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Best Management Practices and Adaptive  
Management in Oil and Gas Development (May  
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5-12-2004

# AGENDA: Best Management Practices and Adaptive Management in Oil and Gas Development

University of Colorado Boulder. Natural Resources Law Center

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# Best Management Practices and Adaptive Management in Oil and Gas Development

*Sponsored by the University of Colorado School of Law  
Natural Resources Law Center*

## Wednesday May 12: Best Management Practices

**9:00-9:30** Coffee

**9:30-9:45** Introduction

**9:45-11:15** Western Governor's Association presentation of their *Coalbed Methane Best Management Practices Handbook* which was officially released at the North American Energy Summit in April, 2004.

**Presenters:** Paul Orbuch, WGA; Shane Henry; Colorado DNR, Lynn Rust, BLM; Nancy Sorenson, Landowner; Gwen Lachelt, O&GAP; Dave Brown, BP; Suzanne Stevenson, EPA

**11:15-11:30** Brief Break

**11:30-12:00** Q&A and discussion with WGA panel

**12:00-1:30** Lunch on your own

**1:30-2:00** BMP and Adaptive Management on the Southern Ute Reservation

**Presenter:** Bob Zahradnik, Red Willow Production Company

**2:00-2:15** Q&A

**2:15-3:00** The Best Practices Initiative, an effort led by the Canadian Parks and Wilderness Society has a goal to implement continuous improvements in strategic and operational practices that reduce or eliminate the past and present impact of industrial activity on Canada's working landscape and seascape.

**Presenter:** Peter Zimmerman, Canadian Parks and Wilderness Society

**3:00-3:15** Q&A

**3:15-3:45** Coffee/Soda Break

**3:45-4:30** Overview of EPA's Gas STAR program supporting BMPs for natural gas operators to reduce gas losses and methane emissions.

**Presenters:** Roger Fernandez, EPA Gas STAR Program; Don Anderson, Western Gas Resources

**4:30-4:45** Q&A

# Best Management Practices and Adaptive Management in Oil and Gas Development

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## Thursday, May 13: Adaptive Management

**8:30-9:00** Coffee

**9:00-9:20** A look at national policy on adaptive management. CEQ issued *Modernizing NEPA Implementation* (Sept 2003) that has guidance on adaptive management, monitoring and NEPA.

**Presenter:** Horst Greczmiel, White House Council on Environmental Quality

**9:20-9:30** Q&A

**9:30-10:15** NEPA and adaptive environmental management. What problems were identified in the CEQ report *Modernizing NEPA Implementation* and what is the CEQ solution? How has adaptive environmental management worked and what are its obstacles?

**Presenter:** Denise Dragoo, Partner with Snell & Wilmer, Salt Lake City, Utah

**10:15-10:30** Q&A

**10:30-10:45** Brief Break

**10:45-11:30** Lessons learned from the Pinedale Anticline Natural Gas Exploration and Development Project in Wyoming where adaptive environmental management processes were proposed for an area where development potential was not known and/or impossible to predict and where environmental responses to development were thought to be uncertain.

**Presenters:** Prill Mecham, Pinedale BLM; Robin Smith, Mountain Top Consulting; Peter Aengst, The Wilderness Society

**11:30-11:45** Q&A

**11:45-12:30** A panel on agency use of adaptive management, the pros and cons and lessons learned.

**Presenters:** Tim Salt, BLM; Bob Dach, US Fish & Wildlife Service; Pete Morton, The Wilderness Society

**12:30-12:45** Q&A

*The Board of Continuing Legal & Judicial Education has accredited the workshop for 10 CLE Credits.*

*Made possible by the generous support of the William and Flora Hewlett Foundation, BP and Calpine*

## **Adaptive Management in the BLM**

**Tim Salt**

**May 13, 2004**

The Bureau has initiated efforts to develop policies and procedures to integrate adaptive management into the NEPA and planning processes. The challenge is to efficiently and effectively employ the NEPA and planning processes to address actions and make decisions that may subsequently be modified in light of monitoring or other new information so that one need not reinitiate the process. The effort is based upon four assumptions. 1. The underlying objective in adopting AM is to better achieve desired outcomes by supporting changes or modifications in management actions without reinitiating the planning/NEPA process. 2. The key to achieving that underlying objective is outcome or performance based decisions. 3. The key to performance-based decisions is clearly defined, measurable performance standards. 4. Measuring performance standards requires a firm commitment to long term monitoring.

The Bureau has a long history of changing management actions in light of new information or new proposals. However, those changes generally come as a result of new analysis, new decisions and oftentimes plan amendments. The intent in developing new policies and procedures is to enhance our decision-making capabilities. The traditional “prescriptive” decision does not easily lend itself to change within the framework of the planning and NEPA processes. Since prescriptive decisions are about specific actions, the analysis is limited to that action and provides the decision maker limited flexibility to change decisions within the existing planning and NEPA documentation. Actions should be viewed as a means to achieve outcomes rather than the plan decision. Outcome or performance based decisions focus on the desired outcome rather than the means to achieving the outcome. Since an outcome or performance based decision might be subject to varying interpretations, to be meaningful it must also contain performance standards which define how and when the outcome is considered to be achieved.

Ultimately, the plan outcome is paramount. AM policies and procedures must enhance our ability to achieve outcomes. The rigid nature of traditional prescriptive plan decisions is not the most effective means of achieving desired outcomes in all cases. Should the prescriptive actions not lead to the desired outcomes, additional analysis, new decisions and plan amendments are required. The NEPA/planning process is a powerful tool to aid the decision maker and inform the public. When the NEPA/planning process is effectively used and mechanisms are built into the decision to validate impact predictions, ensure mitigation is effective, adapt for unintended consequences, the plan will have the flexibility to enhance the ability to achieve plan outcomes.

## Lessons Learned from the Development and Implementation of an Adaptive Management Plan at Three Hydropower Plants in Northeastern Washington State

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Over a period of approximately 10 years, Habitat Conservation Plans (HCPs) were developed at three non-federal hydroelectric projects in the Pacific Northwest. The fundamental component of these HCPs was an adaptive management process developed to ensure that specific biological standards were achieved and maintained for a period of 50 years. The HCPs address five species of Columbia River salmon and steelhead, two of which are listed as endangered under the Endangered Species Act (ESA). In addition to satisfying requirements of the ESA, the HCPs and associated Anadromous Fish Agreements also satisfy requirements under the Federal Power Act, Fish and Wildlife Coordination Act, Pacific Northwest Electric Power Planning and Conservation Act, and Title 77 Regulatory Code of Washington (RCW).

Implementation of the HCP agreements began in 1998. Many of the parties involved with the development of the initial agreements (e.g., state and Federal resource agencies, Indian Tribes, non-governmental organizations, and the owner/operators of the facilities) became increasingly disenfranchised during implementation as a result of poorly defined and inconsistently interpreted provisions. As a result, most of the agreements were renegotiated and redrafted over the following four years. The lessons learned from this initial false start helped to highlight specific requirements necessary to ensure the adequate implementation of an adaptive management program over the long-term.

My presentation will focus on the following points:

- Necessary initial information to determine appropriate standards and to assess the potential risks of the adaptive management program over time.
- Specificity in all aspects of the adaptive management plan including: goals and objectives, standards, criteria, schedules, study designs, data collection, reporting, decision making, oversight, long-term monitoring, and alternatives.
- Measurable standards.
- An alternative to the initial action to be implemented without delay if the standards are not met as defined.
- Time sensitive dispute resolution, communications protocol, and long-term monitoring and compliance measures.

## **Summary: Lessons Learned from Pinedale Anticline**

Presenter: Prill Mecham, Pinedale BLM Field Manager

Date: May 6, 2004

The Pinedale Anticline Oil & Gas Exploration & Development Project EIS was completed in July of 2000. At the time of the signing of the Record of Decision (ROD), only 14 wells had been drilled in the roughly 197,000 acre project area. Following the signing of this ROD, new issues regarding wildlife arose, new management guidance arose, data gaps were discovered, management prescription modifications were identified and new mitigating technologies were discovered. Additionally, the subsurface geology was virtually unknown, resulting in uncertainty regarding where the development would take place and how dense it would be.

The high level of uncertainty associated with this project required flexibility on the part of BLM in order to responsively manage the development through time and potentially changing impacts. Adaptive Management (AM) was viewed as the vehicle to provide this flexibility. It was critical to this effort that BLM gain acceptance of the project by governmental agencies (federal, state, county and town), by interest groups such as livestock operators, oil & gas operators and the environmental community, and by adjacent landowners and the public at large. Including the AM process as an integral part of the ROD resulted in Wyoming BLM receiving EPA's highest rating on this EIS and also resulted in no appeals filed which were based on resource or analysis issues.

The AM process was stopped cold by a lawsuit in early 2001 based upon two points: 1) BLM does not have the authority to implement AM because it has not gone through the rule-making process, and 2) inclusion of non-government members on Working Group/Task Groups is a violation of the Federal Advisory Committees Act (FACA). Although the judge dismissed the lawsuit as moot, it was agreed that the Working Group did violate FACA. The AM process has been placed on hold for three years waiting for the chartering and nomination processes under FACA to be completed. The committee was finally approved on May 4, 2004.

Many lessons have been learned from this experience. Advisory groups are one way to involve the public in AM. The traditional NEPA process is another way. There are positive and negative aspects to implementing both AM approaches to resource management decisions. Managers need both approaches in their tool box.

**Summary: Lessons Learned from Pinedale Anticline**

Presenter: Robin Smith/Mountaintop Consulting, LLC

Date: May 6, 2004

**Lessons learned from PA AM are:**

***1) AM must be regional in scope, because ecological processes and species can only be managed in large ecosystems.***

As a first step, managers must set goals and objectives. As a key component, these objectives, or statements of desired future conditions, must be regional in scope and incorporate economic and social objectives as well as ecological ones. Wildlife monitoring data gathered at Jonah Field provides an example. This data, when analyzed by different individuals, gives two very different answers. Some focus on the decrease in attendance at a single lek near moderate development activity and conclude that the presence of that activity has resulted in an impact to sage grouse viability. The reaction to this conclusion is that more mitigation is needed to protect sage grouse. Analysis of the entire data set and comparison to statewide sage grouse trends yields a much different view when considered from a regional scope with population survival as the goal.

***2) AM must reconcile conservation biology with sustainable development.***

Industries understand the importance of data gathering and analysis. Companies that engage in the search for oil and gas reserves rely heavily on data. They constantly “look back” and improve technologies and methodologies, so that decisions can be made on actual experience, not supposition. If they didn’t, they would not survive in the highly competitive arena in which they operate. BLM has typically managed through environmental policy that has been formulated in response to unmonitored experience. BLM’s role in managing ecosystems and habitat is far different than that of users of public lands. The activity of these “customers” more closely resembles cultivation, and is focused in relatively small parcels. BLM’s management goals must be broader in scope, and include incorporate economic and social objectives.

***3) AM must promote experimentation and learning to a high priority.***

BLM application of AM in the PAPA is designed to determine the effectiveness of its mitigation decisions. BLM should not use the NEPA process as its “back door solution” for providing data that supports its current mitigation policies. Goals and objectives of AM, and ultimately BLM’s mitigation decisions, should be performance based. The objectives should include the ability to test the basis for mitigation in controlled experiments. Winter drilling on Mesa is a good example of this.

#### **4) *BLM must share in the cost of collecting data.***

BLM has not adequately addressed the cost, personnel, and future commitment needs of a successful AM process. BLM should not continue to shift the entire cost burden of AM to operators, but should participate on an equal basis.

#### **5) *Solutions***

Successful implementation of AM will require a shift in agency philosophy from one of maintaining systems in a single optimal state to one of maintaining optimal management capacity. This will require well-defined objectives that consider economic and social objectives as well as ecological ones. Crucial to successful implementation is a willingness to test management decisions by experimentation, and flexibility in management decisions. Addressing personnel needs and budget requirements is also a key to successful implementation of AM.



Peter Zimmerman, CPAWS

## **Oil and Gas Best Practices Initiative - A Partnership Proposal -**

### **What are we proposing?**

CPAWS is proposing to build a Best Practices compendium that will explain what principles, processes and activities constitute a “best practice” for conservation of landscape and marine ecosystems. The goal is to describe Best Practices at the conceptual (strategic) level, and actions at the operational (tactical) level. Presented as prescriptive cases and using actual examples the Best Practices would “push the envelope” by promoting innovation, new technology, emerging concepts and new scientific learning. The final product would build knowledge and understanding with oil and gas industry managers and staff, government regulators, environmental and conservation organizations.

### **Why is this needed?**

Overlapping land tenures and continued escalation of resource extraction activity is rapidly transforming the face of Alberta and northeast BC. The proposed arctic pipeline projects and development of hydrocarbon reserves in the north will have a profound effect on the Yukon and NWT. This is creating conflict between the various landscape users – energy, forestry, mining, agriculture, ranching, public recreation, and traditional use by aboriginal communities.

The issues surrounding these conflicts are urgent as the adverse environmental effects are cumulative and there are indications that landscape thresholds or ecological tipping points are potentially being approached in many areas.<sup>1</sup> In response to this, there is a need for developments to continually shrink their ecological footprint. We propose that the Best Practices of the oil and gas industry be documented first followed by agriculture, forestry and mining. The framework for change in the hydrocarbons sector is articulated in the attached Canadian Parks and Wilderness Society (CPAWS) oil & gas policy.

### **Who is invited to be a partner?**

CPAWS has launched this initiative with the intention of joint venturing with a progressive and credible industry \ government orientated organization.

We propose a collaboration of Environmental Non-government Organizations (ENGO), progressive energy companies, First Nations, and Federal/provincial government agencies all of whom have a direct stake in landscape and marine conservation. The combined resolve of these interests will make the Best Practices Initiative (BPI) robust and is expected to increase the potential for this to act as a real agent for change including renewal of public policy by government.

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<sup>1</sup> “Managing Cumulative Effects of Land Uses in the Western Sedimentary Basin”, by Rick Schneider et al.

To move forward with the Best Practices Document we are seeking partner support in one or more of three aspects:

1. Support in principle.
2. Technical expertise and case examples.
3. Funding.

The project manager is Peter Zimmerman, a Sr. Environmental Planner with Komex International Limited, and the current Chair of CPAWS Calgary\Banff Chapter. Peter has many years of experience in the upstream oil and gas sector. Phil Lulman, a Director of the CPAWS board and an independent environmental consultant with many years of experience in the electrical energy sector is assisting Peter in the management of the BPI.

### **Where to from here?**

#### **Phase I**

Phase I has created a framework and format for the BPI. This phase has received preliminary commitments from partners some of whom funded the first steps. During phase one we have completed development of a project charter, set the terms of reference, established a project schedule with milestones, and determined the outline of a format for the compendium. A half day focussed workshop on January 26 refined the details of these foundation documents and launched phase II of the project. Phase I was completed by the end of 2003 as per the schedule.

#### **Phase II**

Phase II would build from the work of phase I by researching existing documents and determining sources of best practices case examples. During this phase writing, editing, and publishing of the Best Practices Compendium would be an iterative process between the partners, so as to maximize the opportunity for input and the probability of consensus. It is projected that by the end of 2004, phase II would be complete. The estimated cost for phase II is \$97,000 subject to details of promotional and documentation needs.

A partial list of specific issues that the Best Practices Compendium could address include:

- Land tenure and pre-operational planning.
- Reclamation.
- Stakeholder Relations and Collaborative Decision Making Processes
- Cumulative Effects Assessment and Management
- Access Management
- Ecological Footprint Reduction
- Landscape Thresholds
- Wildlife Corridors & Core Habitats
- Landscape Offsets and Compensatory Actions
- Waste Disposal
- Water Conservation
- Light and Noise Pollution
- Watershed Protection

- Rare & Threatened Species

**What will this cost? Funding Requirements for phase 2:**

Phase II

The following table summarizes the estimated funding requirements for Phase II. A detailed cost estimate is itemized in the Project Budget document.

<b>Task</b>	<b>Project Components</b>	<b>Total</b>
1	Research, development of criteria, compilation of best practices, screening process, input to web-based compendium.	\$74,600
2	Web-design and development	\$8,600
3	Meetings and partner workshops	\$8,400
4	Overhead	\$5,400
	<b>Total Project Costs for Phase II</b>	<b>\$97,000</b>

**Phase I Partners**

There have been many expressions of interest from industry, First Nations, ENGOs, and provincial, territorial and federal government agencies to participate in this initiative.

Organizations that have funded phase I of the BPI include:

1. Canadian Parks and Wilderness Society (CPAWS)
2. Brainerd Foundation
3. Petro-Canada Limited
4. Suncor Energy
5. Y2Y Conservation Initiative ([Y2Y](#))

**CPAWS Policy on Oil and Gas Industry Issues (Adopted March 2003)**

CPAWS’ policy is to recognize scientific evidence that the exploration, production, distribution, and end use of hydrocarbons come with severe environmental impacts. This includes impacts directly threatening CPAWS' mission of a healthy ecosphere, protection of wild ecosystems and marine ecosystems, and preservation of biodiversity. Humanity needs to shift its energy supply and consumption away from carbon-based energy towards energy efficiency and low-impact renewable energy sources. CPAWS recognizes this will take time and effort and we encourage an acceleration of this transition. When, during this transition period, hydrocarbon resources continue to be explored for, developed or transported, we will:

- i) explicitly oppose any hydrocarbon development activity in terrestrial or marine parks and protected areas, or with significant impacts on these areas
- ii) work to ensure that other high-value wilderness landscapes and

marine ecosystems are not affected by hydrocarbon development activity, and, where possible, to ensure that networks of protected areas are established prior to the commencement of oil and gas development activity

iii) where development is proposed for other areas, promote the use of best environmental assessment practice (that includes cumulative effects assessment and adaptation to climate change) socio-economic assessment (that includes full cost accounting), and industry practices that affect ecosystem integrity to the least degree possible, and

iv) support efforts to abate climate change by reducing the use of carbon-based energy and exploration.

*Incorporates changes as of March 13, 2003*

## **CPAWS Mission Statement**

**CPAWS envisages a healthy ecosphere where people experience and respect natural ecosystem.**

We will achieve this by:

- protecting Canada's wild ecosystems in parks, wilderness and similar natural areas, preserving the full diversity of habitats and their species;
- promoting awareness and understanding of ecological principles and the inherent values of wilderness through education, appreciation and experience;
- encouraging individual action to accomplish these goals;
- working co-operatively with government, First Nations, business, other organizations and individuals in a consensus-seeking manner, wherever possible.

**CPAWS believes that by ensuring the health of the parts, we ensure the health of the whole, which is our health too.**

## **Charter: Best Practices Initiative**

### **Mission Statement**

To implement continuous improvements in strategic and operational practices that reduce or eliminate the past and present impact of industrial activity on Canada's working landscape and seascape.

## **Vision**

Establish a sustainable pattern of energy and resource development. This means that environmental health, social well-being, and economic success are given measured consideration in all development strategies and decisions.

Environmental health means a network of legally protected areas connected to healthy working landscapes which together ensure fully functioning ecosystems with the capacity to recover ecosystem integrity following the effects of resource exploration, production and transportation.

## **Goals**

1. Build and sustain a collaboration of progressive resource companies, government agencies, aboriginal groups, and Environmental Non-governmental Organizations (ENGOS) dedicated to the mission and vision.
2. Identify public policy tools for valuing natural capital.
3. Achieve economic, environmental and social benefits from continuously improved strategic and operational practices.
4. Create and sustain a database compendium of best practices.
5. Identify public policy and regulatory barriers to implementing and maintaining the use of best practices.
6. Achieve and hold total cumulative adverse environmental effects below thresholds from which ecosystems and the components of ecosystems can recover.
7. Identify and implement methods that stimulate the creation of innovative public policy that embeds best practices to ensure these will be systematically, quickly and continuously implemented by regulators.

## **Leadership**

The Best Practices Initiative (BPI) is designed to be co-led by the Canadian Parks and Wilderness Society (CPAWS). CPAWS is a national environmental non-government organization dedicated to protecting Canada's wild ecosystems, and promoting awareness and understand of ecological principles, through action and education. More details can be found at <http://www.cpaws.org/>.

CPAWS is currently seeking a credible, progressive, industry \ government orientated organization to co-lead this initiative.

We are keen to develop the BPI using an inclusive leadership model in which all participants can contribute. As the initiative develops we anticipate many leadership opportunities will emerge. The intention of CPAWS is to facilitate discussions on content and process with all the BPI partners throughout development and maintenance of the initiative.

### **Value proposition**

Progressive businesses, aboriginal peoples, sustainable communities, and concerned citizens are continuously seeking better ways to plan, develop, operate and decommission energy and resource projects and infrastructure. Positive recognition and the “license to operate” goes to those who work hard to continuously improve on traditional and conventional practices that go beyond just complying with what is legally required. “Best Practices” embodies this concept of continually striving to improve performance beyond a regulatory standard or convention. There is a significant gap in public policy that needs to be bridged before best practices are widely recognized, understood, adopted and implemented.

CPAWS and the joint venture partner will be committed to building bridges across this practices gap, in a way that leaders can showcase and share their experiences. Those who are keen to adopt new and progressive practices can learn from the leaders, and regulatory bodies can gain insights, which may be used to establish and improve minimum standards.

The compendium of practices will be both strategic and operational for the major theatres of operations in Canada. When diligently implemented, these practices will help to shrink the operator’s individual environmental footprint intensity<sup>2</sup> and reduce the cumulative adverse environmental effects on all ecological features of the landscape, and the human communities who live there.

The benefits to participants of the BPI will be numerous, including;

- Expansion of shared best practices knowledge and technology has the potential to lower the environmental impact and increase social and economic benefits from activities that are under the control of a variety of resource companies.
- Establishing robust criteria for best practices that encourage trust and confidence, promote consistency, and may reduce planning, stakeholder consultation, and approval cycle time.
- Provide greater assurance of license renewals.
- Contribute to progress in meeting the triple bottom line<sup>2</sup>.
- Reducing long term costs for reclamation, decommissioning and associated liability.
- Financial, human health, and environmental risk for operators, communities, and individuals may be significantly reduced,
- Ensuring integrity of ecosystems will ultimately ensure quality of life for all.

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## **Statement of Principles**

1. Incorporate conservation first as a fundamental requirement of good landscape management.
2. Encourage development and adoption of public policies that create the foundations of sound regulations and standards for adoption of best practices.
3. Endorse operational practices that will work towards “no net loss” of natural capital now and for future generations.
4. Adopt and promote the precautionary principle, which means: before implementing a practice where sufficient uncertainty exists about the results, assess risk and decide if net environmental economic and social benefits outweigh losses.

## ***Expectations for participation***

1. Decisions are made by consensus of all partners.
2. Participate in the process in an open, transparent and non-partisan manner.
3. Be inclusive of all stakeholders’ views, and share all best practices openly with all participants.
4. Report openly, clearly, accurately, and in a timely manner the degree and magnitude of compliance with the best practices articulated in this initiative.
5. Strive to be as complete as possible in examining the full scope and operational boundaries of BPI participants, including the supply and product chains.
6. Agree to implement, or faithfully work toward implementation of the best practices.
7. Recognize that many practices may reduce but do not eliminate adverse environmental effects.
8. Promote new technology and innovation to achieve economic and social benefits from resource exploration, production and transportation.
9. Provide self-assessments of progress against voluntary goals and regulated standards.
10. Encourage public policies with standards that promote the use of best practices.

Appended to the Charter are the following documents, which serve to give further guidance for the BPI.

1. Partner Proposal.
2. Terms of Reference
3. Project Schedule and Milestones
4. Project Cost Estimate

### ***Measures of Success***

The BPI will track the following metrics and use these in a continuous corrective feedback loop to constantly adjust our course, improve our product, and evaluate the relative success of the project.

1. Actual cost vs. budgeted cost estimates for the project. Cost variance should be less than 15%.
2. Meeting milestones and being on time with scheduled workshops and interim deliverables as per the Project Schedule.
3. Satisfaction of the partners with progress and the product.
4. Satisfaction of other participants with the progress and product.
5. Engagement of the best practices as verified by competent external auditors.



## **Summary: Lessons Learned from Pinedale Anticline AEM Process**

Presenter: Peter Aengst, Regional Associate, The Wilderness Society

To put this adaptive management project in its proper context one must understand both the values found in the project area and the decision that put this adaptive management effort into action. The Upper Green River Valley – and especially the Pinedale Anticline portion of it – has world class wildlife, scenic, and recreation values. It also has world class natural gas deposits. While the BLM’s July 2000 ROD for the Pinedale Anticline project approved the construction of up to 700 new well pads (and 276 miles of roads, 400 miles of pipelines, and construction of compressor stations), this approval was on the condition that the Resource Protection Alternative (“RPA”) also be implemented. The RPA has two prongs: 1) restrictions and mitigation measures; and, 2) adoption of a Adaptive Environmental Management (“AEM”) planning process.

The AEM had some strengths and did some things well. This included recognizing the high degree of uncertainty with impacts and trends, involving the right people from the outset, and trying to be truly adaptive while also recognizing the constraints from lease rights, agency mandates, etc. However, there were some serious weaknesses with the AEM too and an exploration of these leads to the following lessons/recommendations for future adaptive management processes:

- **Start small and pace/scale development with level of learning**
- **Define in detail what the adaptive management process will and will not address**
- **Ensure a solid baseline prior to starting Adaptive Management**
- **Make sure there is a solid agency commitment to fund monitoring**
- **Have a “fall back” plan should monitoring or adaptive management process not be fully carried out**
- **Set up adaptive management process so that private citizens can effectively participate.**

## Adaptive Management and Best Management Practices on the Southern Ute Indian Reservation

Bob Zahradnik

There are many definitions of adaptive management. The BC Forest Practices Branch portrays it as a six step cycle:

First, assess the problem

Second, design the solution

Third, implement the proposed solution

Fourth, monitor key indicators

Fifth, evaluate the performance of the solution compared to the original objectives

Sixth, incorporate the results into future decisions

The Southern Ute Indian Tribe's resource management objectives are much narrower in scope than those of most resource management agencies. The resources held in trust for the Tribe are to be managed in such a way as to obtain the maximum possible benefit for the Tribe and its members while minimizing negative impacts to the land.

While the Tribe's objectives are narrow, the operational methods that we use to achieve them are much broader in scope than those employed by more conventional resource managers. Using the principles of Adaptive Management, the Tribe has chosen to take direct control of the development of much of its resources, eliminating, to the maximum extent possible, the role of lessee, well operator, and gas processor and transporter on the reservation.

The Tribe's hypothesis, proven by more than a decade of field results, is that they can perform these functions better than large, distant, rigid, autocratic corporations, whose policies are set far from the reservation, and whose first loyalty is to their stockholders, not the members of the Tribe. This process permits the Tribe to retain the maximum economic benefit from its finite mineral resources and to retain complete control of the tradeoffs between cost and environmental impact.

The application of the adaptive management process is illustrated by several case studies.