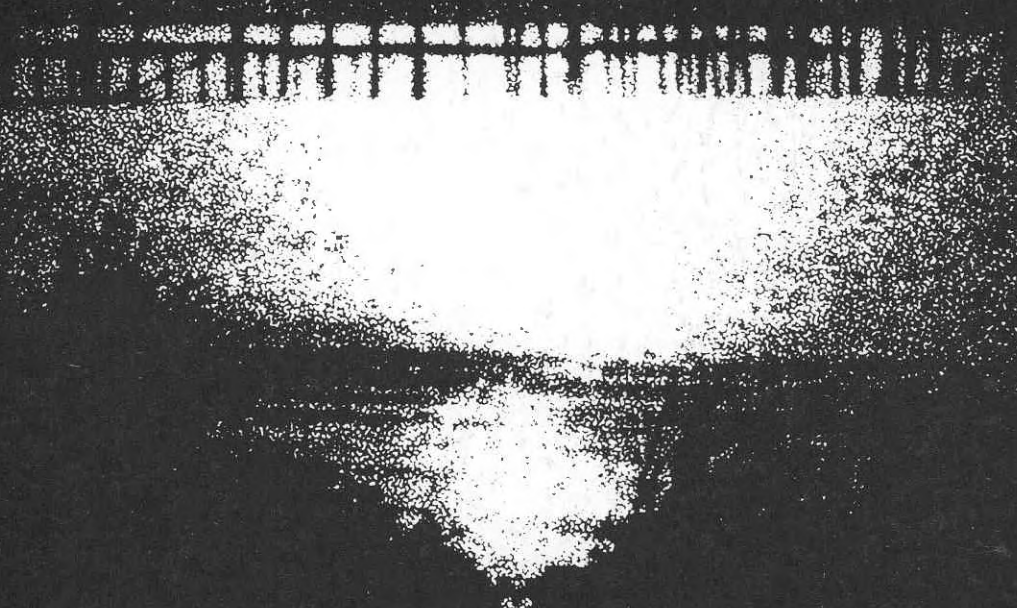


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REPORT OF THE
SCIENTIFIC REVIEW PANEL
ON

**The Chesapeake Bay Program
of
The U.S. Environmental Protection Agency**

December 1979

Chesapeake Research Consortium
Publication No. 71

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ON
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OF
U.S. ENVIRONMENTAL PROTECTION AGENCY

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3 December 1979

Dr. David A. Flemer
Acting Director
Chesapeake Bay Program
U.S. Environmental Protection Agency
2083 West Street, Room 2E
Annapolis, Maryland 21401

Dear Dr. Flemer:

With this letter is transmitted the Report of the Scientific Review Panel on the Chesapeake Bay Program in compliance with Grant 3210010.

The Panel worked intensively and skillfully in preparing a consensus report on the scientific merit of projects and programs and in the suggestion of emphases for the Program -- all with recognition that these studies are intended to assist management agencies in their decisions and actions. My judgement is based only on observation of the conscientious work of the members of the Panel and on the de-briefing on November 30th. I will receive the Report simultaneously with the Environmental Protection Agency.

The cooperation of federal and state officials, of program officers and of investigators with the Panel was generally excellent. The Panel was supported fully but unconstrained. Since they were chosen without control of the agencies, these courtesies give evidence of willingness to accept vigorous review and comment.

It is appropriate to emphasize that the information available to the Panel was limited to the contents of the volume of Status Reports and related material, the oral presentations at the Workshop and limited discussion with some of the participants. The Panel restricted its attention to the science and management aspects of the Program, with the exception that they avoided suggestions of large and expensive modifications.

Chesapeake Research Consortium, Incorporated

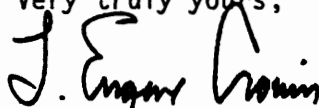
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Dr. David A. Flemer
3 December 1979
Page 2

I wish to express appreciation to the Management Committee of the Program, to participating scientists, to citizens and to others for nominations of possible Panel participants. Many fine persons were suggested and I believe that the final Panel was balanced and effective. They expressed high personal enthusiasm for the Program and wishes for its success.

Very truly yours,

A handwritten signature in black ink, appearing to read "L. Eugene Cronin". The signature is written in a cursive style with a large initial "L" and "E".

L. Eugene Cronin
Director

LEC/dmr

Enclosure

SCIENTIFIC PANEL
TO CRITIQUE
EPA CHESAPEAKE BAY PROGRAM

November 1979

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1.0 SUMMARY OF THE PANELS CONCLUSIONS AS PRESENTED TO THE CHESAPEAKE BAY PROGRAM MANAGEMENT COMMITTEE

Please take our comments as a 3rd party panel. Panel members lack the practical, personal, or scientific insights that have resulted from the perspective of over 30 months of consideration and debate. Our basis for comment rests on the Workshop Workbook, the presentations by Program Officers and Principal Investigators, and innumerable informal solicited and gratuitous comments at the meetings. The nature of this report is to be critical, and it does not adequately reflect the many favorable aspects of the Chesapeake Bay Program.

We have measured and prioritized each project against stated EPA program objectives, we have suggested project modifications and redirections to better meet stated objectives and in some cases we have suggested a sharpening or modification of EPA objectives. In addition, we have reviewed both intra and inter program coordination. The conclusions and recommendations reported in this section are unanimous.

1.1 Overall Program Comments

1. There appears to be no articulated, ordered plan for the entire study;

2. Each program of the study should be explicitly synthesized.

Suggested steps to achieve such synthesis include:

- a) inter-institutional field and/or lab operations;
- b) meetings between P.I.'s and Program Officers to discuss both the scientific results and management implications of the individual projects;

- c) meetings of both scientists and managers to determine the management implications of the over-all program results;
- d) specifically funded synthesis efforts

3. Peer review could have been conducted earlier and certainly should be continued;

4. There is inadequate communication among individual program elements and there are no formal integration studies between each program;

5. There is no formal preparation for the time when the CBP has been concluded.

1.2 Public Participation Program

Public Education

- 1. The scientific results should be effectively presented;
- 2. Scientists should be directly involved in the public education process;
- 3. Other appropriate research efforts in the Chesapeake should be reported in the public education effort;
- 4. More of the projects should be conducted in conjunction with Sea Grant efforts to prevent duplication of effort;
- 5. The CPCB should solicit local funding sources to continue its public education efforts.

Citizen Involvement

- 1. EPA should clearly define the role of the Citizens Steering Committee, particularly in the development of management strategies;
- 2. The CPCB should make an effort to maintain a broad-based Bay-wide representation on the Citizens Steering Committee, and explore the possibility of continuation of such a committee beyond the CBP;

3. Every effort should be made to establish informal meetings between investigators and affected interest groups as data become available;

4. Future forums sponsored by CPCB should focus on scientific results and management alternatives.

1.3 Submerged Aquatic Vegetation (SAV)

1. The panel feels that the overall SAV program represents excellent science, management strategy potentials, and should be funded for the full term of CBP.

2. We feel that the overall synthesis function for this program is very weak. A synthesis strategy needs to be developed now, involving Principal Investigators and Program Officers;

3. The program elements with the lowest degree of relation to EPA needs are the transplant studies, particularly those involving seed propagation;

4. The SAV program, in particular, provides an opportunity for a potential effects focus, and provides an historical perspective on the effects of humans. This program has a significant biological perspective and nutrient emphasis, both of which provide a mechanism not only to evaluate historic changes, but also to evaluate present inputs of toxics and nutrients. This will only evolve, however, through full term funding and strong integration between SAV, Toxics, and Eutrophication principal investigators and program managers.

1.4 Toxics

1. The panel agrees that the baseline study is the appropriate

first priority under the following conditions. There has been much concern recently about the validity of the baseline determinations when natural variations are considered. Thus, we recommend that program managers consider a tradeoff of some of the mapping and spatial detail of toxics in sediments for studies of diurnal, seasonal, and extreme events as natural variants on the baseline of toxic substances.

2. The panel feels that the point source effort might better be directed to measure toxic fluxes at the sub-estuary mouths and should focus on particulates and fluid muds. We recognized that such measurements are technically difficult and recommend, at the very least, that a portion of the point source effort be redirected to obtain toxic baseline data in each important subestuary through the turbidity maximum;

3. With a stated objective of gauging the health of the Bay, we feel that there should have been a significant effort on biological effects work to provide some assessment of either deterioration or amelioration in the bay; the panel does not know whether time or resources could be available for such an effort, but we do feel that closer interaction between this and the SAV program has the potential for placing both programs on a stronger biological and chemical basis regarding the health of the Bay;

4. Mass balance and flux estimates of the redistribution, transport, and accumulation of toxics in the Bay must be initiated. A major synthesis effort must be designed, starting with integrated field sampling and concluding with implementation of a non-field modeling phase;

5. The panel has not been able to identify any formalized effort which will take the data and scientific conclusions of the toxics program and integrate them into a management plan;

6. A set timetable for production of organic toxic data should be developed.

1.5 Eutrophication

1. The panel feels that the four watershed studies will fail to meet their intended purposes; and, even at this late time, it is suggested that this portion of the program be totally redirected. We do not sense that there is any serious experimental design in these projects which will meet the management needs of the non-point source portion of the eutrophication program; the panel recommends strongly that large watersheds of 1000 square miles or larger be used for non-point source studies. SCS, USGS and NWS data are already available for this purpose.

2. The panel has been unable to find any focus on the vital interplay between nutrients and biota, except in the efforts underway in the SAV program. We feel that much more intensive effort on nutrient dynamics needs to be considered;

3. A monitoring program should be developed immediately which involves nutrients, phytoplankton, productivity, and other appropriate biotic measures of enrichment. As a management tool for the inference of nutrient dynamics, the proposed hydrodynamic model will not provide proper information. We suggest that a more simplified model may well be appropriate, and that remaining resources should be redirected to the above mentioned monitoring program;

4. As with the TOXICS program, the panel sees no formalized attempt at program data and concept synthesis to develop a management plan.

1.6 Data Management

The panel encourages EPA to fund efforts to:

1. Produce data reports and summaries that graphically present distributions of common parameters;
2. Synthesize and interpret data to form new or revised concepts of Bay processes. The real goal is not more data, but new or improved understanding of how the Bay works.

1.7 Environmental Quality Management

1. The panel recognizes that an important part of the CBP is the development of management inventories as well as scientific hypotheses and concepts. In order to transfer scientific data into regulatory legislative action, it is essential to integrate the management studies and scientific results. We recognize that EPA intends to do this by developing alternative control strategies but little thought has been given about the mechanism for the development of such strategies. This mechanism must be developed carefully and immediately;

2. The CBP should make a concerted effort to develop a mechanism to take the alternative control strategies to the public sector. This does not mean that CBP/EPA should advocate a particular control strategy, but rather it should assure that a transfer mechanism is in place before program termination.

1.8 Summary of Major Panel Recommendations

Delete Or Modify

Watershed Studies

Hydrodynamic Model (as now conceived)

Transplanting Studies

Point Source Assessment (as now conceived)

Add

Nutrient Dynamics

Sub-Tributary Toxics

Synthesis Mechanism for Determining Alternative Control
Strategies

2.0 CHESAPEAKE BAY PROGRAM'S PUBLIC PARTICIPATION PROGRAM

I. OVERVIEW

The panel recognizes the importance of a public participation effort to the primary goals of the program as mandated by Congress. In the Congressional Report, the committee directed the EPA:

to assess the principal factors having an adverse impact on the environmental quality of the Chesapeake Bay, as perceived by both scientists and users, and to direct and coordinate... research and abatement programs...and define how management responsibility can best be structured so that communication and coordination can be improved...between units of government...research and educational institutions and concerned groups and individuals on the Chesapeake Bay. (U.S. Congress 1976).

Citizen involvement in all phases of the program is critical to the long-term viability of the effort. In fact, in many state coastal planning efforts, inadequate public participation has resulted in initial program failure. To assure eventual implementation of sound scientific management strategies for the Bay, the panel recommends the continuation of funding for the Public Participation Program.

II. PROGRAM OBJECTIVES AND EVALUATION CRITERIA

The objectives of the Public Participation Program are: (1) to raise the level of public awareness concerning the environment of the Chesapeake Bay; (2) to increase the public's understanding of the Chesapeake Bay Program, and its goals and objectives; (3) to provide Chesapeake Bay Program management with citizen input concerning the Bay; (4) and to involve the public in the Program's decision-making process. To achieve these objectives, the Citizens' Program for the Chesapeake Bay, Inc. (CPCB) has to date (1) identified individuals interested

in the Bay, (2) established a citizen's steering committee, (3) developed a public information/education program, (4) developed procedures for coordination with other programs, (5) conducted forums and workshops throughout the Bay to encourage public dialogue.

It is difficult to evaluate a public participation program. How does one measure its success? What do you use for criteria: the number of people attending forums, requesting publications, commenting on the research or the number of times the program name appears in newspaper headlines? Obviously the criteria selected for evaluation should comprehensively reflect the specific objectives of the program. They also must be measurable and acceptable to all involved. In order to more effectively monitor the CPCB program and thereby provide the feedback that would lead to improvements in the program, it is suggested that EPA establish specific objectives and evaluation criteria for the program in conjunction with CPCB.

For the purposes of this evaluation, the panel assessed the project on the basis of approach, results or "products", relationship of the means to the stated objectives, likelihood of success in achieving the stated objectives in the short-term and the long-term (application of results), and cost/timing effectiveness. The four initial project objectives have been grouped in the categories of public education, and citizen involvement. The discussion follows accordingly.

III. PUBLIC EDUCATION

The public education effort to increase awareness of the Bay and the Chesapeake Bay Program is commendable. Bimonthly newsletters to

concerned individuals, presentations to groups, newspaper inserts, fact sheets, posters, radio/television announcements, films and exhibits all can be effective public education tools, if appropriately utilized. The multi-media approach of the CBCP is considered to be an appropriate methodology. Panel members who reviewed the products felt they were of high quality. The posters, newsletters and film "Chesapeake Challenge", are cost-effective, attractive and appear to have generated a greater awareness of the Bay. To reach a broader audience, the CPCB should try to expand its mailing list and broaden its own organizational membership. Continued use of the newspaper insert in Bay-wide papers will also help increase the dissemination of information on the Bay and the CBP. However, due to its cost, the CPCB should consider selectively placing the insert at critical times and places such as during Bay Days, etc. In general, the Review Panel believes that under the present leadership, the public education effort will probably be successful and cost effective in the long run.

Recommendations:

1. The scientific results should be effectively presented

Fact sheets and new brochures to be developed on the CBP research efforts should report the results of scientific studies. It is the intelligent layperson that reads the fact sheets and brochures on the scientific results of the study, therefore, write them accordingly. The brochure, "Decline of Submerged Aquatic Plants in Chesapeake Bay" (Stevenson et al), should be circulated by the CPCB and its general tone followed in future publications of scientific results.

2. Scientists should be directly involved in the public education process

The translation of scientific results into "common English" is not that difficult, with the aid of a good scientific editor. Many scientists involved in the CBP program are quite capable of "translating their results" in both an oral and written format. Although the CPCB is utilizing the scientists in their educational forums, it is not clear who will translate research results into a written format for public consumption. We urge that the scientists be involved in this process in conjunction with a good editor.

3. Other appropriate research efforts in the Chesapeake Bay should be reported in the public education effort

Since the objective of the public participation program is to increase awareness of the Bay as well as the CBP, the CPCB should make every effort to include other study results in future information efforts. The standing exhibit (Corps, EPA, "208", and CZM) is a good example of the intent of this recommendation. However, we are now concerned with the presentation of scientific results, rather than "descriptive" material.

4. More of the projects should be conducted in conjunction with Sea Grant efforts to prevent duplication of effort

This has occurred to some extent (mini-grants), but such cooperative efforts should be expanded. The educational objectives of the two programs are similar and joint efforts will assure CBP cost effectiveness.

5. The CPCB should solicit local funding sources to continue its public education efforts

The final product of the 5-year Chesapeake Bay Program presumably will be a series of alternative management strategies. Although the scientists and EPA will consider the project complete because funding

will be terminated, the true long-term objective of the program will not have been met. That is: the implementation of effective management strategies. This will only be achieved if the public remains aware and concerned, and thereby provides the political support necessary for legislative and regulatory actions.

IV. CITIZEN INVOLVEMENT

The panel believes that the approach being utilized to solicit citizen input to the program is appropriate. Citizens steering committees, citizens work groups and the use of forums are techniques which have been effectively utilized by other programs such as Sea Grant and Coastal Zone Management. It appears from informal discussions that the CPB citizens groups have provided considerable advice to the program in the last year. The Citizens Steering Committee, which is the only broadly representative advisory committee on the Bay, appears to be rather effective in communicating its concerns to CBP management, and in generating citizen involvement and concern for the Bay. The mini-project grants awarded to specific organizations by the Citizens Steering Committee are the most cost-effective mechanism for "spreading the net" and involving people in the CBP. Once an organization, such as the League of Women Voters, has a vested share in the CBP through a program activity such as a forum, one can be sure that their membership is brought "into the fold". It is the opinion of the panel that the citizen involvement program will be successful if EPA management and particularly the program officers actively solicit the advice of the committees.

Recommendations:

1. EPA should clearly define the role of the Citizens Steering Committee, particularly in the development of management strategies

It is apparent from discussions with the Citizens Steering Committee that their input has only been actively solicited by the EPA since Dr. Davies became the CBP Director. Some uncertainty exists as to their role in the future under new leadership and during the management phase.

2. The CPCB should make an effort to maintain a broad based Bay-wide representation on the Citizens Steering Committee and explore the possibility of continuation of such a Committee beyond the CBP

The present membership of the Citizens Steering Committee appears to include representation from all interest groups and all sections of the Bay. However, 4 of the 18 members are farmers, 1 member represents an environmental group, and there is only 1 representative from a chemical industry (Amoco Oil). It is suggested, that if positions become available, that an additional chemical industry representative and an environmentalist be appointed in that order.

3. Every effort should be made to set up informal meetings between certain investigators and affected interest groups as data becomes available

For example, a few investigators working on herbicides could meet with farmers in a specific area to discuss their results. This would provide the farmers an opportunity to suggest control strategies, etc. prior to finalization of the management report. Such informal public participation efforts are more cost-effective than workshops, etc. and make it easier in the end to implement management strategies. Another possibility is that key investigators could have exhibits at user events such as "Bay Days".

4. Future forums sponsored by the CPCB should focus on scientific results and management alternatives

Public forums are frequently not cost-effective, it is recommended that the CBP not sponsor any further large forums until completion of major scientific studies. At that time they should arrange for effective presentations of the results and management alternatives in several areas around the Bay. It is suggested that the CBP consider using a facilitation process during the discussion periods to encourage citizen input.

V. DISCUSSION

This project is one of the largest federal grants for a public participation effort. The fact that EPA supported such an effort in conjunction with an applied research effort is commendable. We only regret that the public participation effort was not initiated at the very beginning during program formulation. Nonetheless, the effort has been highly beneficial and worthwhile. Our major concern is that it continue through the implementation phase. We recognize, however, that it is inappropriate for EPA to fund the CPCB beyond the completion of the research studies, and development of alternative control strategies. However, if the program is to be ultimately successful (implementation of control strategies) citizens must remain actively involved. For this reason, it is recommended that the CPCB seek other sources of funding to continue its public participation efforts for "better management of the Bay".

The panel recognizes that although the CPCB program is excellent, it may be necessary to reduce its future level of funding due to budget

constraints. We have therefore prioritized projects within the program based on our general assessment of cost-effectiveness.

High Priority

Citizens Steering Committee

Mini-Grants (preferably should be expanded)

Bay-wide Forums upon completion of scientific studies

Brochures reporting scientific results

Maintain existing posters, general brochures

Encourage newspaper articles/editorials on CBP

Medium Priority

Informal meetings between scientists/users

Newsletter

Radio/television announcements (Public Service slots)

Low Priority

Additional general brochures, exhibits, posters

Newspaper inserts (unless costs lowered)

Additional large forums prior to completion of major studies

3.0 SUBMERGED AQUATIC VEGETATION (SAV)

The overall objective of the CBP program is to develop management strategies to manage water quality and related environmental conditions in the Chesapeake Bay system. This is an ambitious and formidable task, which only partially will come to fruition through the five-year EPA/CBP. The SAV phase of this program is an integral and vital component. Through published work in tropical, subtropical, south and north Atlantic and Pacific SAV's, it has been established that seagrass systems (including freshwater and low salinity) are among the most productive natural systems, harbor abundant and diverse animal assemblages, and appear important in the functioning of the overall system of which they are a part. Since SAV's are located in shallow water areas, they are often directly and indirectly impacted by man's activities. Our knowledge of the biology and functional ecology of these systems is in a more or less infant state, and little data are available on the biological, chemical and physical factors which regulate or control the success and response of the plant-base of the system or the system as a whole.

The SAV program of CBP is well conceived and generally scientifically strong, and should provide preliminary data and synthesis relevant to developing reliable management strategies regarding submerged aquatic systems in the Bay. The SAV program is the one CBP task where "health of the Bay" can be evaluated biologically in concert with available and developing data on toxics and enrichment, for within SAV there are elements directed toward historical changes in SAV as they relate enrichment and demographic trends, factors regulating the growth of SAV's, effects of toxics on SAV's, modeling of a biological system to develop predictive capability, and functional relations within these

systems. It is evident, however, that the data and information developed will not be sufficient for development of a complete management program but will only provide the basis for initial development of such a plan.

One of the weaknesses of the program, in the view of the Review Panel, is a general lack of integration of the existing tasks within the SAV program. This was reflected not only by available documents and presentations, but also by the fact that at this point the overall SAV integration task does not appear sufficiently mature to be a useful EPA management product. In many instances, integration appears to be on an informal basis, while in other instances, integration appears nonexistent. There is a need on EPA's part to know if SAV's are decreasing, and if so, is it related to man's impact or natural variation. Synthesis and modeling efforts should be designed with this in mind since data developed in the project will not be sufficient to determine this directly. Integration of efforts and findings between Upper Bay and Lower Bay, Maryland and Virginia, needs to be emphasized and made more obvious, as does the utility of the outputs to the overall goal of the EPA/CBP to develop strategies for water quality and environmental parameter management within the Bay. This integration will not occur without concerted leadership by EPA.

Many of the SAV tasks are funded at high levels and careful cost analyses appear warranted. This Review Panel feels that, although a scientifically strong project, both in design and direction, the transplant portion of SAV is least directed toward the EPA/CBP goal.

In the overall opinion of the Review Panel, the SAV program is scientifically sound and has a high likelihood of success, not only in terms of individual stated objectives, but also in terms of providing

EPA with viable data on management strategies. This will only occur, however, if the SAV program is funded through the full term of the CBP. There are relations between SAV's, toxics and eutrophication parameters, demonstrated within many of the SAV tasks. One end product of SAV should be the development of a monitoring program.

A number of investigators seem to be over-extended, including Wetzel et al., Kemp et al., and Orth. This is based on discussions with various investigators, recent visits by some of us to both VIMS and Horn Point, and consideration of written/oral presentations. There is probably not much that can be done about this in the short term, but it should be kept in mind since it could lead to a decrease in quality over the long haul.

Specific comments on each component project follow.

Brush

The techniques employed appear scientifically valid as do the general interpretations. One wonders, however, if there has been differential seed germination and preservation over time which may have influenced the results. Also, what is the impact of migratory waterfowl on seed distribution? Data, however, do strongly indicate historical changes in environmental parameters in brackish water areas, which can be of significance in interpreting changes in floral elements.

1. There is a need to (a) integrate stratigraphy better or more obviously with historical trends in toxics; (b) more effort investigating diatom trends/responses to eutrophication and acid mine drainage; (c) better integration with other SAV studies/sites, especially as related to cause/effect of recent trends.

2. The study should be extended geographically to cover more regional trends and be integrated with the Virginia Institute of Marine Science (VIMS) and Maryland Geological Survey (MGS) coring matrix.

3. There should be some chemical work (e.g. hydrocarbons/PCB), radio tracers, or other biological indicators of urbanization/pollution (e.g. benthic forms).

Mapping Efforts - General

1. These should be more cost effective and possibly de-emphasized after one more year to the point of establishing a strategy and level for further minimum monitoring effort.

2. There was a general concern expressed on whether a three-year effort will provide insight into trends in SAV; emphasis in final funding period should be on identification of selected sites over time to follow expansion/ contraction and establishing monitoring strategy for future.

3. We strongly suggest that high altitude remote sensing techniques be seriously considered, especially for routine future monitoring. We seriously question if this has been done. If satellite imagery is not sufficient, then high altitude over flights (e.g. U-2) should be considered. High altitude photos for other areas of the U.S. show extremely high resolution.

4. Some thought should be given to more quantitative sampling during ground truthing. For example, several plots could yield information on % frequency rather than presence/absence of different species. Biomass is another possibility.

5. It appears to us that analysis of the data collected is insufficient, especially for the Upper Bay program. For example, better statistical

treatment and correlation with information from the CBP projects would probably yield much better results.

6. The panel was impressed with the fact that the Upper Bay project was twice as expensive, although the analysis seemed more complete for the Lower Bay program.

Anderson/Macomber - Mapping Upper Bay

The photographic approach used appears to provide significant data with regard to distribution in combination with ground truthing data. It is recommended that funding be continued with emphasis placed on photographic "sampling" over time in several areas rather than an entire region, and couple this with ground truth to document not only species but abundances and, in particular, the statistical analysis of same; also to complete the maps for 1978-79.

1. Because of bimodal trends in species biomasses, it is imperative that historical trends be determined using photos over the same general time span. Some effort should be placed in getting sound ground truth of abundance; this effort should be coordinated with Lower Bay effort.

2. It is questionable that a single flight line is sufficient, assuming maximal growth; two flight lines would be better if only to confirm maximum growth.

3. A strategy needs to be developed to establish criteria for a future monitoring effort.

4. Parameters of temperature, rainfall, etc. should be involved in study.

Orth - Mapping

This effort has shown an excellent utilization of archival data

sources and 1978 data. The presentation of data on geographic as well as depth distribution of major species and its utilization appears to have provided reliable sample sites for additional studies (transplant) that will be done. Final year funding should be provided. Has any consideration been given to satellite imagery or high altitude photography? Appears to be as good a job with 50% of the funds for the Upper Bay. The panel is concerned, however, that the three-year short-term data base will not provide information on long-term trends for the Bay, and the effort should be designed to form the basis of "how to monitor."

1. Needs to be better or more obvious integration with Upper Bay group.
2. See comments 3 and 4 under Anderson/Macomber.

Orth - Zostera Biology, Propagation and Impact of Herbicides

This is a very ambitious program which is scientifically well conceived. The transplant phase does not appear germane to the objectives of SAV and the EPA/CBP goal, nor is it designed to be able to show why a transplant was successful or not except for attempting transplants in different locales and in different seasons. In the transplant experiments, no consideration was given to the current regimes of the areas, or to the chemical characteristics of the receiving area before and during growth, i.e. factors which may control the success of the transplant. In the seed studies, just because there is a different proportion of sexual material in different areas doesn't mean that seed release and germination are proportional. The question should be asked as just how important is germination of seed?

1. There is a strong need to address the utility of transplants as a management alternative; this is particularly true for propagation studies.

2. If future strategies for transplants are to be developed, one must have a handle on correlative factors (e.g. nutrients, sediment parameters, currents, etc.) involved in success or failure. If this study is to be continued, and the Panel does not recommend continuation, it is recommended that future transplants be coordinated closely with Wetzel's study so that some reliable information on nutrient levels, sediment parameters and currents can be brought to bear on success or failure.

3. "Large-scale" transplants should be de-emphasized in this program, and the science of transplant success requirements should be emphasized (i.e. the biology).

4. Cost analysis of efforts should be provided in the development of alternative management strategy.

5. Herbicide work to date does not integrate well with ongoing program; if it is to be continued, an experimental design to evaluate impacts in the laboratory on growing Zostera should be developed. This does have management implications.

Functional Ecology - General

1. In many instances, there appear to be overlaps and duplication of efforts, particularly in the areas of fishery utilization of SAV and predator-prey relations. Coordination of approaches needs to be more obvious as does the integration of the studies.

2. Since light is one of the major forcing functions for SAV, there needs to be a more obvious measure of its use in the program.

3. There are many aspects of the functional ecology projects having important management implications, e.g. effect of turbidity on competition between different SAV species, influence of nutrients on

SAV, influence of atrazine on SAV. The panel feels that these management aspects should be brought out more strongly and more clearly.

4. In light of the problems encountered in the past with O_2 productivity measurements of SAV, both projects should address this issue directly as it may affect interpretation of results.

Wetzel et al. - Functional Ecology, Lower Bay

This is an excellently conceived study. However, within the time constraints, several of the objectives probably will fall through the cracks or be of lower quality than many other aspects. This also applies to the Kemp et al. task. We have some difficulty separating out what Orth and Merriner are doing on consumers as compared with the objectives of Heck.

1. There is a need to more strongly justify the chamber work;
2. There is a need to better identify the modeling effort as a management tool;
3. Is there a possibility of using artificial SAV to help separate the grass as a producer from the grass as a substance?
4. We believe that the interpretation of the stable carbon isotope results needs to be more carefully thought out, especially in light of the latest information on this subject (Parker's work in Texas, for example).
5. In partitioning respiration between grass/epiphytes and sediment surface, the grass was clipped close to the sediment surface. Past work indicates that significant metabolism may take place via the cut grass base. This needs to be investigated in this project.

Kemp/Stevenson/Boynton - Functional Ecology, Upper Bay

This study, also ambitious, apparently is more or less a laboratory-field corollary to the Wetzel study, with emphasis directed to the brackish water species. The atrazine approach and techniques used appear to be much more sophisticated and feasible than that being done or proposed by Orth, and the efforts of the two groups on atrazine should be coordinated and not totally independent. The interpretation of killifish - amphipod predator-prey relation relative to leaf suprastructure appears to be in opposition to observations by Heck, Merriner, and Walt Nelson in their reports, MS and presentations (ERF). Although many of the field-oriented studies are similar to those in the Zostera/Ruppia (VIMS) system, the approaches don't appear the same in all cases - for future comparability it would be good to have the techniques uniform. The modeling approaches, i.e. VIMS vs. Horn Point, do not appear to be directed toward the same end, an aspect the Review Panel feels is good and strengthens the potential for best synthesis of the overall SAV program. There should be extensive intercourse between these efforts and Valentine's overall synthesis to ensure each makes maximum use of the other's findings.

1. Sediment trap approach is questionable in that the technique is under evaluation and generally not trusted in shelf and open water areas.

2. There is a need to justify the meaningfulness of microcosm results relative to the real world and/or better definition of these results in terms of "tuning" the model.

3. Same comments as Wetzel, #2.

4. N:P ratios of 10:1 were used in the microcosms. Does this

reflect average N:P ratios in natural grass beds?

5. In considering the impact of herbicides on SAV decline, have the investigators researched historical perspectives on the application of herbicides in Bay watersheds?

Heck - Nursery Roles of SAV

The field oriented phase of the program is good, and well designed, although we have serious reservations regarding the use of trawls over a variety of bottoms without having correlative gear efficiency - habitat type - life history stage and species data. We also feel that if tidal variations exist, the P.I. should look at tidal as well as day-night utilization by fishery organisms. The simplicity of the experimental studies and the relevance of the densities used to field situations is good. One wonders about the role of bare patches within dense grass beds. The experimental findings appear somewhat in opposition to those on predator-prey relations for amphipods in brackish water areas, and more effort should be put into these studies by both groups, for the final output will have significant relationship to critical seagrass densities as they relate to habitat utilization.

There is apparent duplication of work between this, Wetzel's and Kemp's groups, and these should be more obviously coordinated. The Panel does not view this as a weakness of the program, but rather a strength.

Perry - Waterfowl

This project has shown fairly convincingly the importance of SAV's for waterfowl, and although intuitively obvious, is the type of data necessary to document fisheries utilization. Has this program been in

contact with investigators doing similar work on waterfowl-SAV interaction at the University of Rhode Island?

Valentine - SAV Synthesis

This work would appear to have a function in putting the information in perspective. It's surprising it's to be completed in 1981. How will it be done? How and when will management options be integrated into this?

1. The overall SAV integration task seems not to be mature enough at this point to serve as a useful EPA management product.

2. There is a need to ensure a priori that specifically stated hypotheses are tested and minimum/adequate data gathered to serve as a realistically useful management tool for EPA regulation of Bay water quality/discharge criteria.

3. It is likely that the Wetzel and/or Kemp modeling efforts should serve as the template for summarization rather than putting together something new.

4. We suggest that Dr. Valentine work closely with several SAV projects, especially the functional ecology studies in both upper and lower Bay. This should include some participation in field and lab work, as well as meetings. The ecology projects are developing information which will be vital in formulating management plans. We believe an active "hands on" participation by Dr. Valentine is essential in maturing his ideas. Gratuitous comments have indicated that Dr. Valentine has gone into the field with the major investigators and has discussed findings to date. This definitely was not obvious from Panel discussions with Dr. Valentine. A detailed work plan that shows not only how the data and published reports, but also the experience and expertise of the

P.I.'s, will be used needs development. Final publication and distribution should be defined.

SAV Priority

High Priority:

Synthesis - very poor now

needs active input from all SAV project P.I.'s
conceptual guide or framework needs to be developed
now for the synthesis function

Functional Ecology - Wetzel - critical programs with some effects work

Kemp - critical programs with some effects work

Heck - lowest priority within group

Brush - quality/historical impact related

Mapping - Lower Bay

Upper Bay

Low Priority:

Transplant - lowest priority and lowest probability of success for
EPA program

4.0 TOXICS PROGRAM REVIEW

Introduction

The overall objective of the CBP Toxics Program is to develop management strategies for EPA to regulate toxic input into the Chesapeake Bay and protect its ecosystems and resources. The Toxics Program will attempt to identify inorganic and organic toxics, their concentrations, inputs and distributions in various geological and selected biological compartments of the Bay. Hopefully there will be an attempt to correlate such toxic distributions to assessing the health and potential damage to the Bay. However, there was little evidence of this as a stated objective or evidence as an anticipated product. Finally, this knowledge will be implemented using modeling efforts to provide management strategies for protecting the Bay.

Thus, the Toxics Program will be implemented with the following objectives: 1) examine current status of toxic materials in Bay (baseline study). This is the core of the funded CBP Toxics Program; 2) examine toxic inputs to Bay (point source assessment program). This is partly implemented for known permitted nonmunicipal point inputs, essentially the EPA Level I procedure; 3) identify which toxics cause environmental damage (a purely laboratory, lethal dose approach using point source effluents); 4) recommend management strategies for control of toxics in the bay (a final management study allocated to EPA).

There are a number of longer range objectives to the CBP Toxics Program not planned for the immediate CBP: 1) develop methods to test effectiveness of control strategies; 2) develop predictive capabilities for impacts of toxics; 3) develop major transport or transformation

processes for toxics; 4) determine effects on the Bay ecosystems and correlate identified toxics with environmental damage.

Overall Review

Ultimately, the CBP-Toxics Program should be evaluated on the basis of whether the stated objectives listed in the introduction will lead to the desired products.

The stated major products of the Toxics Program and their priority are listed:

1. Report of the status of toxics in the Bay, the baseline (Priority 1).
2. Report of toxic loadings for each major tributary (no stated priority or plan).
3. Evaluation of fate and effects testing procedures as related to the Bay's environment (Priority 7).
4. Testing and evaluation of fate and effects models for predicting environmental health (part of Priority 7).
5. Report of management strategies for control of Toxics loadings to the Chesapeake Bay (Priorities 5 and 6).

The stated priority of accomplishments for the CBP Toxics Program, some immediate and funded, and others anticipated for follow on activity are:

1. Baseline distribution of toxics (funded and being implemented).
2. Point source analysis and effects (half funded with municipal point sources to follow).
3. Nonpoint source (aerial inputs, county by county, disperse runoff, solid waste disposal; all unfunded to be implemented by regions).

4. Design and implementation of a monitoring program (unfunded).
5. Management control strategies (some final synthesis funds).
6. Alternative and control options on sources. (Unfunded)
7. The transport, transformation, fate and effect of toxics from the points of inputs in the side estuaries to their eventual deposition in the main stem estuary using ecosystem modeling. (Unfunded)

From such listings, there appear to be some major discrepancies between the products, accomplishments and priorities anticipated by the EPA for the CBP. It is also obvious that most of these anticipations and priorities will not occur as an immediate funded part of the CBP. Thus, the overall review of the CBP Toxics Program will be as follows: First, the core of the funded program lies in the baseline study (Priority 1) and point source assessment (Priority 2), and thus the feasibility of these priorities will be addressed. Second, the ranking of the stated priorities will be evaluated, particularly if priority alterations for the remaining program are more likely to yield the stated products.

There is little doubt that the core funded CBP Toxics Program will yield valuable information on the levels and distribution of toxics in the main stem of the Bay. However, the concept of a "baseline" in an estuarine environment is difficult when one realizes that unlike fresh or smaller bodies of water, estuaries are extremely dynamic. Forces of diurnal tides, seasonal changes (e.g. freshets and blooms), and major storms have profound effects on the redistribution of materials and toxics within the Bay and eventual throughput to the open sea. The concept of an estuarine baseline around singular sampling without attempts to gauge the natural time and space variations is oceanographically naive. Thus, there is a strong recommendation that in the remaining

baseline toxic studies, a serious attempt is made to coordinate a common sampling effort (programwide) over a few representative tides, for a set of seasons, and during extreme events. There is the framework for such coordination around the VIMS-MGS coring programs. Also, part of a toxic baseline that is gauged to assess ecological damage should include the present distribution of toxics in major biota classes. Such an effort could center around the biological components of the SAV ecosystem or be expanded to a "shellfish watch." This appears to be a major gap in the toxics program covered only by organics in oysters. At the very least there should be some more realistic effort on effects.

It appears inappropriate and imprudent for the Toxics Program to rank the point source priority #2, much above the last priority, #7. This last priority is designed to assess the important intermediate transfer of toxics from such point sources through the side river estuaries to the main stem of estuary where the baselines are focused. There is a strong recommendation to redirect these priorities in the remainder of the toxics program as follows. (1) The baseline and historical toxic studies should be expanded to the main side estuaries and should include sediments representative of both the present and pre-occupation times. (2) The point source effort should be redirected first to monitor the subestuary fluxes of toxics to the main stem estuary, using appropriate hydrographic and sensitive analytical techniques. (3) The program should attempt to provide estimates of major fluxes during tidal, seasonal and storm events between the side and main estuary for both sediments and toxics. Such a redirection of the CBP thus should provide an assessment whether these secondary estuaries are in fact the major sinks or point sources for toxic materials in the main Bay.

Lastly, the Panel recommends that a major product of the toxics program be an appropriate mass balance and flux estimate for redistribution, transport, and accumulation of toxics in the Bay. A major synthesis effort must be designed, starting with integrated field sampling and ending with implementation of a non-field modeling phase. This phase must directly involve investigators funded to synthesize their data with EPA through coordinated scientific and managerial goals. It is felt inappropriate to believe that a six month effort by a single agency will be able to bring raw field data to its appropriate scientific fruition for management objectives without a carefully planned, funded, and mutually implemented synthesis phase of the CBP toxic program.

I. Inventory & Toxicity Prioritization of Industrial Facilities
Discharging Into the Chesapeake Bay Basin (T. Hopper, CGA)

There is no description of the Discharge Multimedia Environmental Goal (DMEG). This apparently is some crude measure of toxicity. A much better approach would have been to use the "no effect level" of toxicity, rather than standard lethal dosages.

II. Toxic Point Source Assessment of Industrial Discharges
(G.D. Rawlings, Monsanto Research Corp.)

If the overall goal of the Chesapeake Bay Program (CBP) is to develop techniques for managing the quality of water in the main bay, then this program needs to be redirected to the subestuaries as point sources. A monitoring program developed using the baseline toxic techniques employed in the Bay appears to be better suited for this project.

To pursue the Monsanto program in its present form will merely identify a standard EPA list of chemicals in 80 different outfalls and their short term biological effects. While this might be a means to test the EPA Level I assessment procedure, such an approach will not provide a basis for assessing the actual environmental effect of all integrated toxic impacts on the Bay stem. In addition to the lack of usefulness of the information, there are serious reservations with the proposed protocol. 1) The techniques used are well below the resolution or sensitivity used either in the estuary stem studies or those needed to assess some quantitatively important inputs; 2) There is only an emphasis on the dissolved phase for toxic chemicals analysis without recognizing suspended phases as important toxic inputs; 3) It will be

impossible to use the data in any water quality model without knowledge of transformation and flux through the rivers into the main estuary.

The analytical protocol should be tied closely with the method used in the main estuary. It would make more sense if EPA addressed the problem of how much loading of the Bay can take place without violating the water quality standards that will be set for toxic pollutants under section 304 of the Water Act. As an example, one might monitor for organics at the mouths of the tributaries to establish what chemicals are being released into the main estuary where the baseline is being performed. These data could then be used to establish such a loading and mass balance.

III. Sedimentation (Byrne & Kerhin)

Since toxic compounds tend to be closely associated with sediments, several large CBP projects are determining the present sediment distribution in the main axis of the Bay. They also are attempting to determine sedimentation rates based on historic changes in bathymetry. A final product will be maps of the distribution of erosion and deposition in the upper and lower Bay.

The upper and lower Bay studies, which have identical objectives, approaches and products, should use similar methods. However, the upper Bay is being sampled on a 1.0 Km grid using a Van Veen grab while the lower Bay is being sampled on a 1.4 Km grid using modified Smith-MacIntyre grab. While there may be justifiable reasons for the different grids and grabs, it seems reasonable that the same approaches be used. Since this phase of the project is nearly complete, we suggest that an intercomparison needs to be made that will demonstrate the interchangeability of results.

There are some questions concerning the accuracy of the sediment budget calculation. Corrections were made for crustal warping, sea level changes and seasonal effects. Since the total change may be of the same magnitude as the corrections, it would be useful to present an error analysis to put the calculation in perspective. There is an additional correction that should be mentioned. The older surveys were made with plumb lines which would measure down to a hard surface, whereas present techniques using sound velocity would measure fluid mud if present, yielding a deceptively shallow depth.

The sediment-budget technique also may be ignoring the higher frequency Bay dynamics: is the 520 yr. change greater than the longer term? To answer this question and others concerning seasonal and shorter period changes, we recommend:

1. measuring geotechnical properties of sediments;
2. tidal/seasonal re-occupation of a subset of the grid, perhaps before and after freshet periods or major storms; and
3. finer scaled, statistical sampling around such a subset of locations, particularly in areas where heterogeneity may be a suspected problem.

To synthesize the sediment data into a meaningful mass balance model, it will be necessary to: 1) have better information on branch estuary fluxes; 2) longer term geochronology with better coverage using the radionuclide or pollen techniques and; 3) better appreciation of resuspension as a process for internal recycling of sediments.

Concerning data products, it was not clearly stated what sediment properties will be graphically displayed. Considering the possible errors in the sediment budget analysis, other parameters related to erosive tendencies should be included.

The panel felt the studies were worthwhile and should receive continued funding. Additional funding should be considered for branch estuary efforts. Byrne's grain shape analysis technique looks promising and should be encouraged.

IV. Suspended and Fluid Mud Trace Metals (Nichols - VIMS)

This is a worthy study which is attempting to characterize trace metal loadings in suspended and, just as importantly, fluid muds. It would be fruitful to (1) better characterize trace metal "hot spots" by integrating this sampling with dissolved trace metal sampling by NBS (Kingston), and a seasonal sampling around the mid-bay anoxic event that could mobilize reduceable metals; (2) provide a better correlation of the iron-trace metal relationships to particle size measurements; (3) obtain better resolution of trace metal loading in leachable or reducible phases besides just bulk extractions; (4) better characterize trace metal sediment loading around the null point of the estuary and onto potential colloidal flocculation phases likely to occur there.

V. Particle Associated and Suspended Sediment Toxic Substances

(Taylor - CBI)

This is another worthy study of toxic trace metal loadings on suspended sediments and associated hydrographic stations. There should be better integration of the CBI sampling program to parallel efforts by VIMS (Nichols). This study is cognizant of the important role of tidal currents and mixing for redistributing suspended toxic substances. More effort should be made to verify these effects with flux or current measurements as part of the hydrographic stations. Water quality measurements

should include alkalinity with pH, standard nutrients, and precise oxygen measurements that utilize micro-Winkler techniques. It would be informative to gain a better appreciation on how these studies will be integrated to yield trace metal flux models of the Bay useful to EPA management objectives, discharge regulation, or water quality assessment of the trace metal "health" of the Bay.

VI. Animal Sediment Studies (Rheinhardt-Bricker and Boesch)

Basically the animal sediment program is a good descriptive study. It is providing good information on infaunal stratigraphy, diversity, and depth irrigation correlated with increasing down-Bay marine influence. Since the effects of extensive infaunal sediment irrigation are bound to have significant geochemical and sedimentary implications, it would be desirable to have more quantitative estimates of such irrigation using (1) radio-nuclide techniques and (2) epibenthic chamber studies using indigenous or artificial trace elements.

As for other studies, it would be useful to examine branch estuaries that are closer to pollutant sources. In addition, the effects study of Boesch in the decline of York River benthic communities should be expanded into the CBP benthic community baseline.

VII. Interstitial Water Chemistry (Bricker - MGS)

This is an excellent integrated study on the potential for sediments to provide benthic fluxes for toxic elements, or chemical equilibrium controls for such toxic material. Besides interstitial water, there will be continuing studies of the solid phase (authigenic precipitate) reservoirs for toxic redistribution and transformation in sediments. It

will be most fruitful to have these studies tightly correlated with historical trends in toxic geochronology (i.e. with Brush and Helz). It will also be very necessary to corroborate benthic inorganic toxic fluxes from interstitial gradients with deployed chamber studies, and to evaluate the role of infaunal irrigation in accelerating such exchanges. There should be some assurance these well developed interstitial techniques are transferred effectively to the SAV interstitial work.

VIII. Sediment Trace Metals - (Helz - U.Md.)

This is a very good study of historical trace metal records in the Bay. It would be nice to see better integration of this sampling effort with that of VIMS & CBI. Besides using Pb^{210} for geochronology, use of Cs^{137} , transuranics, and pollen horizons will be necessary to give a complete record over entire length of the core back to pre-industrial times. There are good quality control procedures using different total leaching techniques. Besides total metal extraction, it would be fruitful to evaluate solid metal partitioning using various Eh-pH leaching techniques.

IX. Dissolved Trace Metals (Kingston - NBS)

This study is attempting to characterize the distribution of trace metals between dissolved and particulate phases as integrally sampled with the toxic coring program. The quality control and contamination free procedures of this program are truly impressive. New Chelex-100 extraction techniques using modern atomic absorption and neutron activation techniques are being employed. It would be helpful to have nutrients

run on the same samples to verify biogenic extraction and regeneration processes that may be operative in redistributing and transferring trace metals within the Bay.

X. Investigation of Organic Pollutants (Huggett - VIMS)

This program is measuring toxic organic compounds in sediments, oysters and volatile fractions of water. It is a very good study using very modern and sophisticated analytical techniques. It is not clear how these procedures or substances will be integrated or applied to the Monsanto point source effort. There is a major concern that the analytical effort still required will not be completed within the prescribed time limits. A timetable for production of data should be set and monitored closely. There also should be some effort to analyze a broader spectrum of compounds at just a few sites, and to extend the biota analyses to other seasons of the year. Using EPA toxicity criteria, how will these toxic organic results be synthesized and integrated into the EPA management of the Bay?

5.0 EUTROPHICATION OR EXCESSIVE ENRICHMENT PROGRAM

Whether this portion of the EPA/CBP program is called eutrophication or excessive enrichment, there can be no question of its importance to the overall effort. Nutrients have important effects in the Chesapeake Bay, its tributaries, and in various tributary streams and impoundments. The Panel is in strong support of the EPA decision to recognize nutrients as one of the highest priority topics.

Nutrients are believed to have important relationships to submerged aquatic vegetation (SAV), and therefore, it is particularly important that full coordination and availability of data take place. The Panel believes that EPA is fully aware of this, and will take steps to ensure that it takes place. At present, when these subprograms are going forward in parallel, it appears that such coordination is not yet fully operational.

The Panel agrees with what it perceives to be the overriding strategy of the nutrient program providing input to the Chesapeake Bay transport models and SAV aquatic environment. On the other hand, the nutrient program provides an important linkage to land use which represents one of the important management possibilities for water quality improvement. This overall design of a nutrient program as an important input to the chemistry of the Bay, while being the measure of both physiography and land use is applauded by the Panel as an important and basic concept of project design.

It is hoped that a full representation of present nutrient levels, inputs, interactions and sinks will be developed. The relationship to SAV has already been mentioned. We would also stress full consideration

of nutrient effects in the Bay on algae which may compete with SAV's, but which also have important effects upon dissolved oxygen, and possibly on the state of various trace metal toxics. We are not sure that this is fully contemplated by EPA and that such subprogram integration is taking place.

In the material which follows, comments will be offered on each of the projects reported. Most of these comments are approving in nature and suggestions are relatively minor, except for the Intensive Watershed Studies which are discussed as a group, and which the Panel feels will not achieve their intended objectives of providing a reliable base of information on non-point sources of pollution and a vehicle for evaluating best management practices.

History of Chesapeake Bay's Problem of Excessive Enrichment

Although difficult to evaluate in depth from the short presentation, this appears to be an excellent review of the state of eutrophication in the Chesapeake Bay. The major criticism one might have is that it should have been done prior to the field study portion of the program. In this way it would have provided a useful guide to development of the program elements. The monitoring and research plan presented is especially intriguing. This plan, after adequate peer review, would have been an extremely useful tool in planning the eutrophication portion of the overall CBP.

The cost does seem high, but there was insufficient data available to the panel to evaluate cost fully.

The following recommendations should be considered:

1. The scope of work should require production of a peer reviewed monograph that will serve as a reference to future research on the CB.

2. The monitoring and research program suggested should be subjected to extensive peer review and revised accordingly. This plan should then be used as the basis of future monitoring and research on the bay.

3. In interpreting data, the investigator should use care to assure that the trends observed are not artifacts of changed analytical methods or that the change in variability is not covered by availability of more data.

CB Circulation Model

The objective of this project is to produce an operational model of water circulation in the Bay. The model should describe the basic hydraulic and hydrodynamic phenomenon. In addition, the final model will be made available to EPA staff who will be trained in the use and understanding of it.

Initially several models were screened and the MIT CAFE-DISPER model was chosen. The criteria and selection were probably correct, although it may be more sophisticated than required.

At present, the contractor is modifying the code for implementation. The group is certainly capable of performing this task.

From this point on, the panel is more skeptical of results based on present plans.

Three items are especially critical to the success of the model: boundary conditions, internal density field, and field verification.

Boundary conditions are required for the C&D canal, and the Bay mouth. At present no formal plans exist for acquiring such data. It is recommended that if the model is to be run that a sound observational plan be formed utilizing the local expertise.

The internal density field is required for model initiation.

Evidently some data exist, but a synoptic observation plan is being proposed. We heard of an eight-day sampling schedule with 10-12 sections, but saw no formal plan. As with the previous proposed study, it is urged that local expertise be consulted when planning these large scale observations.

Field verification, which is not formally proposed, is critical to creating a useful model. We again urge consultation with local experts.

For management decisions, this model must be interfaced with water quality models. Such interfacing does not appear to be part of the Chesapeake Bay Program. Even if it were coupled to a water quality model it is doubtful, because of previous lack of success, that the model would form a useful management tool. The lack of usefulness of a water column based model is especially noted when recognizing that most toxics are associated with suspended sediments or sediments themselves.

Fall Line Monitoring

Since little actual data was interpreted or presented, it is difficult to assess the productivity of this project. It does, however, appear that the project may fall short of its objectives in several respects.

1. Once monthly data is not sufficient to calculate stream loadings with any accuracy, unless a unique method of calculating loading from event studies and monthly data has been developed. It will then be necessary to develop a statistical method of assessing the accuracy.

2. The relationship between these data and the Bay is not clear. It does not represent input into the bay, but into the upper tidal river. Extensive interpretation will be required to translate it to the Bay proper.

Recommendations: Cluster analyses might be more useful than

correlation when looking for parameter interrelationships.

Some of these samples should be given to the VIMS group for extensive toxic analyses.

The cost appears high.

Ambrose - Modeling Philosophy ...

The project has four tasks:

- 1) develop criteria for selecting analytical tools for effective management of the Bay;
- 2) develop an inventory of existing watershed models;
- 3) calibrate the selected models;
- 4) test such models.

The Panel found it difficult to evaluate this proposal. There is some question regarding the coupling of any selected watershed model to the hydrodynamic model.

Intensive Watershed Studies

This discussion is directed to the several watershed projects and presentations including the Ware and Occuquan Rivers in Virginia, the Chester and Patuxent Rivers in Maryland, and the Pequea Creek in Pennsylvania. It is recognized that there are differences among these, but our comments are general and apply to all.

We feel that the uses of these watersheds for their intended purposes will fail, and even at this late date, it is strongly recommended that this portion of the program be totally redirected. It is recognized that investments have been made in instrumentation, and some records obtained, although most of the watersheds are not yet fully operational.

Our problems with the Intensive Watershed Studies are several. We do not sense that there is any serious experimental design. For example, how well do the several watersheds sample the physiography, the climate, and the various land use practices? Has any thought been given to the sampling ratio of measured watersheds to that of the entire Chesapeake which may be in the order of 5/60,000? Has any thought been given to the representativeness of two years or less record to sample the climatic variability? Little thought has been given to the role of ground water inputs. And finally, in the light of the above, we believe that the influence of each of the many variables will be impossible to attribute. The EPA may wish to convene a small group of statistical hydrologists to check on these views before considering what changes, if any, it wishes to make in the program.

The Panel suggests that far more reliable information on non-point pollution and the management opportunities through land use changes can be obtained by using large watersheds of 1000 or more square miles each.

Such watersheds would be characterized by existing soils and land use data from the Soil Conservation Service, by geologic and stream flow data from the U.S. Geological Survey, and by precipitation data from the National Weather Service.

Runoff computations for present conditions can be achieved by available models such as the SCS, Hydrocomp, or others. Future runoff, sediment, and nutrient loads would be based on SCS estimates of future land use and practices applied to the same model.

Land Use and Point Source Nutrient Loading to the Chesapeake Bay - by

Dr. Benjamin J. Mason

This project is viewed favorably, while recognizing the many difficulties inherent with respect to consistency and availability of data from the various sources.

In fact, this project contains many of the features which are proposed as an alternative approach to the Intensive Watershed Studies in that it utilizes existing data rather than making a hurried and inadequate effort.

The project is considering the use of satellite information, but the Panel questions the desirability of doing this in the light of available information, time, and funding.

HAMPTON WATER QUALITY LAB

Hampton Institute

A major gap in knowledge of the Bay is the exchange rates between the Bay and the ocean. It might be useful for EPA to have Hampton Institute take this on as a long term research commitment. It must be realized that within the project's life, useful results will not be produced because of the limited experience of the Institute and the complexity of the problem. However, this is a long term research need, and the Institute is conveniently located for such studies.

ASSESSMENT OF NUTRIENTS OF VARIOUS SOURCES - Gerald Lanik

This type of short assessment of data should have been done prior to design of the overall study. The person who conceived the study and the investigator are to be congratulated on achieving so much with so little resources. The investigator should be careful in extrapolating the results of the study beyond its usefulness. Because of the gross assumptions made, it is only useful as a preliminary sampling study-planning tool.

The concept, however, might be useful in more detailed data evaluation of specific sub-portions of the CBP.

Eutrophication PrioritiesHigh Priority

History (Cronin & Heinle)
Fall Line (Grason)
Land Use and Point Source (Mason)
Assessment of Nutrients (Lanik)

Extensive Modification Required

Circulation Model (Walton)
Modeling Philosophy (Ambrose)

Low

Intensive Watershed Studies (Davis, Bostaler, Ward)

No Opinion

Water Quality Lab (Harvey)

Needed Additional Projects

Eutrophication Effects
Synthesis of nutrients programs

6.0 DATA MANAGEMENT

In addition to quality assurance and control, EPA has purchased a new computer system that, among other services, will provide data management systems based on the existing STORET system.

The computer, a DEC PDP-11/70 with 2x176 megabyte disc, will have batch and time sharing capabilities. Languages will include FORTRAN, BASIC and COBOL. Software packages will include SAS, SDSS, BMDP and others. Graphics capability will be available for CALCOMP and Tektronix.

Communications will be available via low and high speed lines.

Comments of the scientific review panel can be divided into those concerned with STORET and others about the new computer system.

STORET

1) It is clear that a small percentage of information produced is compatible with STORET format requirements. For example, the circulation model will not use STORET. Indeed, from some comments it appears that STORET is an antiquated system.

2) The panel only heard of one PI who had successfully used STORET and that was with water quality data.

3) Most PI's are skeptical about the utility of STORET. The concerns are with utility of the system, security of data, and retrieval of stored data.

4) The STORET system apparently has no security protocols beyond initial log-on. Because of this, some PI's may be reluctant to supply data until they have thoroughly analyzed it themselves. There also is concern that incorrect conclusions may be drawn by others who examine the data without the insight of the PI's who did the work.

5) It should be recognized that environmental data is verified not only by laboratory quality assurance/quality control but by intuitive assessment by the investigator involved in gathering that data. The intuitive assessment phase is done as the data are analyzed, plotted and discussed, which means data that may originally have been thought to be "good" is later found useless. Because of this lag, it is not advisable to rush data into a storage system when later there may be little incentive or method for a PI to have it corrected or deleted.

The Machine

1) During our review it appeared that the machine apparently was not bought for CBP, but for the use of the EPA Annapolis field office. Estimates of 50% use by the CBP seem overly optimistic, especially considering the programs end soon after the machine will be really functional.

2) Since most users are not physically near Annapolis, they will work via remote terminals which are not budgeted, especially graphics terminals. Since graphics is a high priority for next year, the omission is regrettable.

3) SPSS, SAS, BMDP will be available but such useful interactive statistical packages such as OMNITAB/MINITAB, SPSS/ONLINE, and the standard subroutine set IMSL are missing. These would be of great utility to the user, especially ones that are "playing" with data. Most participating institutions probably already have these capabilities as a minimum.

Publish a monthly or bi-monthly newsletter for passage of information. Most coordinated projects of this size (i.e. MODE or CUEA) produce newsletters that are very useful within the group and in both cases

mentioned have become widely disseminated in the community. CRC could easily perform this function.

4) For graphics output and data processing over the next year, it may have been more cost effective to equip groups with HP98XX series desktops or Tektronix 4051-3"s with plotters or to provide additional support for in house facilities.

General Comments

The data management of CBP is not just machines and software, it is concepts, ideas, and schemes that are created in minds, often even now, without the use of machines. Machines are mere tools and should not be placed in priority above the promotion of synthesis and hypothesis by the PI's.

We encourage EPA to fund efforts to:

1) produce data reports and summaries that graphically present distributions of common parameters. This should be an effort by PI's not EPA personnel or consulting companies.

2) synthesize and interpret data to form new or revised concepts of Bay processes. The real goal is not only more data, but new or improved understanding of how the Bay works. This should be done by Bay scientists. This effort will take at least two years after the end of data gathering and experiments.

7.0 ENVIRONMENTAL MANAGEMENT

In order to comply with the CBP congressional mandate..."to define how management responsibility can best be structured so that communication and coordination can be improved..." the environmental management study unit was created. Projects established within this unit appear to be appropriate to the immediate task of developing management inventories. Products developed to date, such as, The Evaluation of Institutional Arrangements for Water Resource Problems by Resources for the Future, Inc., and The Agency and Legal Authorities Survey, by the Environmental Law Institute are well structured and appear to be comprehensive. In fact, both documents are very useful general references and will be valuable to other geographic regions concerned with water resource management. In summary, the panel believes that the management inventories are appropriate to the short term objectives of the program, however, we are concerned that the Environment Management program has not developed a strategy for meeting the longer term objective of integrating the scientific and management studies.

Throughout the field and laboratory portions of the Chesapeake Bay Program, staggering quantities of data will be collected. These data will be synthesized into scientific concepts by individual investigators. Limited transfer between investigators may well occur and the panel strongly encourages such interaction. It is easy to conceive of several hundred reports and reprints from the scientific literature resulting from the Chesapeake Bay Program. This scientific data must be integrated with the management information generated by the social and political scientists if appropriate control strategies are to be developed.

The management committee of the Chesapeake Bay Program instituted the environmental management function to use the scientific findings and management reports as a basis for constructing alternative control strategies. The panel agrees that this is exactly what must be done. Unfortunately, we have not heard a well articulated plan indicating how such alternative control strategies will be developed. The mechanism by which control strategies will be developed is of highest priority and must be devised immediately and carefully.

The managers of the Chesapeake Bay Program should make a concerted effort to develop a mechanism to take the alternative control strategies to the public sector. The development of regulations, legislation, and public awareness are critical elements in program implementation. The panel does not mean that CBP/EPA should advocate a particular control strategy, but it should make sure that a mechanism for transfer of alternative control strategies to the public sector is in place prior to program termination.