Ecological Effects Monitoring
Final Report and Workshop Proceedings

Prepared by the
Ecological Effects Monitoring
Workshop Organizing Committee
for the
Clean Air Strategic Alliance
Board of Directors

September 2005

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By consensus, the CASA board of directors approved this report and the recommendations within at the September 22, 2005 meeting.

Download this report from the CASA Web site library at ***http://casahome.org***.

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The committee was responsible for arranging the workshop, and is very grateful to all the speakers who shared their experience and expertise, and to the participants for contributing their perspectives.

About CASA

The Clean Air Strategic Alliance (CASA) is a non-profit association composed of stakeholders from three sectors – government, industry and non-government organizations such as health and environmental groups. All CASA groups and teams, including the board of directors, make decisions and recommendations by consensus. These recommendations are likely to be more innovative and longer lasting than those reached through traditional negotiation processes. CASA's vision is that the air will be odourless, tasteless, look clear and have no measurable short- or long-term adverse effects on people, animals or the environment.

Clean Air Strategic Alliance
10035 108 ST NW FLR 10
EDMONTON AB T5J 3E1

Ph (780) 427-9793
Fax (780) 422-3127
E-mail: casa@casahome.org
Web: http://www.casahome.org

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1 Ecological Effects Monitoring and CASA

Ecological effects monitoring has been of interest to CASA stakeholders and the CASA board for some time. CASA began looking at the question of whether ecosystems in Alberta are being adversely affected by air pollutants in 1995. In December 1997, the Ecological Effects Monitoring Project Team recommended that this broad scope be narrowed to two, more specific, questions:

1. Are forested ecosystems in Alberta being adversely affected by acid deposition?
2. Are agricultural systems in Alberta being adversely affected by ground-level ozone?

Due to the lack of scientific and technical ability to detect and quantify ozone effects on crops, the team did not prepare a proposal for ozone effects monitoring in an agricultural area, focusing instead on the forest acid deposition question.

In March 1999, the Ecological Effects Monitoring Implementation Design Team reported to the CASA board that there was insufficient stakeholder support for an acid deposition effects monitoring program. The team was instructed by the board to prepare a report on the feasibility of forming potential alliances between CASA and the Alberta Forest Biodiversity Monitoring Program and/or the National Forest Health Network. The team completed its feasibility study and reported back to the CASA board in June 1999. A key consideration was whether the board was willing to dedicate significant financial resources to an ecological effects monitoring program; the board decided against this approach.

The board did agree to accept the team's report and its recommendation that "Regular interaction among organizations who are currently conducting ecological or biological monitoring programs should occur." The board also agreed to form a new committee to pursue collaborative partnerships and to conduct a workshop with representatives from the Alberta Forest Biodiversity Monitoring Program to explore establishing a forest acid deposition effects monitoring program. Unfortunately, there was insufficient interest to pursue the workshop at that time.

In 2003, the board revisited the question of ecological effects monitoring in the context of one of CASA's performance measures. It asked a small group of stakeholders to consider the most appropriate mechanism to inform the CASA board about ecological effects monitoring. This group recommended, and the board agreed, that a CASA workshop was the best mechanism to increase board members' knowledge of and commitment to ecological effects monitoring so that they would be in a better position to support a possible future program.

2 The 2005 Ecological Effects Monitoring Workshop

The Ecological Effects Monitoring Workshop Organizing Committee was established when the CASA board approved its terms of reference in November 2004. The primary task of the Committee was to organize and hold an ecological effects monitoring workshop. The workshop proceedings are appended to this report.

The board agreed that the workshop purpose would be to:

a) Understand the science of ecological effects monitoring;

b) Determine what is required for an effective ecological effects monitoring program for Alberta;

c) Identify alternatives to improve capability to measure air quality effects on ecosystems in Alberta; and

d) Determine the values at risk of not acting based on a triple bottom line evaluation.

Coincidentally, the 37th Air Pollution Workshop and International Symposium was held in April 2005 in Banff on the science of ecological effects monitoring. This conference provided excellent international context and background on the topic, and CASA board members and other stakeholders were encouraged to attend. The CASA workshop, which is the subject of these proceedings, was organized to provide more in-depth information to participants on what is being done in Alberta to monitor ecological effects. The organizing committee sought the advice of workshop participants on mechanisms to:

- Enable CASA to determine a path forward for ecological effects monitoring
- Identify a role for CASA in developing:
    - A framework for ecological effects monitoring
    - A database of ecological monitoring activity
    - A coordinating role among other ecological monitoring programs
- Identify a role for citizens in ecological monitoring.

The CASA workshop was held on June 15, 2005 in Edmonton, with over 30 participants and nine presenters who shared their knowledge and expertise about ecological effects monitoring in Alberta. A list of participants is provided in Appendix A and the workshop purpose and objectives are included in the Terms of Reference in Appendix B. The purpose of the workshop was not to seek consensus but to provide input to the organizing committee so it can report back to the CASA board. Workshop participants received abstracts of all presentations.

Several key messages emerged from the workshop presentations and discussions:

- It is not always possible to directly attach costs to environmental effects because they are difficult to assess based on present knowledge. However, knowledge gained from ecological monitoring forms a basis for pollution prevention or mitigation efforts.

- Long-term monitoring studies require:
    - Specific questions to be answered
    - Knowledgeable and experienced researchers
    - Corporate memory to maintain continuity as staff change
    - An intensive and extensive plot network
    - A commitment to ongoing adequate funding
    - Mechanisms to protect sites from loss or damage due to human interference
    - Close proximity to air monitoring stations if air pollution effects are being studied

The Workshop Organizing Committee has experienced some frustration and disappointment that it finds itself in a situation akin to the team that made similar recommendations to the CASA board six years ago. Nevertheless, the committee is optimistic that the phased approach it is recommending based on workshop discussion and input from the presenters and participants, will be accepted by the CASA board.

3 Recommendations to the CASA Board

Recommendation 1

The Ecological Effects Workshop Organizing Committee is aware that some ecological effects monitoring is already occurring in Alberta. Workshop participants discussed the idea of an overall framework for ecological effects monitoring in the province, but the committee recognized it would be difficult to develop such a framework until there is more complete information on which to base it. As a first step towards identifying gaps and determining the best way to address them, and to facilitate sharing of information, the committee believes that one main database would be very useful to researchers, regulators, industry, and any Albertan with an interest in biomonitoring. The team thinks that such a database could be developed in six to eight months for less than $20,000.

The Ecological Effects Workshop Organizing Committee recommends that:

Alberta Environment take the lead in compiling a database of biomonitoring projects completed or now underway in Alberta, with the goal of completing the database by the end of 2006 and reporting back to the CASA board at the Fall 2006 board meeting This database would:

- List all current and historical biomonitoring activity,
- Identify who is doing, or did, the biomonitoring,
- Indicate what data is being, or was, collected, and
- Indicate the time frame for each biomonitoring initiative.

As part of the project to compile the database, Alberta Environment will make recommendations on standardizing data collection approaches and methods.

Recommendation 2

The committee recognizes that there is a gap in linking air quality to effects on biological receptors. Once the database has been compiled, additional work will be needed to determine a path forward for ecological effects monitoring in Alberta. The committee identified two potential options, and there may be others:

1. Incrementally add information and data to ongoing programs for analysis (in essence, “piggybacking” on existing programs and projects)
2. Develop a stand-alone biomonitoring program.

Both approaches have advantages and disadvantages, and the committee was of the view that it would be premature to recommend an approach until the database has been compiled.

The Ecological Effects Workshop Organizing Committee recommends that

When the database is completed, the CASA board consider creating another team to:

a) Assess options and recommend the most appropriate direction for moving ecological effects monitoring forward in Alberta, and

b) Recommend how the database should be maintained and managed to ensure it remains current and accurate.

Recommendation 3

The Workshop Organizing Committee has fulfilled its terms of reference and has proposed next steps. Therefore,

The Ecological Effects Workshop Organizing Committee recommends that the committee be disbanded.

4 The Ecological Effects Monitoring Workshop – Presentations

4.1 Monitoring Air Quality Induced Ecological Effects Speaker: Sagar Krupa

Dr. Sagar Krupa of the University of Minnesota provided an overview of the ecological effects of air pollution on terrestrial vegetation. He described the different types of plant indicators and parameters that can be used in a biomonitoring program and the criteria that should be considered in selecting plant indicators. Biomonitoring is a complex area of science that must take a wide range of factors and responses into account. Many ecological receptors are more sensitive to air quality changes than animals and humans, and ecological monitoring provides an early warning of ecosystem health and degradation. It is not always possible to directly attach costs to environmental effects because they are difficult to assess based on present knowledge. Some of the key issues to be considered are impacts on sensitive species, changes in species diversity and, consequently, ecosystem structure and function. Knowledge gained from ecological monitoring forms a basis for pollution prevention or mitigation.

Discussion[1]

NGO: How well are we doing in Alberta in implementing this kind of system? I believe we are starting to see some cumulative effects in the monitoring that's being done, and my concern is that we are too late to get a baseline.

Sagar Krupa (SK): I have been involved with Alberta issues since about 1978. There is a lot of scientifically interesting piecemeal work but no effort to synthesize design. I see an opportunity to design a generic process using the air quality issues we have to deal with here so that the process could be used in many areas. The environment doesn't have a baseline. The ideal approach is to create enough exposure response sites so we can empirically conclude what would be the baseline if the air were clean or cleaner.

NGO: How do we develop good research questions for regional scale assessments?

SK: This requires more time than we have here. There are two ways of looking at air quality. With the Lagrangian approach, we follow a plume in space and time. With the Eulerian approach, we wait for the plume to arrive. On a regional scale we are dealing with primary and secondary pollutants, so we must design a biomonitoring program that accounts for both. We look at it as a time series, since plants respond at different points in their life cycle. Different compounds require different approaches as well.

Presenter: Could you comment on the issue of education and expertise and experience and their importance in designing experiments and knowing what to do with respect to environmental assessments?

SK: It's always good to have people who know what they are doing, but we need experience as well as knowledge. Researchers need to remember that symptoms are not the cause, and we have to be very careful in establishing cause and effect relationships. Education is very

[1] Questioners are identified by broad sector (NGO, industry, government, presenter, or consultant); all questions are in italics.

important, and we need to ensure that biomonitoring results are scrutinized by knowledgeable people and there is continuity in committees overseeing the work.

NGO: You referred to the need to establish a priori *criteria. What forum has been established to determine these?*

SK: This is done from empirical values assessment, considering if a species is rare, wanted, and so on. Policy makers need to consult knowledgeable ecologists in designing the goals.

Consultant: Government agencies seem to be reluctant to commit to ecological effects monitoring because of all the uncertainties in the real world and all the factors that can affect outcomes. So we fall back on the idea of dose-response, we measure air quality, and as long as we are below the guidelines, we say things are fine. Can you comment on this?

SK: There is no such thing as a threshold. Administrators like them because they are easier to implement. Using SO_2 as an example, we saw impacts at concentrations not related to guidelines. There is no single threshold, nor is there a single cause and effect. There are other effects in the real world, which make plants more vulnerable to sulphur stress. We can't say things are fine because we are below a threshold; we have to deal with it if there is a problem, irrespective of the guidelines. Regulations are important but they are not the whole thing and they don't make the problem go away. Critical loads are fine but they need to be flexible enough to change as things evolve.

4.2 Summary of APW 37 and Ecological Programs in Alberta Speaker: Laura Blair

Laura Blair from Alberta Environment summarized the program and discussions from the 37th Air Pollution Workshop and Symposium in Banff. Elsevier will publish the papers from this symposium in about a year.

Discussion

NGO: What were some of the key conclusions about the use of modeling and were there any comments about the adequacy of this approach?

Laura Blair (LB): None of the presentations focused on Alberta modeling. Modeling is used to get information, not to monitor. Presenters did say that modeling has to be supported by looking at bioaccumulation or other effects. Some papers looked at modeling to compare crop stressors, but the conference didn't look at the cause and effect aspects of modeling.

NGO: I understand that Dr. Krupa is saying that valid ecological monitoring must occur over time and space, whereas the usual view is to not do this.

Sagar Krupa: Observations must be done over time and space. Models can be exploratory and predictive, and are exploratory until proven. We need to be careful about relying completely on models, and should use intelligence to determine if the results are feasible or not. There are limitations on using passive samplers in a biological context, for example, and the data they yield need careful consideration in a biological context.

Presenter comment: The symposium said that all models are wrong, but some are useful. The problem is that people have always believed the output and this is a mistake. The results must be verified.

Participants who attended the APW 37 Air Pollution Workshop and Symposium provided their perspectives, insights and comments on the event:

- Models are useful to learn about the dynamics of the atmosphere but we should be conservative in interpreting the results.
- What about the validity of the input? How much money goes into modeling rather than putting people in the field to gather real data?
- We were told at the Banff symposium that all trees sensitive to acid rain are no longer in the gene pool.
- Some reports looked at ecological damage and used passive monitors to map damage. This may be something we could do on a province-wide scale as it gives a first and early look at what's happening. If actual vegetation damage is observed, we need to go back and investigate in more detail.
- A large-scale British surveillance program called the Air Pollution Information System (APIS) might warrant a closer look.[2]
- Researchers need to understand the relationship between organisms and the conditions they grow in, in order to detect changes and impacts.
- Key things that came out of the conference for me were the two big lies of toxicology: a) There is a threshold, and there isn't, and b) There is no such thing as "no observable effect" level. Air pollution is always doing something. We need to ask how we want an ecosystem to behave because we are not going to not affect it.

4.3 Whitecourt Study Speaker: Allan Legge

Dr. Allan Legge of BioSphere Solutions presented a case study on long-term ecological monitoring in the Whitecourt area. The Whitecourt study started in the early 1970s in response to rapid development of the sour gas industry and concerns about SO_2 emissions. Eight operating companies in the area did a number of studies and concluded that there was not much effect on a regional scale but there were some localized effects. They looked in more detail at one plant, the West Whitecourt plant, which has the longest operating history in the area. The big question in these studies is how to select sampling locations so the receptor can be measured. To establish a cause-effect relationship, we must establish the biological end point.

Sampling locations were chosen to ensure that ecological and environmental variables are as similar as possible between sampling locations (referred to as "ecologically analogous" sampling locations). The study looked at the lodgepole-jack pine forest ecosystem. Dr. Legge reviewed the air monitoring results of the Whitecourt pilot study and the results of the receptor study, which showed changes with distance from the plant. Not much seemed to change from about 1976-77 to 1989, and then there was a drop in emissions with better sulphur recovery. The best indicator in foliage was the ratio of inorganic to organic sulphur. Data seemed to suggest that the system was recovering, but then researchers found that sites

[2] See http://www.apis.ac.uk/ for more online information on APIS.

were in fact declining, in response to environmental stress (drought) as well as air pollution stresses and sulphur dust.

It is essential to know what you are measuring and why, and what questions it will answer. Continuity of funding is critical to ensure that data that are collected get analyzed. And you have to be able to relate air quality to receptor response at the location where you are measuring the receptor. Another issue of concern is that we are not doing a good job of succession planning, since young scientists are not moving into these areas.

Discussion

NGO: Why aren't students coming forward to work in this area?

Allan Legge: Funding for environmental research has fallen off significantly from both the province (Alberta Environment) and the federal government. Canada is seriously delinquent in addressing environmental issues and the US is no better. We don't have systems and people in place to do the work. The Whitecourt project has been used and adapted and recognized around the world, but it is not recognized here. This work is not simple or easy; it needs commitment and time. And it's not something you do via environmental impact assessments. Most EIAs are useless; areas where there is uncertainty just keep getting repeated without any resolution. We need basic applied research over the long term.

4.4 Wood Buffalo Environment Association Study Speaker: Veronica Chisholm

Veronica Chisholm, program manager of the Terrestrial Environmental Effects Monitoring (TEEM) committee, reviewed the biomonitoring work being done in the Wood Buffalo area of northeastern Alberta. The TEEM mandate is to develop and operate a long-term monitoring program to detect, characterize and quantify the effects of air emissions on terrestrial ecosystems including traditional resources. Acidification is a key issue. Programs need to be adaptable to deal with a variety of issues including First Nations issues regarding changes in the traditional resource base. A number of studies were done as input to the design of a longer-term monitoring program. The program includes passive monitoring, two lichen pilot studies, mapping of vegetation health using false color infrared photographs, and nitrogen monitoring. For 2005, TEEM is expanding its program with an increased focus on nitrogen.

Discussion

Sector unknown: What is total cost of the program?

Veronica Chisholm (VC): In the acidification year, with lichen monitoring and additional passives, the program cost about $450,000.

Presenter: What is the greatest comfort in being in your position and what is your biggest frustration?

VC: I personally am not all that frustrated but committee members get frustrated. They are trying to achieve goals for stakeholders, but everyone wants everything now. We have to do some things first before we can implement a long-term monitoring program so we don't waste time and resources. We want to design a sustainable program.

NGO: How healthy are the lichens?

VC: The 2002 study found elevated metals within 25 km, and diversity and richness are lower at this range. Outside this distance, the results are more variable, which we think is related to prevailing winds.

NGO: How does TEEM envision getting its information into the decision-making process? Does the government review the data and take it into account?

VC: Issues would go back to the general members, and we encourage our members to publish their research results, but nothing has yet been documented to trigger a decision. Alberta Environment is a member of the Wood Buffalo Environmental Association and TEEM, so none of this work is being done in a vacuum.

NGO: Has TEEM thought about a strategy for when you might have information about indicators? Would this information be given to the EUB, Environment Canada and/or Alberta Environment? Is there a strategy to ensure information flows into processes or to people who might want to intervene, for example?

VC: Alberta Environment and the EUB are at the table. It is up to them to trigger a reaction from their stakeholder group.

Presenter comment: Some efforts are being made to come up with indicators within the environmental management system and to agree on what triggers action. But we have not reached the point of agreeing on a trigger.

4.5 The Ram River/Strachan Study Speaker: Ken Mallett

Dr. Ken Mallett with the Northern Forestry Centre of the Canadian Forest Service (CFS) reviewed the research and monitoring work done by the CFS, with a focus on the Ram River-Strachan area near Rocky Mountain House.[3] Two major studies have been done in this area and Dr. Mallett focused on the second one, undertaken between 1991 and 1994. Approximately 6000 trees were evaluated by forest ecologists, entomologists, pathologists and soil scientists. It was a one of a kind study that has been very useful to industry, government and ENGOs. Industry has contributed between $750,000 and $1-million in direct and in-kind support to these studies; CFS has contributed about $1-million in salaries, overhead, and operations and maintenance. The project demonstrated the value of long-term studies, but such studies present a number of challenges and can be risky due to events such as forest fires and industrial disturbances that affect the permanent sites. Long-term forest monitoring studies require: specific questions to be answered, appropriate expertise, an intensive and extensive plot network, and a commitment to ongoing adequate funding, which can be significant.

Discussion

Sector unknown: Did this study follow the ARNEWS (Acid Rain National Early Warning System) design?

Ken Mallett (KM): No. Researcher Paul Addison, who led the study, developed the approach before ARNEWS existed. We did try to apply some of it to ARNEWS.

[3] Information on these studies and other is available via the CFS website bookstore at http://bookstore.pfc.cfs.nrcan.gc.ca/default.htm.

Sector unknown: What was the average age of the trees in the study plots?

KM: Probably about 120 years for older lodgepole pine; for the younger stands, probably 12-35 years. Some stands also contained white spruce and aspen, and the aspen were likely about 120 years old.

NGO comment: Weyerhaeuser and Canfor Forest Management Agreement areas make up maybe 50% of the Peace airshed and they have about 2000 plots on this land base. Canfor says their biodiversity plots are co-located with other sample plots, so there is a good tree network for measuring growth and yield in this area of Alberta. Some plots have existed for more than 50 years.

KM: At one time, Alberta Sustainable Resource Development had permanent sample plots, but their interest might be totally different. They may measure trees, but won't indicate the cause of death for dead trees. The CFS study went far beyond the basics in their growth measurements in an effort to see differences. Young trees seem to be growing faster than older trees did when they were young and there was less pollution. The data can be used just for tree growth, but not for full diagnostic purposes.

4.6 Long-term Soil Acidification Monitoring Program Speaker: Gordon Dinwoodie

Gordon Dinwoodie of Alberta Environment reviewed the history of the long-term soil acidification monitoring program, its challenges and future direction. In the 1980s, concerns about emissions from oil and gas development led to a large scientific effort to assess sensitivity of Alberta's soil and water to acid emissions. The intent was to collect soil chemistry data to identify changes caused by acid emissions and to establish long-term soil monitoring plots to assess changes over several decades. Each of the eight sites was sampled every four years; the program was disrupted in the late 1990s for budget reasons but was re-established in 2000. Challenges include: a) the cost to develop and maintain even a "bare bones" monitoring program in light of demands for funds for other uses, b) maintaining corporate memory of the program as staff change, c) conflicting land use pressures that can result in the loss of or damage to sites, and d) changing laboratory and analytical methods. The program now has about 20 years of data and there are some indications of changes in soil chemistry.[4] Funding permitting, the monitoring results will be used to refine model predictions for updating Alberta soil sensitivity ratings.

Discussion

NGO: Soil pH has dropped in all sensitive sites over the years. Since monitoring started, there has been a 75% reduction in emissions, yet soil pH continues to decline. We can assume it is taking a long time for recovery to occur. It is important to have long-term data on pH and emissions, so how do we deal with this "flavor of the month" approach to funding and ensure there is a long-term commitment?

Gordon Dinwoodie (GD): Funding tracks public priorities. As long as an issue stays on the front burner that helps. Some kind of endowment fund would be helpful, but could be

[4] Results to date have been compiled and are available online through Alberta Environment's information centre at http://www3.gov.ab.ca/env/info/infocentre/.

difficult to set up. Unfortunately, government research will always be facing this "flavor of the day" challenge.

NGO: Why was the Devon site chosen? Is it sensitive to emissions?

GD: Probably because it was a sandy site and there are not a lot of sandy soils in the area. I don't know if a plume dispersion model was ever done. It would be useful to look at plume dispersion and see if the site is the best place. Selection parameters include an indication that the site is sensitive and that there is as much assurance as possible that it will be there for the long term (44 years in this case). There are also issues with private land.

NGO comment: Perhaps some sites could be reassessed based on the information obtained.

NGO: What are data showing about the Bruderheim site?

GD: We are seeing some effects. I can't recall the details, but I think there has been some improvement.

NGO: I have concerns about plots being damaged or destroyed by industrial activities. Why can't they be marked very characteristically so it's clear where they are?

GD: The plots were designed not to be obvious. Because there was a lot of industrial and recreational activity, we didn't want people attracted to the sites and disturbing them. But then there is a greater risk that the site will be damaged or destroyed.

4.7 Alberta Biodiversity Monitoring Program Speaker: Kirk Andries

Kirk Andries, Managing Director of the Alberta Biodiversity Monitoring Program (ABMP), reviewed the history, scope and configuration of the program. The ABMP is a partnership of leaders representing a diverse group of public and private organizations. Its goal is to develop a provincial system to monitor changes in biodiversity through a three-phased approach. It emphasizes "species assemblages" that are chosen based on ease of sampling, statistical properties and importance to society. The project is in phase two, in which protocols for data collection and sampling are being field tested.[5] The intent is to provide high quality data to resource managers in a value neutral, non-judgmental format. ABMP data collected between 2005 and 2010 will be used to develop a biodiversity integrity index that will allow comparisons between regions and changes to be tracked over time. Three core products and services will be raw data, an interactive web-based information service, and a series of core reports.

Discussion

Presenter: You noted there would be a staff of six people to sample 375 points per year and recognize all these taxa. That seems very ambitious.

Kirk Andries (KA): We will have a core staff of six and for the field work we will have 65 teams of two persons with supervisors. These would be contract positions. During the pilot phase we are doing 32 sites per year.

[5] Annual prototype progress reports are available on the ABMP website at www.abmp.arc.ab.ca

Presenter: How do you deal with continuity if you don't have permanent staff? Fifteen to twenty years ago there was a program in Europe to assess visual aspects of forest health, specifically the impacts of acid rain on trees. Various countries trained people differently, which made it very hard to standardize the approach. This is interesting, but I have some concerns about the process.

KA: We have aggressive and long training programs that all field staff go through, we have supervisors in the field to check the work, and we do periodic validations. We have 30 scientists who have been advising the program and would be happy to discuss the approach and other options.

NGO: What is the opportunity to use this program to meet CASA's needs regarding air quality and ecosystem monitoring?

KA: I think there is a lot of potential and we would certainly be willing to explore this.

NGO: What is the status of the WISSA (Western Interprovincial Scientific Studies Association) program to look at agricultural biomonitoring?

Martha Kostuch: They are still analyzing data and are at least three months behind. Results should not be expected until the end of this year or early next year.

Consultant: What is the budget for the ABMP?

KA: We are costing it now and estimate it will be about $8.5-million per year. The board finds this number acceptable, as do industry partners. The notion of cost sharing would see the federal and provincial governments and two primary industries assume some costs. To create this kind of program for forestry only, on the basis of Forest Management Agreement areas, would be $9-11 million.

4.8 Wabamun and Genesee Area Biomonitoring Program Speakers: Jim Bolton and Robert Raimondo

Jim Bolton with TransAlta Utilities and Robert Raimondo with EPCOR provided an overview of the biomonitoring program in the Wabamun-Genesee area west of Edmonton where these two companies have electricity generation plants. The operating approvals for both companies include requirements to conduct special environmental monitoring activities. Ambient air quality has been monitored for some time in the area, and biomonitoring programs focused on aquatic and terrestrial receptors have recently been put in place. Developing an integrated biomonitoring program presented a number of challenges. The program focuses on key receptors that would indicate ecological health and/or have the potential to accumulate chemicals of possible concern and acid deposition components. It was concluded that a one-window approach that brings all stakeholders together to do the plan is a good one, as stakeholder collaboration improved efficiency and quality of the program. There is also a need for provincial standardization with respect to receptor-based monitoring, and it is important to establish a cost-sharing formula early in the process.

Discussion

NGO: Some community members felt they were excluded from the process. Concerns included: a) the view that traditional knowledge was omitted, b) the program does only tissue

sampling and not populations, and c) the program is not looking at insect populations in their role as pollinators and bird food.

Robert Raimondo (RR): We are doing tissue and population sampling on voles, which is more sampling than was done earlier. With respect to community and stakeholder involvement, we did try to make those opportunities available through open houses and other approaches, and I don't think it's correct to say there was no public consultation. It was a challenge to get the right people at the table.

Jim Bolton (JB): This outreach was follow-up to the stakeholder concerns noted in the EIA. The EUB and Alberta Environment said the companies needed to do these programs to address concerns raised in the public meetings and this direction was reflected in the approvals.

NGO comment: Compared with the work being done in the Wood Buffalo area where all the stakeholders are at the table, this is inadequate. This program did not arise from the EIA; it was clear direction from the EUB and Alberta Environment.

4.9 Ecological Monitoring and Assessment Network Speaker: Brian Craig

Brian Craig with Environment Canada reviewed the history and focus of the Ecological Monitoring and Assessment Network (EMAN). EMAN's role is to augment Canada's capacity to collect, access, integrate, manage, interpret, apply and communicate sound data and information on ecosystem status and trends. EMAN is developing a set of standardized measurements that can be carried out by interested networks, research organizations and communities to establish whether and how local ecosystems are changing, while at the same time contributing to timely status and trends reporting. EMAN works in partnership with many other agencies that undertake long-term monitoring programs across the country. More detailed information is available online at www.eman-rese.ca.

Discussion

NGO: What about the sociological impacts?

Brian Craig (BC): We can't do everything at once. We do need to engage social scientists to look at the social and cultural aspects and how they change over time. Economics is also important, but would take a monitoring program in itself.

NGO: What air quality information can you access to look at cause-effect-solution relationships?

BC: We just started working with the Ontario Ministry of Environment, which is making data freely available. Industry in Ontario must also monitor air quality and this data is also being provided.

Presenter: Where are air monitoring stations located?

BC: Most are in urban areas, but there are some industry sites.

5 Workshop Group Discussion

Participants were asked to consider:

1. How does the information presented at this workshop and at APW 37 help us move forward on ecological monitoring?
2. What is CASA's role in developing a:
    - Framework for ecological effects monitoring?
    - Database of ecological monitoring activity?
    - Coordinating role among other ecological monitoring programs?
3. How can citizens play a role in ecological monitoring?

Workshop participants offered the following comments:

Sector	Comment
NGO	We have to get back to what CASA's vision is. One of CASA's key focus areas is ecosystems. What do we want to do with an ecosystem monitoring program? Is it to answer if we are meeting our vision? Is air quality affecting ecosystem health? A monitoring system needs to identify changes in the ecosystem (and we'd need to determine what these are) that could trigger more detailed investigation and research. And it should have some ability to correlate with air quality. Perhaps we do the following: 1) look for ecosystem changes that may have something to do with air quality, 2) go back and see if the changes and the air quality can be correlated, and 3) see if there is a cause and effect relationship. There are also many opportunities for CASA to look for existing partnerships or to develop them with others to meet our needs.
NGO	This work has to tie in with expectations for Environmental Impact Assessments (EIAs). We also need to get traditional knowledge, land use and other elements into a "report card" and standardized grading system. The way EIAs are done should be tied into the report card to add value and information.
NGO	The third question about citizen engagement is important. Engaging affected communities is the only way to get funding from industry and government. Our role is not to come up with a definition of ecological monitoring. The board needs to figure out the next steps and how to move this forward. We need a framework across Alberta with community engagement and other components. The question should not be what is CASA's role – some of the proposed roles are not realistic. This just continues to fragment the work as all organizations have their own agendas. We should look at what roles we can play to move the whole issue ahead and how we can interface with other groups.

Sector	Comment
Gov't	The organizing committee saw CASA playing a role in bringing people together. Although CASA's mandate is air, the committee envisioned something bigger and more integrated. A database could be developed of all the ecological monitoring in Alberta as a good starting point. A coordination role is another option.
Gov't	One of CASA's strengths is a proven track record. CASA should play a leadership role and not wait for government or others. If the broader long-term goal is to work with other mediums (air and water?), then do it.
Consultant	We have to have a specific question. The overall long-term goal is to understand how air quality affects us, but we need to be more specific in the questions we ask – on a regional, local and provincial basis. It would be good for CASA to develop an ecological effects monitoring framework within which we could do many things such as setting overall monitoring priorities. If we had a provincial framework that all stakeholders could support, it would help secure long-term funding to address the priority questions. It is also important to link ecological monitoring into the regulatory system. The regulatory system ultimately is what costs money for pollution control and ambient monitoring. The more closely we can link these so monitoring information feeds to the regulatory system and helps us spend more effectively, the better off we are.
NGO	The big question is "Is the ecosystem being changed?" To find this out, we need to answer specific questions. I would not be keen to see CASA start over with a framework since some good ones already exist and we should consider how they might be modified to meet our needs. We should be able to partner with some of these, such as EMAN and the ABMP. Then what are the smaller questions? What do we want measured? CASA does have a mentoring role for others such as the water strategy and emerging land issues. The question is how to integrate them. I'm not sure we should lead because that is government's role. Rather, why not consider how we can partner with others.
NGO	This group is not the right one to address many of these issues. We need to figure out a role for CASA in relation to local communities. Maybe we should start to map out what needs to be done over the next five years or so.
NGO	Trees and other vegetation are the single largest geographic receptor of air quality in Alberta. Approximately 15 organizations (companies and government) now gather growth and yield measurements on a continuous basis, and some have been doing this for as long as 50 years. This is not compiled in any way as far as I understand. I believe the province should do this, as is done elsewhere. We should recommend that such a compilation be done and that it be in the public domain.
NGO	Some residents in southern Alberta do not feel that enough has been done there to look at the impacts of air quality. *Response from a presenter*: A lot of work has been done on human health and other aspects, but it is not exhaustive nor has it been put together in perspective and made easily accessible.

Sector	Comment
NGO	Some analysis was done recently on airshed zones and is available. But ecological monitoring is still a gap. Who should be responsible for ensuring there are no major gaps in monitoring in Alberta?
Presenter	We have plenty of air quality data, which could be used to do first order analysis of what the problems are and what we need to do.
NGO	I don't associate developing a framework on ecological effects monitoring with starting from scratch and taking on a lot of activities. Much good work is happening already and we should use this when considering how to develop an Alberta framework. We should develop a framework before we can get to specific questions.
NGO	A framework is not the issue in Alberta; the issue is a lack of commitment to implement it. As a group we need to recommend to the federal, provincial and municipal governments the measures needed to fulfill such a commitment and the obligations involved in undertaking ecological monitoring in a timely manner. Maybe CASA should work with other agencies. We also need to recommend legal protection for monitoring sites to ensure they are protected for the long term.
Industry	Some industries, specifically mining and forestry, must now do a range of monitoring of water bodies and watercourses and report to the federal government. They have a model and have done a lot of the basic work already. We should look to that process for guidance.
NGO	Alberta has a pretty good air management system. There is a lot of good biomonitoring work occurring in different regions on different scales and we just need to put it together with the air quality issue.
Industry	This should be a broad societal discussion. Any activity affects the airshed and the impact on people is the bottom line. What is the role of risk assessment?
NGO	There are value judgments to make. Do we increase one thing and let another go? What species are important? We will have an impact, so what is an acceptable impact to the people of Alberta? We can't look at all things all the time, so we need to set priorities.
NGO	Don't wait until 50 years after industry developments to start wondering if there are ecological effects. Commit to investing the dollars to address these issues in a timely fashion.
Industry	We don't have many links because different regions and airsheds have different approaches. This means that we may struggle to find the right indicators, etc.
NGO	With respect to the first question, today's information only marginally helped identify a path to ecological monitoring. There must be a business case for a company to do ecological monitoring, and that hasn't been made today. The only thing that explained why a company would do it was that it was in their approval.

Sector	Comment
Presenter	Ecological effects related to air quality have been observed in Alberta, so this is why such monitoring should be done.
NGO	This is why need a legal framework. A survey of CEOs revealed that the main reason they undertook environmental protection action was because of regulations. So why do we always feel we have to avoid legal requirements? We should be asking why is this monitoring being done, is it a legal requirement, and would it happen otherwise? This tells me we need to take another look at our overall regulatory framework, including guidelines, EIAs and other aspects. We shouldn't have to make the business case. Industry is operating as a privilege and we have the right to have a clean environment.
Industry	It's also about monitoring the right receptors.
Industry	We need something credible and long term. CASA went down this road before and started to flesh out programs in two areas: acidifying emissions and the effects of ozone, largely focusing on agricultural crops. This was narrowed down to one – acidifying emissions. When the team made recommendations to the CASA board, the recommendations were not accepted. The basic issues were funding and long-term commitment. Today we heard that you need to have focused questions, which we did, plus a long-term commitment and funds, which we didn't. What CASA can't do is guarantee funds for a project. The board said turned it down these recommendations because they only looked at one ecosystem component. I really can't see what has changed. *Response from CASA secretariat:* The CASA process has evolved. One thing the board has learned is that money is an issue and some funding issues have to be worked out as a framework is developed. This has happened. The board and stakeholders are both better at working cost issues in from the start so there is a better chance of implementation and funding. Ecological effects monitoring admittedly is a high cost item, but the CASA process has advanced.
NGO	What if we don't do this? Can we commit to delivering a program that will meet these objectives?
NGO	CASA's 2004 performance measure said that ecological effects monitoring is occurring in three out of the seven ecological zones in Alberta, which leaves a very large area where nothing is happening.
NGO	The committee needs to consider that we are talking about three different scales: basic research, investigative work, and ecosystem monitoring work. The last CASA group did an investigative study. These all have a role, but we need to decide what we want to put in place in Alberta. My vision is ecosystem surveillance monitoring. Then if we detect impacts, we design a more investigative study or a research program to get at the cause/effect or correlation. So do we build a province-wide surveillance monitoring program with the capacity for subsequent steps if needed, or do we design a specific program to look at something like nitrogen impacts? We do have surveillance air monitoring now, so where we see problems we could do more work.

Sector	Comment
Consultant	I have experience in BC where we went through a biomonitoring process without a CASA-style framework. Those efforts could offer guidance, and the presentation from Dr. Krupa seemed to lay out a roadmap for setting up a system. His presentation covered the steps that were followed in BC. The more complex you get the more specific it will be to a specific problem. I would suggest starting with a very simple document on what you are looking for and how you might start to develop a program to provide guidance.
NGO	These are good suggestions, but it has to be tied in with development processes – applications, approvals, expansions, etc., and legislation has to be there as a backstop.
NGO	What is the regulator's role? The regulator has a huge role in deciding what is adequate.
Presenter	Presently, a large amount of air quality data is collected, especially in urban areas. These data could be analyzed in line with available literature on how receptors respond in other jurisdictions to see if any of these impacts are seen here. This would be a good first cut to determine if there is an issue. There could be a simple risk assessment looking at the extent of the stress, then a gap analysis to determine where information is missing. One such area is likely to be in southern Alberta. CASA could do this now. The cost would be associated with the data, since a lot of it is not digitized.
NGO	In some parts of Alberta such as the south, concentrations may not be high enough to cause problems based on what is documented in the literature. Also biodiversity changes could be related to factors other than air quality.
NGO	How do we deal with situations where there have already been severe environmental impacts and species have been affected? *Response from a government representative:* Museum archives of species go back a very long time and could help.
Presenter	There is almost an implicit assumption that all vegetation will behave the same way at the same age regardless of its exposure to stress. When plants are stressed, those with a history of exposure are more responsive to much lower levels than those with similar genetic make-up not exposed under field conditions. Alberta is part of the Great Central Plain that was maintained by fire, so we've already altered this ecosystem. We need perspective on what are we are trying to save, and need to remember that the reference point may not be the same as it was four generations ago. Finally, plants see pollutants as mixtures not in isolation.

6 Workshop Summary

Ahmed Idriss summarized the comments:

1. Alberta has an air quality management system with a number of air monitoring activities already underway. These include:
    - Provincial monitoring
    - Airshed regional monitoring
    - Compliance monitoring
    - Review of Alberta's strategic air quality monitoring plan

2. Alberta also has the elements of an ecological effects monitoring system with pieces of information, but it lacks the linkages and connections to make the components fit together. We need a mechanism to bring these pieces into one system that regulators can use.

3. We don't want to reinvent the process. There are opportunities to partner with other agencies and organizations, such as Cumulative Environmental Management Association, Ecological Monitoring and Assessment Network, Alberta Biodiversity Monitoring Program, Wood Buffalo Environmental Association, and the Western Interprovincial Scientific Studies Association. Some companies are also doing ecological effects monitoring as part of their approvals and on a voluntary basis. CASA should share its expectations and needs for moving ahead.

4. Ecological effects monitoring is complex and costly, and requires a long-term funding commitment. Commitments are also needed to put in place appropriate law and policy for protection of long-term monitoring sites.

5. Any ecological effects monitoring framework should address standardization so there are similar and consistent approaches across the province.

Following review by the organizing committee, the proceedings will be distributed to all participants. The organizing committee will also prepare a report and recommendations to be presented to the CASA board, likely at the September 2005 meeting.

Appendix A: Workshop Participants

Name		Organization
Kirk	Andries	URSUS Public Affairs Group Inc.
Randy	Angle	Alberta Environment
Ann	Baran	Southern Alberta Environmental Group
Carol	Bettac	Agriculture and Agri-Foods Canada
Laura	Blair*	Alberta Environment
Bill	Bocock	Rose Ridge Citizens
Jim	Bolton	TransAlta Corporation
Bob	Cameron [b,*]	South Peace Environmental Association
Ross	Chapman	Parks Canada
Veronica	Chisholm	Wood Buffalo Environmental Association
Kerra	Chomlak	CASA
Sherri	Clark	CASA
Brian	Craig	Environment Canada
Marilyn	Craig	EUB
Matt	Dance	CASA
Gordon	Dinwoodie	Alberta Environment
Linda	Duncan [b]	Lake Wabamun Enhancement & Protection Association
Marianne	English	CASA
Kristina	Friesen	Environment Canada
Brian	Gilliland [b]	Weyerhaeuser Company Ltd.
Doug	Heath	Balancing Pool
Jason	Heisler	Suncor
Dave	Huggill	City of Calgary
Bill	Hume	Environment Canada
Ahmed	Idriss	CASA
Les	Johnston*	EPCOR Energy Services
Wayne	Kenefick [b]	Graymont Limited
Myles	Kitagawa [b]	Toxics Watch Society of Alberta
Martha	Kostuch [b]	Bert Riggall Environmental Foundation & PARC
Sagar	Krupa	University of Minnesota
Shane	Lamden	NOVA Chemicals
Allan	Legge	Biosphere Solutions
Norm	Lowe	Alberta Urban Municipalities Association (AUMA)
Kent	Mallett	Natural Resources Canada
David	McCoy*	Husky Oil

Name		Organization
Russell	Miyagawa	Toxics Watch Society of Alberta
Myra	Moore	Fort Air Partnership
Keith	Murray [b,*]	Alberta Forest Products Association
Ian	Peace [b]	Residents for Accountability in Power Industry Development
Bill	Peel	ATCO Power
Mike	Queenan*	Residents for Accountability in Power Industry Development
Robert	Raimondo	EPCOR
Peter	Reid	Jacques Whitford
Jagtar	Sandhu	Health Canada
Kent	Santo	Milner Power
Jason	Schulz*	EPCOR, Environment and Sustainable Development
Bob	Scotten	c/o Seacor Environmental Inc.
Karen	Smith	Lung Association
David	Spink	Pravid Environmental Inc.
Donna	Tingley	CASA
Kevin	Warren	Parkland Airshed Management Zone
Raymond	Wong	Alberta Environment
Brenda	Woo	Health Canada
Ruth	Yanor	Mewassin Community Action Council

[b] denotes a CASA board member

* denotes member of the Workshop Organizing Committee. James Brandt with the Canadian Forest Service and Kenneth Pearce with Wood Buffalo Environmental Association are also on the organizing committee but were unable to attend the workshop.

Appendix B: Terms of Reference

Approved by the CASA Board of Directors on November 24, 2004

Background:
CASA Board has agreed to hold an ecological effects monitoring workshop. The overall goal is to increase board members' knowledge of and commitment to ecological effects monitoring so that they will be able to support a future ecological effects monitoring program.

The board agreed that the purpose would be to:

a) Understand the science of ecological effects monitoring;

b) Determine what is required for an effective ecological effects monitoring program for Alberta;

c) Identify alternatives to improve capability to measure air quality effects on ecosystems in Alberta;

d) Determine the values at risk of not acting based on a triple bottom line evaluation.

The stakeholder group agreed that the workshop will:

- be interactive
- focus on specific questions
- provide access to well-informed experts
- include a session(s) where members of the public can participate
- use rapporteurs to summarize discussions
- result in proceedings that will be distributed to participants
- lead to recommendations to the CASA board

Purpose and Objectives of Workshop:

Purpose:
In additional to above direction from the board the organizing committee added the following to the workshop purpose:

1. Increase board members' knowledge about ecological effects monitoring.
2. Give the board the option to start a new program, to join an existing program or potentially to agree to a strategy or framework to implement.
3. Be used as a decision tree for the board to make educated and informed decisions.
4. Show how to use the outcomes of ecological monitoring programs to direct policies.

Objectives:

1. Address importance of ecological effects and consequences for not acting.
2. Review long-term ecological effects monitoring programs from air born substances in the province and elsewhere.
    - What are the challenges?
    - What are the results?
    - How much did it cost?
    - Were there any policy changes or mitigation actions taken to address the programs outcome?
3. Address synergies with other programs.
4. Address the scientific requirements needed to develop a scientifically defensible ecological effects monitoring program (scientific rigour)
5. Raise a wide range of questions about ecological effects from different substances (i.e. mercury, acid deposition, sensitive lakes, indicator species, etc.), and different media (soil, water).
6. Develop alternatives to the board for the path forward.

Purpose and Tasks of Organizing Committee:

Purpose

CASA Ecological Effects Workshop Organizing Committee is to:

1. Plan CASA Project Team Ecological Effects Workshop; and
2. Report to the CASA Board.

Tasks

The Organizing Committee has agreed to:

1. Discuss and agree to the following details for the workshop:
    - workshop purpose;
    - style of workshop;
    - timelines;
    - budget;
    - invitees;
    - background information; and
    - follow-up work (workshop report, evaluation, and outcomes).
2. Identify, prioritize and summarize/condense the results of the workshop.

3. Summarize the effectiveness of the workshop based on attendees' evaluation forms, attendees' comments, and the committee's interpretation of the workshop.

4. Written Report to the CASA board on:

   - the results of the workshop and proposed next steps, options or alternatives;
   - the effectiveness of the workshop; and
   - challenges and issues identified at the workshop.

Timelines:
The ecological effects workshop will be held June 15, 2005 in Edmonton.

Membership:

Laura Blair	Alberta Environment
James Brandt	Canadian Forest Service
Bob Cameron	South Peace Environmental Association
Ahmed Idriss	CASA
Les Johnston	EPCOR
David McCoy	Husky/CAPP
Keith Murray	AFPA
Mike Queenan	RAPID
Kenneth Pearce	Wood Buffalo Environmental Association
Jason Schulz	EPCOR