lakeview Ranch	E. Polukosho
Parkland County	E. Kinsey
Paul First Nation R. C. Secord	D. Paul M. Rain L. Bird N. Adams P. Rain
Porter Ranches Limited B. Berrien	K. Porter
T. Cymbaluk and R. Breymann	D. Cymbaluk
TransAlta Energy Corporation (TransAlta) D. G. Davies L. Bernette Ho	M. Digel B. Hartley M. Mackay D. Fedorchuk J. Bolton G. Brown D. Leahey B. Page D. Pritchard R. Patching

APPENDIX B – MEMORANDUM OF DECISION FROM THE PREHEARING MEETING

ALBERTA ENERGY AND UTILITIES BOARD
Calgary, Alberta

PRE-HEARING MEETING
TRANSALTA ENERGY CORPORATION **Memorandum of Decision**
EXPANSION OF KEEPHILLS POWER PLANT **Application No. 2001200**

1 INTRODUCTION

TransAlta Energy Corporation (TransAlta) filed Application No. 2001200 on July 6, 2001, requesting approval of the Alberta Energy and Utilities Board (the Board) to expand its coal-fired power generating plant located at Keephills, about 70 kilometres west of Edmonton, in Section 36, Township 51, Range 4, West of the 5th Meridian, in the County of Parkland No. 31, Alberta. TransAlta is proposing the addition of two 450-megawatt (gross nominal output) coal-fired generating units at the Keephills site that would commence operations in 2005.

The Board directed that this application be considered at a public hearing scheduled to commence in Stony Plain on October 22, 2001. The Board also decided to convene a pre-hearing meeting to discuss hearing issues, the timing of the hearing, and other preliminary matters so as to make effective use of the hearing time.

On September 21, 2001, the Board held a pre-hearing meeting at the Genesee Community Centre before N. McCrank, Q.C. (Presiding Member), R. G. Lock, P. Eng. (Board Member), and G. Miller (Board Member).

Those who appeared at the pre-hearing meeting are set out in Appendix A to the Memorandum.

2 ISSUES CONSIDERED AT THE PRE-HEARING MEETING

The Board established an agenda to be considered at the pre-hearing meeting as follows:

1) issues to be examined at the hearing,
2) identification of parties who may be directly and adversely affected by the project, if approved:
   interveners with common interests pooling their resources in order to minimize duplication and provide for a more efficient review, and costs and the funding of interventions,
3) application and the hearing procedure
4) any other preliminary matters requiring clarification, which would enhance the fairness and efficiency of the main hearing.

3 ISSUES TO BE CONSIDERED AT THE HEARING

A number of issues arising from the application had been identified by the parties and included in the Board agenda prepared for the pre-hearing meeting. Participants confirmed the relevance of many of the issues.

The Board notes that TransAlta will be applying for license amendments related to the Highvale Mine and the new mine areas to the south of Highway 627 that will meet the fuel requirements of the proposed new Keephills units. The Board is of the view that issues that arise as a result of current and future mining operations will be more properly addressed at the time of the mining application.

With respect to the power plant facility application, the Board believes that the following matters are relevant for consideration at the upcoming hearing:

- Local and landowner issues (fogging, noise, increase in local traffic, and public consultation)
- Human health
- Environmental issues (atmospheric emissions, greenhouse gases, particulate matter, heavy metals, ground-level ozone, and their cumulative and long range effects)
- Water issues (water use from and water blowdown to the North Saskatchewan River, impact of plant emissions on Lake Wabamun and other waterbodies)
- Technology issues
- Impact on Alberta Integrated Electric System (AIES) in a general way
- Socio-economic issues
- Any other relevant issues raised by parties

With respect to the impact of the proposed plant on the AIES, the Board believes that, if the application to construct and operate the proposed power plant is approved, a detailed and thorough review of this matter should take place at the time that TransAlta makes application under Section 17 of the Hydro and Electric Energy Act (the HEE Act) to connect the power plant to the AIES.

At the present time, the Board believes that the nature of potential impacts on the AIES should be reviewed in a general manner so as to identify technical, operational, or regulatory issues that may be pertinent to the development of electric generation and transmission facilities in Alberta, arising out of the application. The Board notes that granting an approval under Section 9 of the HEE Act does not automatically result in an approval under Section 17 of the HEE Act.

The Board notes that a number of parties, including the Applicant, expressed a serious concern regarding the issue of transmission congestion management on the AIES and its relationship to the present application. These parties argued that consideration of the present power plant application, in the absence of either a prior or concurrent section 17 HEE Act application or a determination of the basic principles governing transmission congestion management, would significantly impair the Board's ability to ensure that the development of generation and transmission facilities take place in an economic, orderly and efficient manner. Other participants

submitted that the magnitude and complexity of the transmission congestion management issue demanded a dedicated, stand alone proceeding to accommodate a wide variety of interests and parties, most of whom were not in attendance at the pre-hearing meeting nor intending to participate in the current application before the Board.

The Transmission Administrator, ESBI, advised the Board that a congestion management working group has been actively engaged in discussions regarding the appropriate framework or principles under which congestion management may be implemented. ESBI indicated that it planned to file a submission setting forth its position with the Board on or about October 31, 2001.

The Board recognizes that the matter of transmission congestion management is an important and complex issue affecting a large number of industry stakeholders. While the potential addition of new power plants in the Wabamun Lake area and/or the transmission of power from the Fort McMurray area to southern Alberta may trigger a congestion management response from ESBI as a fundamental part of its transmission responsibilities for the AIES, the issue has implications and consequences that warrant a separate proceeding with all interested stakeholders having a reasonable opportunity to participate. It is the Board's view that the present work of ESBI and stakeholders is desirable and will provide valuable assistance to the ultimate consideration of the congestion management issue.

The Board is cognizant of its responsibility under the HEE Act to ensure that the development and operation of electric generation and transmission is carried out in an economic, orderly and efficient manner. The Board does not accept the contention that facility applications that may trigger transmission congestion concerns must only be considered after a determination has been made regarding the allocation of transmission related costs among industry participants in order to meet the purposes of the HEE Act. The determination of the public interest in this matter will be influenced by a variety of circumstances before the Board including at the present time a deregulated generation sector. The fact that a congestion management scheme or other transmission costs may result from the Board's finding that new generation is in the public interest does not, in the Board's opinion, contravene the principles of the HEE Act.

Accordingly, the Board is not disposed to consider the congestion management issue in any substantive way as part of the present facility application. The Board also considers that issues regarding electromagnetic interference of new and existing transmission lines should be addressed at the time of the application for connection of the proposed plant and/or application for new transmission facilities.

The Board recognizes that there may be other pertinent issues that arise out of the ones described above and is prepared to include them in its consideration of the application if raised by the parties.

4 INTERVENER AND PARTICIPANT STATUS

Under Section 31 of the ERC Act the Board has the authority to direct TransAlta to pay the participation costs of those persons who qualify as local interveners. Persons will meet the test set forth in section 31(1) of the ERC Act, if they demonstrate that they own land or possess an

interest in land which may be directly and adversely affected by an approval of an energy project. TransAlta stated that it did not object to the following parties being considered as local interveners. The Board confirms that the following participants qualify as local interveners:

1) K. and G. Gray
2) the Village of Kapasiwin and G. Jones
3) the Clean Energy Coalition
4) the Mewassin Community Action Group
5) the Lake Wabamun Enhancement & Protection Association
6) Committee on Keephills Environment (COKE)
7) W. Mustard
8) L. F. Duncan
9) B. Henderson and A. McClelland
10) D. Cymbaluk, T. Cymbaluk, and R. Breymann
11) B. Mitchell
12) Porter Ranches Ltd.
13) Paul First Nation

The Board confirms that these interveners, whether individuals or groups, are located or have individuals from their group who live sufficiently close to the proposed plant so as to meet the test in section 31(1) of the ERC Act. Issues such as the effect of emissions from the plant on human health and the environment, potential noise impacts, and water issues all potentially affect their lands or use of their lands. The Board notes that several of the parties in the above list have similar issues and urges these parties to work together to make the hearing more efficient. This will ensure that the Board is able to allow all parties seeking cost recovery to do so with a minimum of risk.

A finding of local intervener status does not inevitably result in all costs submitted by local interveners being approved by the Board. Costs must be shown to be reasonable and necessary to the intervention and meet the requirements of Part 5 of the Board's Rules of Practice. Any duplication of effort on common issues by two or more interveners will not likely result in two sets of costs being approved in the absence of special circumstances. Parties are encouraged to review Part 5 of the Board's Rules of Practice and Guidelines for Energy Cost Claims Guide 31A.

5 ADJOURNMENT AND CHANGE OF VENUE APPLICATION

A number of the participants were very concerned that with the heavy regulatory agenda, and the short period between the Genesee hearing and the proposed start date of October 22, 2001 for the Keephills hearing, they were unable to prepare and file their written submission without providing some additional time. Therefore, they asked the Board to adjourn the hearing start date. The Board considers the adjournment request to be reasonable and that an additional amount of time be provided to the interveners. The Board believes that a short adjournment will ultimately provide for a more productive hearing. Accordingly, the hearing will commence at 9:00 am, on October 30, 2001. The new deadline for intervener's submissions is October 22,

2001. A revised Notice of Hearing will be issued which will include the revised filing schedule, location, and time of the hearing.

DATED at Calgary, Alberta, on September 28, 2001.

ALBERTA ENERGY AND UTILITIES BOARD

(Original signed by)

N. McCrank, Q.C.
Presiding Board Member

(Original signed by)

R. G. Lock, P. Eng.
Board Member

(Original signed by)

G. Miller
Board Member

APPENDIX A - THOSE WHO APPEAREDAT THE PRE-HEARING MEETING AND ABBREVIATIONS USED IN THE MEMORANDUM OF DECISION

Principals and Representatives (Abbreviations Used in Report)	Witnesses
Alberta Energy and Utilities Board Staff	D. Larder, Board Counsel P. Wickel, P.Eng. P. Hunt C. Brown, P.Biol. L. Roberts, P.Biol. R. Schroeder D. Morris
B. Mitchell	B. Mitchell
Committee on Keephills Environment	D. P. Mallon
D. Cymbaluk, T. Cymbaluk and R. Breymann	D. Cymbaluk
ENMAX Power Corporation, ENMAX Energy Corporation and Calpine Canada Power Holdings Limited	L. A. Cusano
Enron Canada Corporation	R. N. Hemstock H. R. Huber
EPCOR Power Development Corporation and EPCOR Generation Inc.	M. K. Ignasiak
ESBI Alberta Ltd.	P. J. LaFlair J. Bradford
Fording Coal Limited	D. Gaspe
Government of Alberta (Alberta Environment)	H. L. Veale
Government of Canada (Environment Canada, Department of Fisheries and Oceans)	M. Vincent
K. & G. Gray Village of Kapasiwin G. Jones Clean Energy Coalition Mewassin Community Action Council Lake Wabamun Enhancement Protection Association	K. Buss
Paul First Nation	R. C. Secord
Porter Ranches	B. Berrien
Regional Health Authority	A. Mak
The Honourable Judge W. M. Mustard B. Henderson and A. McClelland	L. F. Duncan
TransAlta Energy Corporation (TransAlta)	D. G. Davies L. B. Ho
TransCanada Energy Limited	R. B. Wallace