

W.D. Donald Chery

First Draft
March 20, 1990

**NATIONAL RESEARCH COUNCIL
WATER SCIENCE AND TECHNOLOGY BOARD
DRAFT MINUTES
TWENTIETH MEETING--FEBRUARY 15-16, 1990
NATIONAL ACADEMY OF SCIENCES BUILDING
WASHINGTON, D.C.**

ATTENDANCE

Board Members

Michael C. Kavanaugh, Chairman
Norman H. Brooks
Richard A. Conway (2/15)
James P. Heaney
Howard C. Kunreuther
G. Richard Marzolf
Robert R. Meglen
Donald J. O'Connor (2/15)

Betty H. Olson
P. Suresh C. Rao
Patricia L. Rosenfield
Donald D. Runnells
A. Dan Tarlock
Hugo F. Thomas
James R. Wallis
M. Gordon Wolman

Absent

None

WSTB Staff

Stephen D. Parker
Sarah Connick
Sheila D. David
Chris Elfring
Jeanne Aquilino

Liaison Representatives and Guests

Carl Bartone, World Bank
David Bodde, CETS
John Cairns, VPI
Donald Chery, USNRC
Larry Clark, TVA
Peter S. Eagleson, CPSMR/CGER & MIT
Robert Hirsch, USGS
Michael Krouse, USACE
Luna B. Leopold (and Mrs.), U.C. Berkeley
Rick Linthurst, USEPA
John Maccini, NSF

Ian McGregor, NSF
Jay Messer, USEPA
Marshall Moss, USGS
Frank Osterhoudt, USDOJ
David Policansky, BEST
Richard Porter, BuRec
Stephen Rattien, CETS
William Roper, USACE
John Schaake, NWS
Frank Thomas, FEMA

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Thursday, February 15

CALL TO ORDER AND INTRODUCTIONS

Chairman Michael Kavanaugh convened the twentieth meeting of the NRC's Water Science and Technology Board at 8:30 a.m. on February 15, 1990 in the NAS Main Building, Washington, D.C. He welcomed the numerous guests, and subsequently all members, staff, liaisons, and guests introduced themselves.

AGENDA

The meeting agenda was reviewed and, with several changes, adopted. Kavanaugh asked each member to be thinking during the meeting about the Board's long-term agenda of studies so that a meaningful strategy discussion could be held during the last hour or so of the meeting on February 16.

MINUTES

Following a brief discussion, the minutes of the Board's nineteenth meeting, September 14-15, 1989 at Woods Hole, Massachusetts were approved with minor changes.

FUTURE MEETING SCHEDULE

Up-coming WSTB meetings are scheduled as follows:

- (1) 21st Meeting; August 6-7, 1990; Woods Hole, Massachusetts (NAS Study Center)
- (2) 22nd Meeting; December 13-14, 1990; Irvine, California (NAS Beckman Center)
- (3) 23rd Meeting; May 1991; Washington, D.C. (to include second Abel Wolman Distinguished Lecture)

NRC REORGANIZATION

Stephen Parker provided a briefing on the recent (February 5) reorganization of the NRC at the commission level. Since its creation in 1982 the WSTB has been responsible to the Commission on Engineering and Technical Systems (CETS) and the Commission on Physical Sciences, Mathematics, and Resources (CPSMR). The reorganization disbanded the CPSMR and established two more manageable commissions in its place: the Commission on Physical Sciences, Mathematics, and their Applications (CPSMA) and the Commission on Geosciences, Environment, and Resources (CGER). The Water Science and Technology Board will be reassigned from the CPSMR to the CGER, and its oversight will continue to be shared with the CETS, as in the past.

As a unit of the new CGER, WSTB will be part of the development and pursuit of an integrated agenda for the disciplines involved in the global geosciences--including

atmospheric science and climate, ocean studies, polar research, and water sciences and resources. This agenda will embrace the concerns of the 1990s, including national and international programs in global change, management of radioactive, toxic and other waste products of industrialization, the myriad future water resources issues, and resources for energy.

Parker indicated that the changes should prove as substantive as administrative. The importance of the environment is now recognized nationally and internationally, and the NRC looks to this new commission and its boards to provide leadership in this area. When the CGER becomes operational, its chairman will be M. Gordon Wolman and its executive director will be Stephen Rattien. Parker will be the associate director on a part-time basis, continuing as director of the WSTB.

MEMBERSHIP CHANGES

Michael Kavanaugh indicated that the terms of appointment for J. Heaney, R. Marzolf, and P. Rosenfield will expire on June 30, 1990 and thus this would be their last Board meeting before retirement. He thanked them for their many contributions. He then asked N. Brooks and D. Tarlock to join himself and S. Parker on an ad hoc committee to review nominees for appointment in July. (Parker was asked to formally canvass the members for nominations within a couple weeks.)

NEW AND DEVELOPING ACTIVITIES

Wastewater Management for Urban Coastal Areas

S. Parker provided an update on the status of funding for the Wastewater Management for Coastal Urban Areas project. The awards from the EPA Office of Estuarine Protection and National Science Foundation are expected to come through soon. In addition, the City of San Diego is providing \$100,000 in support of the study. Grants from these three sponsors and the National Academy of Engineering through its Technology and the Environment Program are expected to total approximately \$470,000.

Parker noted that there has been some confusion among EPA and some environmental groups over the intent of this study. He has spent much time in the past month talking about the project with interested groups including EPA and the San Diego City Council. Parker emphasized that the project is intended to be forward-looking with an emphasis on risk reduction and innovative technology, and not on relaxation of standards.

Sarah Connick brought the Board up to date on the status of the committee nominations package. The committee is expected to consist of 14 members having expertise

in environmental engineering, treatment processes, urban hydrology, marine geochemistry, pollution ecology, marine ecology, oceanography, public health, utility management, law, and environmental economics. Candidates had been identified for all but two slots, marine ecology and pollution ecology. Betty Olson pointed out the current heightened sensitivity in California of this topic and emphasized that the committee must be balanced appropriately with respect to bias. Don O'Connor expressed the point of view that the study should address the management of all residuals in a comprehensive manner. Mike Kavanaugh referred further discussions to the nominating subcommittee which consists of Kavanaugh, Brooks, Conway, Heaney, Olson, and Wolman.

Climate Change and Water Resources Management

S. Parker reported on the status of this study, requested by the Bureau of Reclamation. The activity is intended to assist the Bureau and other water management entities to better deal with issues of climate uncertainty. The committee, chaired by former WSTB member Stephen Burges, had been appointed but was still awaiting the financial agreement to be signed before scheduling their initial meeting to plan details of the study. This meeting should occur in late-March. Members pointed up that there is currently a great deal of attention being given to this area by many entities. A considerable effort must be given to distilling current published information and applying it most effectively.

Emerging Technologies in Water Treatment

Chris Elfving briefly reviewed the status of this developing activity. She explained that the proposal had been sent to about a dozen potential sponsors but that there were no clear backers. The American Water Works Association encouraged us to submit the proposal to their Research Foundations competitive grants system by April 1. The Bureau of Reclamation expressed some potential interest during FY91. M. Kavanaugh and S. Parker reported that their recent meeting with EPA representatives might have uncovered some interest in a Superfund-related variation of this topic.

Discussion focused on what "burning issues" were present to drive the proposal. The Board discussed whether this topic might somehow be addressed as a subcommittee of the upcoming Urban Coastal Wastewater study, but it was argued that, while related, the topic is bigger than a subcommittee could handle and the intended vision was broader. Since the issues appear in many WSTB studies, it was suggested that a colloquium could be designed to incorporate other committee experiences. The White House's Office of the Science Advisor was suggested as another potential sponsor, as was NASA.

N. Brooks stated that the proposal was too broad with too many objectives. He urged the WSTB to start with one piece and in time do other pieces as part of a series. That would make potential sponsorship more clear. R. Meglen stated that perhaps "de-focusing" was an alternative route. We could look to the future with an "inter-problem," interdisciplinary focus as a way to improve communications and share experiences between problem-solvers in different fields. G. Wolman suggested that a small colloquium focused on the marine angle might be appropriate because of the relationship to the coastal wastewater study. There was some concern, however, about concentrating too much WSTB energy in one area at one time. This issue should be addressed at the WSTB's August planning retreat.

A planning group was appointed (Howard Kunreuther, R. Meglen, R. Conway, and B. Olson) to consider the separately-funded (as opposed to WSTB sponsored) colloquium idea. They are to consider an ongoing 5-year approach that might, under the one umbrella theme, cover a number of related topics. One framework idea might be "what are the wastes of the future and are we beginning to plan to deal with them?" The first colloquium could be Emerging Water Treatment Technologies: A Focus on Wastewater. Beyond the technical questions, the sessions should look at the policy environment. Sponsors might include EPA, Orange County, or the Department of Energy. The audience would include technology developers, funders, and users. R. Conway advocated that the first symposium support the coastal urban wastewater study as that committee really needs bolstering in the treatment area, one of its central themes.

Techniques for Assessing Ground Water Vulnerability

S. Parker reported that the previous day's planning session for a Study of Techniques for Assessing Ground Water Vulnerability was a success. He found the group to be enthusiastic.

Suresh Rao then summarized the results of the planning session which was also hosted by WSTB members Hugo Thomas and Jim Wallis. He reported that the study fills a unique niche in that by taking a broad, forward-looking approach it builds on rather than duplicates other efforts, and that for this reason there is strong support for the study. As a result of the planning session, the study will focus on the limitations of techniques now available for assessing ground water vulnerability, and review their scientific basis and usefulness in view of current and future applications. The outcome of the study will be a guideline for developing the next generation of assessment techniques and the appropriate data bases to support them. The planning group identified a set of specific tasks, potential sponsors, and a preliminary list of potential nominees for this committee.

Discussions following Rao's summary focused on the uses of vulnerability assessment techniques as land use planning tools. In addition, it was clarified that the

techniques to be studied are those that address vulnerability to contamination introduced at the surface or near surface. The meaning of the term "regional" in this context was also discussed. M. Kavanaugh closed the discussions and appointed a project development nominating committee to be chaired by Rao, and including Thomas, Wallis, and S. Connick.

Review of Environmental Monitoring and Assessment Program

Sheila David explained that the EPA had requested a review of the surface water quality component of their new initiative, the Environmental Monitoring and Assessment Program or EMAP. A letter of request was reviewed. Additionally, a letter from EPA had been sent to the NRC's Board on Environmental Studies and Toxicology (BEST) requesting a review of the terrestrial ecology portion of the EMAP. The requested action for the Board was to decide if a review of EMAP should be undertaken, perhaps in conjunction with BEST.

Jay Messer of EPA's Office of Research and Development gave an overview presentation to the Board on the scope and purpose of EMAP. EMAP is intended to respond to the growing demand for information characterizing the condition of and the type and location of changes to the environment. The program is being promoted as answering the following questions:

1. What is the current status, extent, and geographic distribution of our ecological resources (e.g., lakes, estuaries, streams, wetlands, forests, grasslands, deserts)?
2. What proportions of these resources are degrading or improving, where, and at what rate?
3. What are the likely causes of adverse effects?
4. Are adversely-affected ecosystems responding as expected to control and mitigation programs?

EMAP is planned to provide the EPA Administrator, the Congress, and the public with statistical data summaries and periodic interpretive reports on ecological status and trends. It will provide a baseline on "the health of the environment" and if specific problems are found then more effort will be put into looking at the cause-effect relationships. After Messer's presentation, the Board discussed the possibility of a review of the program.

M. G. Wolman felt that the present letter of request to the Board was too narrow and vague. He would like to see clearer tasks stated for such a committee and much more coordination with other Boards of the NRC. The Board should raise issues as to where the ultimate data will be used and how it will be tied into policy questions and decisions. Several members felt that EPA may have come to the Board for review of the program at

too late a date. Both EPA representatives assured the Board that the program was in the formative stages and they would welcome any assistance such an NRC review committee could provide.

J. Heaney, who is also a member of the NAWQA committee, stated that there was no direct overlap between EMAP and NAWQA. NAWQA focuses on rivers and ground water only while EMAP focuses on lakes, streams, estuaries, rivers, forest, soils, etc. Heaney stated that NAWQA too has a problem addressing cause-effect relationships.

After a lengthy discussion it was decided to approve the project in principle and to form a steering committee consisting of two WSTB members and two BEST members plus staff of these Boards. The steering committee would discuss more focused tasks for the committee or committees with agency representatives and write a proposal for presentation to the Boards, CGER, and the NRC Governing Board.

PRESENTATION ON OPPORTUNITIES IN THE HYDROLOGIC SCIENCES

Peter S. Eagleson made a presentation on the study of Opportunities in the Hydrologic Sciences, about to be completed by the WSTB committee which he has chaired over the last two years. After reviewing the project history and describing the study process and report format (currently in review), Eagleson stressed the recommended actions, identified in the report. These include the establishment of a research grants program, coordinated field experiments, long-term hydrologic observations, and emphasis on the geosciences in graduate training for hydrologic scientists. A lively discussion followed this discussion, including comments by John Maccini concerning the future of grants for hydrologic sciences in the NSF.

Another line of discussion was on the audience and hoped for impact of the report; Board members observed that a concerted effort should be made to distribute the report to college administrators.

LUNCH BREAK

12:30 to 1:15 P.M.

SEMINAR ON RISK ASSESSMENT AND RISK MANAGEMENT IN WATER RESOURCES--A SOCIAL SCIENCE PERSPECTIVE

Howard Kunreuther led an informal seminar titled "Risk Assessment and Risk Management in Water Resources--A Social Science Perspective." Kunreuther began his talk

pointing out that human behavior does not always conform to what appears to be scientifically rational. As a social scientist or "irrational economist," he finds that it is important to understand and resolve the tension that exists between public perception and scientific perception in order to develop a successful strategy for risk management.

Using hazardous waste management as an example, Kunreuther described how economic costs and other factors fit into the framework for risk assessment and development of risk management strategies. Past problems arising in the area of hazardous waste management are being addressed under the auspices of Superfund. Currently, hazardous waste management strategies focus on waste reduction and improved treatment and disposal facilities. For the future risk assessment and risk management will be important tools for dealing with hazardous waste management. Kunreuther focused on four key areas: 1) how dangerous are hazardous wastes?, 2) public perception of risk, 3) role of benefit-cost analysis, and 4) role of incentive systems in dealing with waste.

In the first area, how dangerous are hazardous wastes, the question that a risk assessment is designed to answer, there are several important considerations that must be made. The accuracy of a risk assessment may have an impact on how firmly a risk management decision can be said to be scientifically sound. Further, the nature of the exposure--past, present, and future--should influence the type of risk management strategy adopted. For example the potential of a waste to migrate to a drinking water supply must be considered. Finally, the impact of any remedial action on risk should factor into a risk management decision. For example the costs and risks associated with digging up and transporting contaminated soil to a new disposal site should be weighed.

With respect to public perception of risk, there are several important factors that can have an impact on the success of a risk management strategy. Characteristics of public perception of risk include: fear of chemicals (invisibility, latent effects, dread), feeling that there is no method of predicting the behavior of chemicals, increased ability to detect minute levels of toxic substances, desire for zero risk, disbelief of experts because experts often disagree, increasing cautiousness as individuals' economic situations improve, and fear of devaluation of property. Kunreuther pointed out that it is important to understand public perception of risk in order to be able to respond to it and improve one's chances of developing an effective and acceptable risk management plan.

In the area of economic benefit-cost analysis, Kunreuther pointed out that the key questions for addressing cleanup problems are different than those for addressing the management of present and future wastes. When looking at a cleanup problem the economic tradeoff is the reduction in risk to the exposed population versus the cost of achieving the reduction. The balance of these tradeoffs will help answer questions such as

what should the pace of cleanup be? and how much cleanup should be done? Other questions that must be answered include what are the capabilities of available cleanup technologies?, and who pays for the cleanup of past wastes?

For present and future waste management strategies, the focus is on the reduction in risk versus the increase in production costs. To develop an effective waste management strategy in this area, it is important to know what production and control technologies are available, what the cost of mitigation or source reduction measures is, and what is the liability associated with the production of waste.

Several incentive systems for dealing with hazardous waste management problems were mentioned, including the existing Superfund approach in which chemical and petroleum companies are taxed to establish a fund to cleanup the most dangerous hazardous waste sites. The government then attempts to recover cleanup costs from companies who were responsible for contamination. Another approach that has been proposed is to tax all existing corporations to generate funds for cleanups. Alternatively, another proposal would make any a company liable for 100 percent of the cleanup costs at a site regardless of their original contribution of waste to the site. The liability would be reduced to the proportion of their contribution to the problem if they cooperate with the government in providing information on the relevant waste treatment and disposal procedures and practices. Different types of incentives are built into each of these approaches with the aim of improving the processes for deciding upon and implementing remedial actions.

Three studies currently underway on the role of social science in risk assessment were mentioned: 1) Survey of How the Public Feels about Waste and Cleanup at the University of Tennessee, 2) Magnitude of the Superfund Problem by the Rand Corporation and the University of Illinois, and 3) Perception of the Liability System for Cleanup by Different Stakeholders at the Wharton School, University of Pennsylvania.

In conclusion, Kunreuther summarized that: 1) conflicting information makes tradeoffs difficult for the public, 2) public perception of risk is affected by many factors, 3) we are limited by what we know and what we can do, 4) any effective strategy must recognize the desire for zero risk, and 5) there is a price for risk reduction that must be paid by someone.

RESTORATION OF AQUATIC SYSTEMS: SCIENCE, TECHNOLOGY, AND PUBLIC POLICY--Discussion with committee chairman John Cairns

S. David stated that this committee was fully funded and has met twice since October 1989. The committee has developed a report outline and selected case studies of both successful and failed restoration attempts for review. The committee has been

divided into several panels: rivers, lakes, wetlands, and large integrated aquatic systems. They felt that a key issue is to review restoration attempts emphasizing how water systems affect each other by looking at large integrated aquatic systems. The committee believes that this would be a valuable contribution to the restoration literature.

John Cairns, chairman of the committee, was introduced. He stated that the committee was gathering information on the case studies under review and writing assignments were due before the May meeting. He explained that the committee had defined "Restoration" as meaning the return of an ecosystem to the closest approximation to its previous condition prior to the disturbance with which we are concerned.

Cairns mentioned that two committee members seemed to want to refocus the study to look at cost-benefit aspects of restoration activities past and future. He has had to remind the committee that the primary goal of the study is to determine the feasibility of restoration from an ecological standpoint. While cost-benefit is important, the committee should be analyzing each restoration project for its scientific validity.

The Board concurred that the committee should review large integrated aquatic system restorations as well as reviewing separate case studies of lakes, rivers and wetlands. The Board agreed that the committee should continue along these lines. S. David mentioned that the hydrologist on the committee, Clarence Skau had resigned due to health reasons and requested suggestions for another nominee to the committee with this expertise. The next meeting is scheduled for May 2-4, 1990 in Chicago. Betty Olson and M. Gordon Wolman, WSTB liaisons are invited to attend this meeting.

MEXICAN ENVIRONMENTAL PROBLEMS

Mike Kavanaugh briefly outlined the goals of a cooperative program being initiated by the NRC Executive Office and the Mexican Academies of Sciences and Engineering to build a science and technology partnership for Mexican economic development. A component of this program is envisioned to focus on environmental issues in Mexico, which is where an effort by the WSTB may be germane. Specifically, Phil Smith believes that the complex issues surrounding water resources management in Mexico City provide fertile scientific, technical, and policy topics for pursuit as a cooperative study effort with the Mexican academies.

Discussions following Kavanaugh's introduction focused on the motivation and potential benefits of entering into such an activity, and on the nature of Mexico City's water problems. Pat Rosenfield questioned the underlying motivation of this type of effort noting that advice from the north when provided without invitation often goes unheeded. She felt that any such effort would require the active involvement of the

Mexican scientific and political communities. She noted that there are many other entities, including foundations and government agencies, currently involved in helping Mexico resolve these types of problems and that the Academy must determine first how its effort would fit into the existing framework.

Steve Parker then introduced Carl Bartone of the World Bank's Urban Development Division. Bartone provided a brief synopsis of the water problems currently faced by Mexico. According to him, the development of urban water supply and sewerage has been in "remission" since 1976 and agricultural irrigation policies are inadequate. He cited the lack of operational capacity at the local level as a major problem. Bartone noted that while Mexicans are aware of the technical water quality problems and the importance of water quality issues to tourism, the primary obstacle to the improvement of conditions has been the lack of economic incentives. In Mexico City, for example, water is heavily subsidized by the federal government and user fees recover only approximately six percent of the current investment while conservation is unheard of.

Although little effort is made to conserve water in Mexico City, all of the city's wastewater is reused for agricultural purposes. Sewage treatment capacity for Mexico City meets only a small fraction of the city's needs, actual treatment is much less than capacity. Raw sewage is transported via canals to agricultural areas where it is used for irrigation. Bartone suggested that a potential study area may be to look at the risks associated with wastewater recycling for agricultural purposes and the effects on other downstream users.

Bartone cited the recent establishment of the National Water Commission by the Mexican President as a sign of encouragement that progress can be made in the area of water resources. He believes that this commission would be the appropriate level of contact for any NAS effort in the water resources area.

Betty Olson seconded the usefulness of studying wastewater reuse issues pointing out that findings in the area of microbiological risks would be of interest to both countries. She also expressed an interest in having the Board look at problems of subsidence in Mexico City due to ground water mining. Jim Heaney saw an opportunity to broaden the Board's efforts to include a look at infrastructure development.

Rosenfield emphasized the need to keep sensitivities in mind in pursuing this type of an undertaking. She stressed the importance of respecting the expertise and accomplishments of Mexican scientists and suggested that the topic selected for study should be one that presents a problem common to both countries. Bob Meglen agreed and added that it would be important that this activity not be a "guinea pig-type" effort. Norm Brooks concurred and added that these types of problems require a holistic approach.

Kavanaugh reiterated that Smith's intention is to pursue any activity in a cooperative spirit.

Sources of support for such an initiative were then considered. Kavanaugh suggested that the World Bank might ask the Academy to do a study. Olson suggested that an activity could take place under the auspices of scientific exchange. Rosenfield thought that the Ford and Rockefeller Foundations might have an interest in an exchange-based undertaking. Dan Tarlock suggested that a joint colloquium might be the most appropriate form for the project to take.

Suresh Rao concluded that the Board has agreed that it will become involved in international activities on a case-by-case basis, assuming a country expresses its need and the project is responsive to the Board's mission. Further, if an international project is to be undertaken, it must be in collaboration with the other country's equivalent of the NAS and have significant potential to affect policy. Board members agreed with these statements and deferred discussions until the following morning when Smith was scheduled to address the Board by telephone.

RECESS

3:45 to 4:00 P.M.

THE ABEL WOLMAN DISTINGUISHED LECTURE "ETHOS, EQUITY, AND THE WATER RESOURCE" BY LUNA LEOPOLD

At 3:45 p.m. the business meeting adjourned and the members joined some 250 guests in the NAS Auditorium for the inauguration of the Abel Wolman Distinguished Lecture Series. Following introductory remarks by WSTB Chairman M. Kavanaugh and M. G. Wolman, Luna Leopold lectured for one hour on the subject of "Ethos, Equity, and the Water Resource." This was followed by a reception in the Great Hall. At 6:00 p.m. the meeting adjourned for the day.

Friday, February 16

DISCUSSION OF LECTURE AND IDENTIFICATION OF SECOND LECTURE

It was agreed that Professor Leopold had delivered a successful lecture on the previous evening. Leopold had many criticisms for federal agencies whom he believes are failing to protect water and land resources under their jurisdiction because they have "a

special interest bias and short-term outlook." Leopold had noted that most federal agencies do not do long-range planning to provide for the overall common good.

Leopold's comments prompted much conversation at the Board meeting about how NRC studies are selected and the criteria used by the WSTB in selecting which projects to accept.

Dr. Leopold's lecture will be published in the March 1990 issue of Environment magazine. Several persons were suggested to deliver the next lecture including Dan Okun, University of North Carolina at Chapel Hill; Gilbert White, University of Colorado; M. Gordon Wolman, the Johns Hopkins University; and Harold Thomas of Harvard University. Dan Tarlock, chairman of the lecture steering committee will discuss a list of candidates with the staff so that a selection can be made before the August 1990 Board meeting.

NEW AND DEVELOPING ACTIVITIES (CONTINUED)

Hydrology in the Everglades Ecosystem

C. Elfring, at S. Rao's request, has been investigating the potential for a WSTB study relating to the hydrologic problems in the Everglades ecosystem. According to her review, the Everglades face many serious water-related problems--problems of both water quality and water quantity. Some of the issues include agricultural pollution (fertilizers, pesticides, and nutrients); mercury contamination; habitat loss; drought effects; disruption of natural wet/dry cycles and the repercussions of this; and population growth and water needs. The issue is receiving lots of attention--there are ongoing conflicts among agricultural, industrial, and environmental perspectives; political conflicts at the local, state, and federal levels; recent legislation, which will expand Everglades National Park by 107,000 acres at a cost of more than \$40 million, and which orders the Corps of Engineers to restore the natural flow of water; and a pending federal lawsuit against the South Florida Water Management District.

WSTB members discussed various aspects of these problems, noted the politically charged atmosphere present, and debated what special perspective we might add to the issue. Some members argued that our role could be important simply as a referee, to review options for solving the various problems in an integrated way, and assess that all the options, including unpopular ones, are being explored. WSTB members agreed that this type of study should be requested of us, rather than self-supported. Sponsors might include the National Park Service, the Corps of Engineers, the State of Florida, the South Florida Water Management District, and related foundations.

To conduct such a study, we would need to make a strong case for the national importance of the issue. There was broad consensus among WSTB members that the

Everglades ecosystem is a unique national resource and thus our participation is justified. We would have to refine, however, what focus to pursue that gives an appropriate charge--what generic issue underlies the specifics of the case. One related possibility would be to take the Everglades issue and broaden it--what are the important hydrologic problems in national parks in general (e.g., Yellowstone and Yosemite also face water-related problems). There are many conflicts related to water and its management that affect the parks broadly, particularly related to the National Park Service's ability to control conditions outside the parks (external threats).

It was noted that the Restoration of Aquatic Systems committee is using the Everglades as one of their case studies under the integrated systems category, and the timing and coordination with this effort will be important. WSTB members agreed that this initiative should be pursued further. The key issue is what generic questions can the WSTB constructively address and who would want them answered. A subgroup including S. Rao, J. Heaney, D. Tarlock, and C. Elfring was appointed to study the issue further and report back to the WSTB with further recommendations at the next Board meeting in August.

Mexican Environmental Problems (continued)

Phil Smith addressed the group at 9:00 a.m. on February 16 by speaker phone. He first briefed the board on recent NRC structural changes that have resulted in the formation of the Commission on Geosciences, Environment, and Resources (CGER) which shares oversight of WSTB with the Commission on Engineering and Technical Systems (CETS). Smith then provided the board with background information on the Mexican initiative. Over the years, the institution has had relations with science and engineering academies in other countries, but never with its counterparts in Mexico. The development of relations with the Mexican academies was on Frank Press and Smith's agenda when they came to the NRC in 1981, but was not a feasible goal until 1987 when changes in the Mexican government presented some new opportunities. In the summer of 1988, Smith and his colleagues made connections with their Mexican counterparts, visited them, and acquainted them with the NRC process. Since then he and others have worked with Rodman Rockefeller of the Mexican-U.S. Business Committee and made four more trips to Mexico to develop a cooperative program of activities of mutual interest to foster science, technology, and innovation in Mexico.

Smith outlined the three major thrusts of the program: 1) strengthening the Mexican research infrastructure, 2) initiation of joint policy studies, and 3) improving science and math education. Smith elaborated on the second area noting that it is where he

envisions a WSTB undertaking. Recognizing that what the institution does best is policy studies and that its traditional role of fostering communications in the international scientific community is rapidly becoming obsolete, the institution is now becoming interested in conducting joint policy studies with other countries. With respect to Mexico, three such studies are envisioned: 1) identification of technical opportunities for the modernization of the Mexican economy with a focus on indigenous science and technology, 2) agricultural issues, and 3) environmental problems.

WSTB's involvement would center on environmental problems. Specifically, Smith would like the board to look at water problems in Mexico City. He outlined some of the concerns regarding supply, distribution, sewage, and industrial wastes, and emphasized the urgency of these conditions as the city's population skyrockets. He reported that a \$110,000 grant from the Tinker Foundation could be used to support a two-phase exploratory effort consisting of an initial visit to meet and discuss a potential effort and a second meeting of a larger group to develop a jointly organized and planned project.

Tarlock then inquired about the receptivity of the Mexican academy officials. Smith assured the board that his Mexican counterparts are very interested in pursuing joint activities and have been extremely receptive to the institution's participation thus far. Rosenfield followed up on Tarlock's concern inquiring about the receptivity of Mexican decision makers, efforts to build linkages with Mexican agencies, and prospects for joint funding of any proposed activity. Smith stated that he and others have worked and are continuing to work to ensure that these necessary and appropriate connections are in place. He assured the committee that any effort on the part of the NRC would be in full collaboration with the appropriate Mexican institutions. Sheila David inquired about the status of the administrative structure at the Mexican academies. Smith reported that they are not staffed in the same way as the NRC, but that any effort would include cooperation among staffs of the organizations too.

Kavanaugh thanked Smith for addressing the committee and providing it with such an interesting opportunity and Smith then hung up. The board then discussed how such an activity could be successful in demonstrating the NRC process to the Mexican scientific and decision making communities and produce a result that was meaningful from a technical and policy standpoint to both nations. Board members were unable to arrive at a topic that filled these criteria and agreed to give the concept more consideration at a later date.

REVIEW OF STATUS OF EXISTING ACTIVITIES

Ground Water Recharge of Surface Mined Sites

J. Wallis, a member of this study committee, and S. Parker reported on this nearly completed study. Wallis commented that, after several months of assessment and trips to mining areas, the committee had crafted what should be a useful report to the Office of Surface Mining and others interested in hydrology of mining areas. The committee had essentially concluded that recharge capacity need not be computed but should be maintained if prescribed mining and restoration practices are followed. The committee's report, due out in March, will cover recharge, water quality, and legal aspects of mining area hydrology. The report also will recommend development of hydrologic data bases at the state level and topics for pursuit by researchers.

Glen Canyon Environmental Studies

R. Marzolf, chairman of the committee gave a brief summary of the history of this committee from its inception in 1986. He mentioned that one of the committee's recommendations from its River and Dam Management report issued in 1987 was partially accepted. However, the recommendation was that the Bureau of Reclamation needed a day-to-day Science Advisory Board and that five or six persons should be hired to provide this expertise to the researchers. The committee recommendations went on to say that the Board should be placed at the Department of Interior level and not at the Bureau of Reclamation level, so that it would be above all the sister agencies involved in the GCES. He explained that instead of doing this, the DOI hired a senior scientist and former committee member, Duncan Patten, on a part-time basis to provide the GCES researchers with scientific guidance.

Marzolf and David then discussed the present role of the committee in organizing a symposium. The symposium, The Colorado River Ecosystem and Dam Management, will be held May 24-25, 1990 in Santa Fe, New Mexico. The symposium is being built around 10 background papers designed to gather all existing information on the Colorado River ecosystem both before and after Glen Canyon Dam was built. The papers will be historical in their approach and will provide a review of the existing literature, both of which are required for the interpretation of recent investigations and for the planning of continued work on the river. It is hoped that the state-of-knowledge will be established with the publication of these papers in an NRC report.

Also discussed was the announced Environmental Impact Statement to be conducted on Glen Canyon Dam operations and to be completed by December 1991. This tight deadline has placed much pressure on Patten and the GCES researchers to complete their

research in 14 months which may be detrimental to conducting some of the needed research. Several WSTB members and Luna Leopold felt that a letter should be written to the Secretary of Interior and signed by M. Kavanaugh stating some of the problems the committee believes are unresolved. Marzolf agreed to draft this letter and have it reviewed by the committee before sending to Kavanaugh for signature and transmittal.

National Water Quality Assessment Program

S. David stated that the committee was in the process of finalizing its conclusions and recommendations to the USGS. An interim report was delivered to the USGS in September 1989. The emphasis of this committee has been on the utility and design of the NAWQA program. A key issue is how the USGS plans to synthesize the regional data being gathered to provide a perspective on national trends. David mentioned that this has been a particularly difficult project to review as the program is constantly changing and evolving.

H. Thomas mentioned that he had participated as a member of one of the USGS national coordinating committees which USGS calls upon to help with portions of the assessment. Thomas felt that there are several major issues that must be addressed by USGS such as the integration of the surface and ground water study units and atmospheric; how will this be done; how will the USGS select which third of the selected basins to review and will there be an outside review of this selection process? Thomas felt that there should be continued review of the program especially concerning ongoing land use and land classification, use of data now being collected by the scientific committees, and the data management community.

J. Heaney, WSTB liaison to this committee, agreed with Thomas on many of his points. He felt that the review of the NAWQA study revealed some problems that should be discussed by the Board in relation to their criteria for accepting studies which review ongoing programs. He stated that if a review of EPA's EMAP program was accepted by the Board, one or two members of the NAWQA committee should serve on that committee as they now have experience in reviewing evolving water quality assessment programs.

Committee on Water Resources Research

S. Parker provided an update on the activities on this "standing" committee, which had last met in September 1989 and was scheduled to meet February 22-23. A membership rotation had just occurred. The committee, chaired by Walter Lynn, had a variety of issues on its agenda, such as the "institutes and grants" program and others, but currently is focusing its efforts on a broad report on a variety of management issues for consideration by the U.S. Geological Survey as it prepares for the future--its data networks, relations

among its districts and research programs, and relations with universities, for example. Parker pointed up that while this committee has been in place for five years its agenda remains dynamic and vigorous. Members of the committee find the committee satisfying and interesting as evidenced by their level of participation.

Western Water Management Change

D. Tarlock and C. Elfring reviewed the activities of this ongoing project. D. Tarlock summarized the basic question being asked as "what happens when water in the West is reallocated--who wins and who loses?" The committee's focus is on who has been excluded in the past. To prepare a report, the committee has decided to use a case study approach. The Truckee-Carson basin in Nevada and Arizona have been visited so far. Subcommittees of four to five people will soon conduct visits to the Imperial Valley in California and northern New Mexico. Other case studies will follow. The committee also has begun substantive debates on what the real issues are and how this committee can make a unique contribution to the literature. The committee's next two meetings have been scheduled (each including a case study): May 21-22 in Fresno, California, and July 16-17 in Denver, Colorado.

Irrigation-Induced Water Quality Problems

R. Meglen and C. Elfring reviewed the final activities of this committee (scheduled to end March 30, 1990) and plans for a transition to a follow-up committee. R. Meglen summarized the "deliverables" produced over the course of the study: letter reports, the final report, the outreach workshop to the Western States Water Council, and a final letter to be drafted for the WSTB.

Regarding the committee's workshop with the Western States Water Council, R. Meglen reported that the audience was larger than expected at about 40 people, but it was not very participatory. The members who spoke did an excellent job with their presentations but the workshop was more formal than expected. After-the-fact feedback from the WSWC indicated that they were in fact greatly interested and that our presentations were helpful in their process of determining what issues deserve attention. They explained that they are used to being briefed on issues, not to a format of give-and-take as we had hoped. The committee concluded that some after-publication dissemination of WSTB reports is very productive, especially as in this case where the information can be targeted to relevant decisionmakers. It recommended that similar avenues be used for future WSTB studies.

The committee specifically asked R. Meglen to pass along its strong support for the use of letter reports. When a committee is charged to provide guidance to a developing research program, the letter reports are critical mechanisms for providing careful but timely commentary. Much of this committee's effectiveness can be traced directly to its letter reports. The committee asked the WSTB to consider what routes of communication are available to committees carefully as it is designing their statements of task. The committee also commented via R. Meglen and C. Elfring about the DOI's request for a follow-on study to look specifically at the National Irrigation Drainage Program. There was much debate within the committee about the potential value of a new committee, with some members believing that this was an appropriate time to end this association. Although the committee in the end recommended that such a committee be formed because there are places where constructive outside advice can continue to improve the program, they warned that the charge must be designed so the new committee does not fall into the role of "consultant" to the program or simply be used as a "good housekeeping seal" of approval. The WSTB noted that approval of the project was voted at the last meeting. It agreed that the activity would terminate at the end of its 18 month term. If the DOI requests further advice on the topic, they should be encouraged to develop an in-house science advisory capacity.

C. Elfring was directed to work with a nominating group consisting of R. Meglen, D. Tarlock, and G. Wolman to sort the many nominations received and prepare a slate of candidates and alternates for the new committee.

Committee on International Soil and Water Research and Development

S. Parker reported that this committee, overseen jointly with the Board on Science and Technology for International Development, had recently been appointed. It is chaired by Leonard Berry of Florida Atlantic University; Suresh Rao will serve as the WSTB liaison/ex officio. The committee, charged with advising the U.S. Agency for International Development on its world-wide programs in soil and water management, may become more important and active than originally anticipated as sustainable development becomes increasingly emphasized in AID. Several WSTB members commended the high quality of the committee that had been appointed and expressed enthusiasm for the project. It is expected that the initial meeting of the committee will be scheduled for mid-April.

LUNCH BREAK
12:00 NOON to 1:00 P.M.

UNFINISHED BUSINESS AND DISCUSSION OF PLANNING FOR STRATEGY DEVELOPMENT

Following the lunch break, the opportunity was taken to bring to closure many issues relevant to individual projects; these decisions are reflected in the preceding discussions. Once this was accomplished, Kavanaugh reviewed plans for the Board's August 1990 meeting at the Woods Hole Study Center. This meeting will be devoted to "looking ahead" and development of a long-term strategy of studies for the Board. Several ideas were presented as excellent examples of appropriate Board initiatives. It was agreed that all members should provide ideas in writing to the staff by March 30. These will then be reviewed and organized by the ad hoc subcommittee of Meglen, Rao, Thomas, and Parker and become focus of discussions for the August meeting.

ADJOURNMENT

The meeting adjourned at 3:00 P.M.