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**ECONOMIC RESEARCH AND POLICY CONCERNING WATER
USE AND WATERSHED MANAGEMENT**

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Introductory Remarks -- Summarization

by Chuck Clarke, Administrator, US EPA Region 10

Mr. Clarke's opening remarks revolved around four issues concerning economics and EPA's environmental regulations: (1) the need to address compliance problems relating to water quality standards, (2) hydroelectric re-licensing, (3) management of the Snake River and Columbia River systems, particularly with regard to salmon stocks, and (4) enforcement.

The first issue pertains to a national upheaval in water issues over the past four to six years concerning water quality standards. States must now face the question of whether waters will meet water quality standards. Under section 303(d) of the Clean Water Act, each state must publish a list of "impaired waters," and develop a strategy for bringing these waters into compliance with water quality standards. Twenty-one lawsuits have been filed against the EPA for failure to implement section 303(d), all of which EPA has lost.

In dealing with water pollution EPA initially focused upon point sources, as they are easier to identify and regulate. The broader and ultimately more important problem, however, concerns non-point pollution sources. One of the greatest obstacles to regulation that EPA must face is the economics of regulation, not simply the scientific or technical information pertinent to water quality regulation. People in the agricultural industry and the timber industry have aggressively used economics to argue against water quality regulation for non-point sources, and have elevated the economic analysis to a level far above that which EPA has ever had to previously face in connection with water quality regulation.

The problem of bringing water bodies into compliance with water quality standards is daunting enough, but if one combines water quality standards with Endangered Species Act (ESA) requirements, then the impacts can be immense -- over two-thirds of the water bodies in Washington, Oregon and Idaho will not be in compliance with either water quality standards or ESA requirements. Bringing water bodies into compliance with water quality standards and ESA requirements will require the use of economic analysis in two critical ways: (1) using natural resource damage assessments to determine the damages of noncompliance, and (2) determining the impacts on regulated industries of various options for bringing water bodies into compliance. Most resource agencies are poorly equipped to deal with the increasing importance of economic analysis, so in the next several years there will be much more pressure on resource agencies to focus more on economic analysis than has historically been the case. In order for resource agencies to be able to negotiate with regulated industries, it will be imperative that they be able to discuss economics without being at a disadvantage.

The second issue pertains to the impending decisions on the re-licensing of hydroelectric dams. Many hydroelectric systems will expire over the next five to fifteen years. Economics will play a prominent part in the ensuing re-licensing decisions. Economics will answer questions such as:

- Do they continue to operate?
- Can they operate economically under the environmental constraints that will be placed upon their operations?
- What will be the economic impacts, both in terms of the natural resource damages and in terms of the regulated industries?

In re-licensing discussions over the past several years, the EPA has obtained outside economic expertise in order to be able to debate the economic impacts of re-licensing decisions with the regulated parties.

The third issue pertains to management of the Snake River system and the Columbia River system, and the impacts on salmon. In virtually all discussions that EPA has had with other federal agencies, the Bonneville Power Administration, or any members of the regulated community, a major portion of the discussion has revolved around economics. Issues of electricity rate-setting, impacts on regulated parties and others issues invariably center upon economics. Concentrating on the environmental resources and neglecting the economics has typically resulted in failure to implement EPA's mandates in the end, so being able to use economics in negotiations will continue to be critical.

The fourth issue is the broad issue of enforcement, but has specific applicability to water issues, in that research is needed to ascertain the economic benefits foregone by the states' and EPA's failure to enforce water quality laws. Without some economic basis for determining the damages resulting from water quality violations, EPA cannot determine the appropriate level of penalties.

As an example of how the EPA must increase their commitment to economic analysis, Mr. Clarke noted the example of a discussion he had with the Governor of Idaho, in which they discussed strategies for cleaning up the waters of Northern Idaho. The discussion was primarily economic in nature, in that the impacts on mining industry and the impacts on cities and counties were of concern to the Governor, a much different discussion than would have taken place five or ten years ago. As an example of the need for economic expertise within the resource agencies, one question that EPA needs to answer before negotiating with mining industries is how much can EPA require of the mining industry without compromising their ability to pay for remediation. Further, being ignorant of the economic issues will allow the mining industry to win the political argument and frustrate EPA's regulatory objectives. Mr. Clarke noted in closing that regulatory agencies have done a poor job of dealing with economics in regulatory issues, and failed to anticipate the importance of economics in negotiating with regulated industries. Regulatory agencies in the future must involve economists and make use of economic analysis, or they will be unable to adequately represent the public interest in resource issues.

Introductory Remarks -- Summarization

by Bill O'Neil, US EPA Office of Economy and Environment

Dr. O'Neil's opening remarks pertained to the competitive grant program jointly administered by EPA and the National Science Foundation. EPA will make decisions on funding for proposals submitted in Winter 1999 on May 12. Another request for proposals will be issued in Fall of 1999, which will be due some time in Winter of 2000.

Dr. O'Neil described some of the areas of particular interest to EPA. An area of continuing importance is the valuation of components of ecosystem that are not necessarily consumed by human beings. The components of ecosystems are still poorly understood, and assessing the importance of these components (in dollar terms or otherwise) will be critical. In economic parlance, it is important to identify the intermediate goods or services provided by the components of ecosystems that contribute to the overall health of ecosystems, which provide more tangible benefits.

EPA is moving away from focusing on traditional pollutants and focusing more upon nutrients and toxic materials, which leads to the exploration of the need to manage, not just control nutrients and toxins. For example, toxins stored in the bottoms of waterbodies might be better left alone than released and stirred up by dredging and removal. Problems with nutrient loading require consideration of non-point sources, including agricultural, construction runoff, and sediment from forestry practices. This in turn requires consideration of best management practices. EPA needs better information about which practices are effective physically, and means of valuing the controls achieved by such practices, so as to be able to assess the cost-effectiveness of different management strategies.

Finally, the need to involve so many different stakeholders and agencies suggests that the division of authority for natural resources at the federal level may be too fragmented. Conflicting and duplicating regulations and overlapping authorities are some of the problems that result from the existence of so many federal agencies. Proposals to look at a better division of responsibility, perhaps even involving the merging of existing agencies or the creation of a new agency, may be of interest to EPA. Integration of the federal, state and local levels of government are necessary as well, so any studies on the proper roles of the different levels might be of interest to EPA as well.

Presentation-- Summarization

by Dennis Wagner, US Army Corps of Engineers, Northwestern Division,
and Chair, Drawdown Regional Economic Workgroup

Mr. Wagner opened his presentation by noting that the U.S. Army Corps of Engineers has historically used economic analysis as a key component of its decision-making process, and has expanded the role of economics recently from its traditional role in flood control and navigation studies into environmental issues. The Lower Snake River Juvenile Salmon Migration Feasibility Study is one example of the Corps's use of economic analysis applied to environmental issues. This issue has caused much debate within the region since the listing of the sockeye salmon under the Endangered Species Act in 1991, followed by the listing of the fall, spring and summer chinook salmon in 1992.

In 1995, the National Marine Fisheries Service issued a biological opinion asking for a study of the feasibility of modifying the four dams on the Lower Snake River operated by the Corps to aid recovery of the salmon and ultimately lead to the delisting of the species. Among the alternatives that emerged from the biological opinion were various plans to alter the four dams to achieve free-flowing conditions, including the decommissioning of those dams. The alternatives considered by DREW are 1) maintaining the status quo, 2) making major system improvements such as building surface bypass collectors and guidance structures, 3) removing the earthen bank components of the dams, and 4) conducting a natural river drawdown to simulate free-flowing conditions. Mr. Wagner outlined the process by which the Drawdown Regional Economic Workgroup (the Corps group convened to study the feasibility of different alternatives to aid recovery of listed salmon species, or "DREW") will analyze all of the alternatives, and issue a final report with a recommended course of action sometime in the spring of 2000.

Mr. Wagner identified the four dams on the 120-mile stretch of the Snake River that were included in the study (Ice Harbor, Blue Goose, Lower Granite and Lower Monumental dams), and stated that power generation accounts for 80-90% of the benefits from the dams. The dams have a combined generating capacity of 3000 megawatts, and produce ten to twelve million megawatt-hours of energy in an average water year, or roughly enough to power the city of Seattle. In addition to the large proportion of benefits obtained from power generation, the dams also offer several other benefits. The dams provide navigation benefits: four to six million tons of commodities are shipped down the river, consisting of agricultural products, timber and petroleum. The dams also provide irrigation for 13 farms with 35,000-40,000 acres of cropland behind the Ice Harbor dam. Finally, the dams provide some recreational benefits in terms of boating and other water activities.

Mr. Wagner emphasized that the analysis presented in this workshop is only one of a number of aspects of the dam projects that are being studied, with the economic analysis being contained in the "Socioeconomic Appendix" of DREW's final report. Formally, the economic analysis will evaluate the various economic effects associated with alternative plans to provide for recovery of listed salmon stocks on the Lower Snake River. This

analysis will look at how the alternatives will lead to changes in "national economic development," (changes in goods and services for the nation as a whole), regional employment, and tribal circumstances. Mr. Wagner noted that the Corps is only one of many agencies and organizations participating in the study. This is a divergence from how the Corps has historically performed its economic analysis, which has generally not been in cooperation with other agencies. However, given the great common interest of a broad variety of organizations and agencies in this issue, the Corps believed that a group approach would ultimately be the most effectual. The subjects under analysis by DREW include the effects in the following areas: power, navigation, irrigation, recreation, commercial fisheries, tribal circumstances, implementation costs, cost effectiveness, regional effects, social studies, mitigation requirements, avoided costs, costs allocation, relevant agreements, and uncertainty.

Presentation --Summarization

by Audrey Perino, Bonneville Power Administration

Ms. Perino began her remarks by explaining that Bonneville Power Administration (BPA) markets the power that is generated by the four Lower Snake River dams that are being considered for decommissioning to aid the recovery of the sockeye and chinook salmon. The BPA is the entity that would be most directly affected by removal of the dams. The purpose of her portion of the economic analysis is to value the electricity and other products of the power produced by the four dams. Each dam generates approximate 300 megawatts of power per year, or ten to twelve million kilowatt-hours under average water conditions. To emphasize the uncertainty introduced by water flow variability, Ms. Perino stated that in a dry year, only eight million kilowatt-hours of electricity are produced by the four dams. Along with the electricity produced by the four dams, the dams also support the regional power transmission system and provide other ancillary services.

One method of establishing the cost of decommissioning the four dams is to look at the increase in production costs necessary to replace the lost power generation, typically known as the "production costing method." The increase in costs was calculated by looking at the change in West Coast production costs, since that is the regional power grid that will have to produce the replacement power. A production cost spreadsheet model developed by the Bonneville Power Administration and a U.S. Army Corps of Engineers model called PROSYM were used to calculate the production costs of replacing the lost electricity. The two spreadsheet models demonstrated that loss of the four dams would necessitate the production of 900 megawatts of thermal resources (the best alternative energy source) by the year 2010. Under "medium" market conditions, production costs would amount to \$255 million per year, averaged over 100 years. "Medium" market conditions are the use of a set of middle level of assumptions for three potential economic uncertainties: the price of natural gas (an important West Coast resource), the growth of the Pacific Northwest region, and the costs of new resources, such as the cost of building new combustion turbines.

A second method used by BPA to establish the costs of decommissioning the dams was the "pricing method," which calculates the cost of buying replacement electricity from a world-wide market. The prices were developed using the forecasting model AURORA. Historically, only West Coast electricity prices would have been used to calculate power costs, but in light of the deregulation of electric utilities, a world-wide market price for electricity was used. Under "medium" market conditions, the market price multiplied by the generation loss yielded a cost of approximately \$220 million over 100 years.

It is also necessary to perform uncertainty analysis. Using the pricing method, the simulations used three pricing scenarios – low, medium and high – of each of the three key economic uncertainties. Three forecasts for each of these uncertainties were included in the simulations. Also, climatic uncertainty was included by using 50 different historical water conditions in the simulations. Assuming an average water year and using different economic conditions, the range of costs is \$160 to \$360 million annually.

Assuming "medium" market conditions, and using different water conditions, the range of costs is \$150 to \$300 million annually.

Finally, there is a component of dam decommissioning costs that pertain to the actual costs of decommissioning, the cost of transmission reinforcement, and the loss of ancillary services, which amount to approximately \$50 million annually. Thus, assuming medium market conditions, the range of the total costs of decommissioning the four Lower Snake River dams is \$250 to \$300 million. Also to be included in the analysis (but not included in the estimates reported here) is the cost of a change in air quality resulting from the change in the mix of resources used to produce electricity. Increases in carbon dioxide emissions as well as the costs of conservation measures and renewable energy use will be considered.

Question and Answer Period

Jennifer O'Neal, University of Washington, asked if it was possible to use the models that Ms. Perino used to estimate the costs of decommissioning dams to also estimate the cost of the status quo alternative in terms of ESA compliance costs, or mitigation costs. Ms. Perino replied that it was possible to use these models to analyze many different types of cost scenarios, but was uncertain as to whether the model could be adapted to measure other types of *costs*, since the model is predicated upon the loss of kilowatt-hours as the source increased cost. The problem is that it is unclear as to who ultimately pays for the costs of mitigation.

Tony Prato, University of Missouri, pointed out that if it is the entire country that benefits from the recovery of the salmon, it should be the entire country that pays for its recovery. A second point made by Mr. Prato was that the opportunities to reduce costs through conservation measures are often overlooked. Ms. Perino agreed, and pointed out that DREW was including the possibility of conservation measures in their analysis, but also posed the question of why such conservation measures are not being implemented now, even with the dams in place. Linda Fernandez, University of California at Santa Barbara, followed up by pointing out that along with deregulation has come a freedom on the part of the consumer to choose different electricity sources. Ms. Perino acknowledged the possibility that consumers can opt for cleaner fuel sources, but that in this deregulated atmosphere, there is still an inability to send the correct price signals to consumers for conservation measures. All of the programmatic conservation programs that existed under a regulated economy have now been abandoned because of deregulation.

Presentation -- Summarization

by Phil Bengé, US Army Corps of Engineers, Walla Walla District

Mr. Bengé presented the progress of the team responsible for analyzing the recreation and tourism component of the economic analysis. The team included the U.S. Army Corps of Engineers, the Northwest Power Planning Council, the Bureau of Reclamation, the National Marine Fisheries Service, and various interest groups. There were twelve members on the team with a variety of backgrounds and experience in recreation and tourism impacts. The team agreed on a number of ground rules, including a team goal of consensus and that the economic analysis would include contingent behavior and existence benefits.

A prior study existed on the recreation and tourism benefits of a drawdown option (i.e., where the dams would be decommissioned and free-flowing conditions restored): the Columbia River Systems Operation Review, completed in 1993, which had a recreation analysis component, but only looked at the existing recreation benefits. The Columbia River review did not address all of the areas of analysis that the Drawdown Regional Economic Workgroup (DREW) wished to address. It lacked an analysis of the changes in recreators' behavior resulting from decommissioning of the dams, and it lacked an estimation of existence value benefits. DREW thus decided to conduct its own recreation and tourism study.

The DREW conducted an inventory of existing recreation facilities, and each was evaluated for suitability of use in a drawdown situation. For example, campground facilities may be less desirable in a drawdown situation, but still usable, while boat launch facilities might become completely unusable. A contractor was obtained to conduct the survey, and assist with development of the survey instruments, which Mr. Bengé noted became very political and controversial. The team is currently in the process of reviewing the draft analysis, which had just recently been received from the contractor. The contractors have produced four components of the economic analysis: the existing reservoir general recreation, the existing reservoir angling, the upstream angling above existing resources, and the natural (restored free-flow) river contingent behavior and existence value. The survey evaluating changes in recreators' behavior and existence values will be reviewed by DREW once the team has reviewed it.

Mr. Bengé noted that there were several issues and controversies that have occurred thus far in the process of administering the survey. One pertained to the inclusion of existence value as part of the economic analysis. The team agreed to include it, despite the fact that the U.S. Army Corps of Engineers has historically not recognized existence value as valid. A second controversy pertained to the formulation of survey questions to elicit non-hypothetical responses, which was viewed with great concern by the legal counsel for the team, and was ultimately subject to a compromise. A third controversy arose in the context of variations in estimates of use and visitation from different sources, which included some data collected by the Corps, University of Idaho students and some aerial surveys of boating activity. Again, a compromise was struck to resolve a large discrepancy between these estimates.

A fourth controversy arose because the team had originally planned to use an incentive payment in connection with the survey to boost response rates. A \$2 bill was planned to be included in the survey, and a \$10 reward would be mailed to those who completed the survey. Unfortunately, a misunderstanding on the part of Senator Gorton from Washington that the survey was much broader and costlier than had actually been planned by the team, led to a rejection of the incentive payment plan by the Corps. Senator Gorton's office then also became concerned with the inclusion of existence value in the benefits analysis. Thus, even though the team had decided to include existence values in the benefits analysis, Senator Gorton's opposition led to the ultimate removal of all such questions from the survey. The team decided to use a benefit transfer analysis instead. Other challenges faced by the team included responding to the various political pressures being placed on the team, and maintaining the confidentiality of estimates while distributing draft products to team members.

Question and Answer Period

Jon Goldstein, U.S. Department of Interior, Office of Policy Analysis, asked why existence value is relevant to a recreation and tourism study. Mr. Bengé replied that the team was studying the existence value of salmon as a natural resource, not necessarily just the existence value of recreation.

Jennifer O'Neal, University of Washington, asked about the existence value calculation, to which Mr. Bengé replied that the existence value estimate was obtained through the benefit transfer calculation. Mr. Meyer stated that he understood that existence value would be treated in stepwise fashion, such that the benefit-cost analysis would be done with and without existence value. Mr. Bengé reiterated that the calculation will be mentioned in the report but not included as part of the final benefit-cost analysis.

Edna Loehman, Purdue University, asked if the valuation changes when one considers the possible site substitutions (for boating recreation, for example) that people will make in a drawdown situation. Mr. Bengé replied that site substitutions for boating recreationists were considered and will be a part of the study.

Scott Farrow, Carnegie Mellon University, commented that review of the study might be aided if the different impacts were more clearly identified, perhaps in tabular form, in terms of their geographic scope. For example, if one were to ask a question about the fisheries, it is necessary first to identify whether this would be regional issue or just a Snake River issue. Mr. Bengé replied that the study area is the Lower Snake area, but conceded that some larger-than-regional issues are important.

Nicole Owens, US EPA Office of Economy and Environment, asked how the recreation and tourism team's benefits estimates compare with Ms. Perino's cost estimates. Mr. Wagner replied that the estimates are not quite complete, but expressed hope that the benefits will be ready in draft form in the next several weeks.

Presentation -- Summarization

by Gary Ellis, US Army Corps of Engineers, Walla Walla District

Mr. Ellis presented the findings of the team responsible for the regional impact analysis for the Drawdown Regional Economic Workgroup (DREW). The charge for the team was to evaluate the various regional economic and social effects associated with the different alternative plans, including jobs created and lost, and impacts on dam operations for the entire 100-year study period. A social impact analysis is being conducted under contract with Foster-Wheeler Corp. The contractor is also performing a regional impact analysis. The regional impact analysis includes estimates of indirect impacts associated with changes in river operations in eight different subregions and covering several different time-periods in the future. The social impact analysis pertains to how communities will be affected by changes caused by decommissioning of the dams, including an analysis of the effect of lower disposable incomes. The complete study will look at changes in all categories, including navigation and irrigation, and the end result will be presented in tabular form, expressed in terms of changes in income and jobs.

The regional analysis will be conducted using various sets of subregions. One set of subregions consists of four states -- Washington, Oregon, Idaho, and Montana. Another set of subregions consists of four different agglomerations of counties: an upriver region, those areas upstream of the dams considered for decommissioning, a reservoir subregion near or around the existing reservoirs, a downriver region below the the dams considered for decommissioning, and a subregion that combines all of these three smaller subregions. The upriver subregion extends into Central Idaho, is a large agricultural and recreational area. This subregion would certainly benefit from increased salmon runs, particularly since the Salmon River (which is in this subregion), is still open for salmon spawning. The reservoir subregion around the existing reservoirs includes many dryland farms and runs from Walla Walla, Washington to Lewiston, Idaho. This subregion would also benefit from increased salmon runs. The downriver subregion extends well beyond the Snake River and almost to the City of Portland, Oregon. This subregion may benefit from increased fishing and also from shipping ports moving from the Snake River to the Columbia River, but may be negatively affected by the loss of approximately 35,000 acres of agricultural production. Finally, one model simulation will combine all three of these subregions, and total the changes in all of the categories.

Mr. Ellis outlined the potential direct spending effects. They include recreational expenditures, capital expenditures for power replacement, changes in household income, changes in transportation costs of farmers who have had their products shipped via barge. The analysis assumes that all of the land that is farmed now will remain in farming after the drawdown, although it is assumed that some of the farmers with higher equity will buy out those with marginal farming operations. Farmers will lose some disposable income as a result of increased transportation costs.

Some change in farmland use will occur, however, and in the area around the Ice Harbor dam, which relies heavily upon the dam for irrigation, some income and jobs will be lost. These farmers will have to make pump modifications to continue to operate their farms.

The capital expenditures associated with decommissioning of the dams should provide a temporary boost to the local economies, for approximately a decade. There should be lower costs of operation and maintenance due to lower maintenance needs of a drawdown alternative.

Mr. Ellis's team is also responsible for the social impact analysis, which pertains to how communities will be affected by and how they adjust to the changes brought on by decommissioning of the dams. How did these communities react to similarly adverse economic developments in the past? One community lost its primary employer, a mill operation, but adjusted by developing a strong recreational rafting industry. Seventeen different communities were chosen to represent a variety of sizes, interests and industries. Focus groups and community forums were conducted by Foster-Wheeler and the University of Idaho in each of these communities. A report summarizing the discussions of these focus groups is forthcoming.

Question and Answer Period

Jon Goldstein, Department of Interior Office of Policy, asked Mr. Ellis if he could discuss some specific problems that have been encountered by his team in the analytical process. Specifically, Mr. Goldstein was surprised to hear that his team assumed that all agricultural land would remain in production after a drawdown, considering that the irrigation and transportation system would be removed. Mr. Goldstein also asked how coefficient estimates were being estimated, and whether or not indirect as well as direct effects were being examined, and what macro-economic multipliers were being used. Mr. Ellis responded that the assumption of agricultural lands was not an important one, since only the 35,000 acres of irrigated land near the Ice Harbor dam will be lost. With respect to the other two questions, Mr. Ellis responded that they were better directed to the contractor, Foster-Wheeler.

Edna Loehman, Purdue University, asked about the structure of the public meetings. Mr. Ellis responded that there was an established four-hour format and a pre-focus group practice meeting. Often, farmers wished to come in and express their opinions, rather than participating in a focus group, but the researchers were able to avoid this problem in the actual meetings. The findings will be part of the social analysis component of the DREW report.

Tony Bynum, from the Yakama Nation, commended the U.S. Army Corps of Engineers on their efforts to study this social aspect of a drawdown alternative. Mr. Bynum also asked if there were communities outside of the subregions that were considered in the social impact analysis. Mr. Bynum commented that the drawdown alternative clearly has national implications, and social effects affecting communities and activities beyond those currently under study. In particular, increased salmon runs may result in some new and positive social impacts. Dennis Wagner, U.S. Army Corps of Engineers Northwestern Division, replied that the models using states as subregions are picking up some of these effects. Mr. Bynum suggested that perhaps one or more outside communities might be used as control groups, such that the team could at least calibrate

their study to see how the social impact might diminish further away one moves from the project.

Presentation -- Summarization

by Phil Meyer, Meyer Resources, Inc.

Mr. Meyer commended the U.S. Army Corps of Engineers for undertaking for the first time a consideration of tribal circumstances. Mr. Meyer noted that the Corps has had a history of ignoring tribes' needs, and tribes have had a history of not trusting the Corps.

Mr. Meyer stated that it was important to address methodological issues. Tribal assessments must necessarily be multicultural, and must not rely upon narrowly defined procedures. Assessments must employ a broad framework, and must include "groundtruthing," or the double-checking of the reasonableness of the findings, and the invitation of feedback from the subjects being studied. It is critical to avoid "cultural encapsulation,"¹ or the substitution of model stereotypes for actual characteristics, the disregard of cultural variations, and the use of technique-oriented definitions of process.

Mr. Meyer lauded the federal initiative on environmental justice. The President's executive order on environmental justice requires that people be treated fairly regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations and policies. Moreover, no such group should bear a disproportionate share of the negative environmental consequences from industrial, municipal and commercial operations or the execution of federal, state, local, and tribal programs and policies. In addition, the EPA's Interim Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analysis identifies Native American communities as at-risk, and provides more specific guidance where the natural and physical environments of tribes are implicated.

With respect to the Lower Snake River and the Drawdown Regional Effects Workgroup, impacts were considered for five tribes: the Nez Perce Tribe, the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation and the Confederated Tribes of the Warm Springs Reservation of Oregon. The report also assesses impacts on the Shoshone-Bannock peoples, who reside further upriver from the Snake River drainage. For all of these tribes except the Shoshone-Bannock, salmon was their most important food. For the Shoshone-Bannock, salmon was also traditionally very important. Mr. Meyer cited some statements from elder tribe members emphasizing the central importance of salmon to these tribes.

Mr. Meyer reviewed the major treaties with the five tribes, which involved the loss of over 40 million acres of land in return for the agreement to move onto 12.2 million acres of reservation land. The right to take fish in all streams, however, was reserved by the tribes, an interpretation that has been upheld in court decisions. Furthermore, the treaties were negotiated when the rivers were biologically functional and fully productive, and the argument can be made that the right to harvest is from a "fully productive" river, not one that has been altered by dam construction.

¹ Sue, D.W. and D. Sue. (1990) "Counseling the Culturally Different: Theory and Practice." John Wiley & Sons, New York. pp 8-9.

Mr. Meyer reviewed some statistics on the present circumstances of the six tribes. Each had high rates of poverty, ranging from 26.9% to 43.8%, while non-tribal people in Washington, Oregon and Idaho have poverty rates ranging from 9.7% to 12.4%. Unemployment ranges from 19.3% to 26.5% among the tribes and 5.7% to 6.2% among non-tribal people. Per capita income in the tribes ranges from \$4,300 to \$8,700, as compared to \$11,500 to \$14,900 among non-tribal people. Mr. Meyer pointed out, however, that tribal spokespersons are uncomfortable with statistical representations of tribal circumstances, as some feel that there is a tendency to place the blame for poverty with the tribal people. However, Mr. Meyer presented some statistics showing that fish harvests have declined precipitously. The Nez Perce annual harvest has declined from 2.8 million pounds in prior to the treaty, to 1.6 million after the treaty in the mid-1800's, to 160,000 pounds today. The Umatilla and the Warm Springs tribes annually harvested 6.9 million pounds before the treaty, 2.6 million pounds after the treaty in the mid-1800's, and 77,000 pounds today. Some initial declines in harvest may have been due to illegal obstructions of access, but in more recent times have clearly been due to the transformation of the rivers accomplished by dam construction. Mr. Meyer stated that tribes have also lost originally reserved lands by force or by ex post facto legislation. Even in the presently depressed circumstances, salmon have remained of central importance for the tribes.

Mr. Meyer reviewed the alternatives being considered by DREW and their effects on salmon harvests. The drawdown alternative would clearly be the one most favored by the tribes, and the only one that moves towards restoring the rights reserved by the tribes under the original treaties. While the non-drawdown alternatives would result in increases of tribal catches of seven or eight percent (a continued violation of the treaties), the drawdown alternative increases present tribal salmon catches by an estimated 29% within 25 years.

In conclusion, Mr. Meyer stated that the drawdown alternative is the only one that is consistent with U.S. treaty obligations towards the tribes, and the only one that can lead to an improvement in tribal circumstances.

Question and Answer Period

Jon Goldstein, US Department of the Interior Office of Policy Analysis, commented that the environmental justice mandate referred to by Mr. Meyer is only an executive order, so is of limited status for enforcement purposes, but the treaties with Native American tribes have a much more binding effect in law. Mr. Goldstein noted the treaties called for a specific percentage of harvest of a "fully functioning river system," a very specific requirement. Mr. Goldstein asked Mr. Meyer how enforceable he thought this requirement was, and whether there is any requirement that this be monetized. Mr. Meyer demurred, noting that he was not an attorney and stating that this was essentially a legal question. Although tribes have generally won cases involving treaties, these cases

have been rare. Mr. Meyer opined that the real question is whether society will opt to choose a policy direction that is less adverse to Native Americans.

Scott Farrow, Carnegie Mellon University, commented that it would benefit Native American tribes if they could provide strong economic evidence of their damages and hardship. Mr. Meyer responded that the problem has been that tribes have trouble monetizing the loss of some goods and rituals that are religious in nature. Mr. Meyer noted that nevertheless, "there may be bills to be paid down the road" in damage claims and lawsuits, but did not wish to present that work in this conference, and added that if one only took the economic aspect, the commercial value of the lost salmon harvest, one would obtain a gross under-representation of the damages.

John Tanaka, Oregon State University, asked a question about a point that Mr. Meyer made about the accuracy of economic estimates versus the reasonableness of estimates, and whether the "ground-truthing" investigations proposed by Mr. Meyer might benefit from social sciences in adding an aspect of reasonableness. Mr. Meyer replied that he felt that he would have characterized the two methods in the exact opposite way, that social sciences could provide accuracy, while ground-truthing could provide some assurance of reasonableness. Mr. Meyer added that because of his experience, he is probably more comfortable with broader ranges of variability in information, and with ordinal ranking of alternatives, rather than cardinal measures. At any rate, Mr. Meyer opined that the suggestion that one can accurately measure tribal values with cardinal measures is a faulty one.