

ORBES

Volume IV

Independent Comments

June 1978

PHASE I

OHIO RIVER BASIN ENERGY STUDY

ORBES Volume IV
Phase I
June 1978

OHIO RIVER BASIN ENERGY STUDY
INDEPENDENT COMMENTS

Grant Number R804848-01

Prepared for

Office of Research and Development
U.S. Environmental Protection Agency
Washington, D.C. 20460

ORBES

Boyd R. Keenan
Project Office

James J. Stukel
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October 19, 1978

Lowell Smith
ORBES Project Officer
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R.D.-681
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Dear Lowell:

We are pleased to transmit to you the final volume of the ORBES Phase I report series: Volume IV, Independent Comments (enclosed). As you know, last April, upon completion of the review draft of the Phase I integrated summary report (Volume I-A), all members of the Advisory Committee during Phase I and all first-year ORBES researchers were invited to send us comments on this draft. At the same time we invited comments on other aspects of ORBES Phase I, including other reports. Each Advisory Committee member and Phase I researcher was given the opportunity to present up to ten single-spaced typewritten pages of comments. These unedited remarks, reproduced directly from the originals, make up Volume IV.

All the comments that we received were reviewed carefully, and a number of the points made in them were used as the basis for changes in our final version. You will note these changes when comparing the draft Phase I report with the final version, which was sent to you last July. Under the stipulations of our Phase I Experimental Management Plan grant, the summary report is to be submitted by EPA to Congress.

Again, let us express our pleasure in transmitting to you the last formal document of ORBES Phase I.

Sincerely,

Boyd R. Keenan

Boyd R. Keenan

James J. Stukel

James J. Stukel
Co-Principal Investigators

mtr

Enclosure

cc: Core Team
Management Team
Advisory Committee

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OHIO RIVER BASIN ENERGY STUDY

CONTENTS

Foreword	iii
Comments by Advisory Committee Members	1
J. P. Apel	2
Hugh A. Barker and Owen A. Lentz . . . . .	.12
Harold G. Cassidy . . . . .	.18
James P. Darling . . . . .	.24
Fred E. Morr . . . . .	.29
U.S. Environmental Protection Agency, Region V . . . . .	.30
Carl B. Vance . . . . .	.38
Comments by Phase I Researchers . . . . .	.43
John F. Fitzgerald . . . . .	.44
Ross J. Martin . . . . .	.47
K. S. Shrader-Frechette . . . . .	.50

FOREWORD

The Ohio River Basin Energy Study (ORBES) is a multiuniversity activity whose objective is to assess potential environmental, social, and economic impacts of proposed power plants and other energy conversion facilities on a major portion of the Ohio River Basin. The study came about through the efforts of a group of environmentally aware citizens who, in the early 1970s, became concerned over plans for accelerated power plant development along the main stem of the Ohio River. Responding to these citizens, in 1975 the Congress directed the U.S. Environmental Protection Agency (EPA) to perform a specific research project: "This study should be comprehensive in scope, investigating the impacts from air, water, and solid residues on the natural environment and residents of the region."

To carry out the congressional mandate, in 1976 EPA awarded a series of one-year grants to researchers at six state universities located in four Ohio River Basin states, announcing that these grants represented the first phase of a proposed three-year project. These institutions were Indiana University, the University of Kentucky, the University of Louisville, the Ohio State University, Purdue University, and the University of Illinois (both the Urbana-Champaign and the Chicago Circle campuses). During the first year (1976-77), the researchers investigated basic high-energy-growth and low-energy-growth scenarios for future energy development in the study region. The implications of these scenarios were addressed by three preliminary technology assessment team efforts as well as by ten special studies in areas requiring more detailed exploration than was possible by the three teams.

Other important participants during the first year were members of the project Advisory Committee, whose responsibilities include reviewing project documents and providing counsel and assistance to ORBES researchers. Advisory Committee members are drawn from both public and private groups affected by or making decisions on energy facility siting in the project study region. In the spirit in which ORBES originated, the committee is a major element of the continuing involvement of the public in the study. During Phase II of ORBES, which began in November 1977 and is expected to last two years, the committee's role and composition have been expanded. This expansion parallels the extension of the study region from major portions of Illinois, Indiana, and Ohio, and all of Kentucky, to encompass southwestern Pennsylvania and most of West Virginia.

As co-directors for the ORBES Experimental Management Plan under our own EPA grant, one of our responsibilities during the first year was to integrate selected findings into an interim report for submission to Congress. When appropriate we also consulted non-ORBES findings available from other EPA-

sponsored research and other sources. The interim report concentrated on comparing the impacts of the basic low- and high-energy-growth scenarios as projected for the year 2000. Entitled ORBES Phase I: Interim Findings, it became Volume I-A of the first-year report series. The report also is being published by EPA in its own edition for wide distribution.

Collected in this volume of the series--Volume IV--are comments on a draft version of Volume I-A. Each Advisory Committee member and university researcher was invited to review and submit responses to the draft integrated report and any other aspect of ORBES. They were asked to pay particular attention to the policy issues listed in the four substantive divisions of the report: natural resources, developed resources, the biological and ecological environment, and public health, economics, and society. A number of the points made by these reviewers were considered in revising the draft report. Because of these revisions, many of the comments do not apply to the final version of the integrated report; page references are to the draft version. The comments are reproduced directly from the responses sent to us.

We are deeply grateful for the help provided by all Phase I researchers and Advisory Committee members. We would like to extend special thanks to those individuals who submitted the comments reproduced in this volume.

James J. Stukel and Boyd R. Keenan
University of Illinois

COMMENTS BY
ADVISORY COMMITTEE MEMBERS

EvD78-181
May 12, 1978



COLUMBUS AND SOUTHERN OHIO ELECTRIC COMPANY
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J. P. Apel
Vice President, Environmental

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Re: Comments on ORBES Phase I

Dear Sirs:

These comments have been prepared in response to the Project Office's invitation to review the ORBES Phase I: Interim Findings as well as other Phase I reports. We specifically request that these comments be part of the documentation of ORBES Phase I and included for publication in Volume IV.

INTRODUCTION

The review of the product of any study must be accomplished in light of the stated objectives and purposes. The first part of such a review is to determine if the study contains errors in fact or other deficiencies which challenge the credibility of the entire effort. Only after determining that there are no basic flaws in the study is a detailed review of the product warranted. Unfortunately, the review of the reports received for this study indicates errors. Furthermore, unjustified, unwarranted and unprofessional assumptions, decisions and conclusions permeate the study to the point that the validity and credibility of the entire project are challenged. Since the study does not meet nor even approach its own stated objectives and purposes, the product of this research study does a disservice to the best interests of both the general public and the legislators for whom this study is directed.

STUDY REGION

First of all, I must question the scope of the entire ORBES project. It appears the researchers have taken it upon themselves to conduct a regional assessment study which is clearly broader than the mandate from Congress which reads as follows: "The (Senate Appropriations) Committee directs the Environmental Protection Agency to conduct . . . an assessment of the potential environmental, social, and economic impacts of the proposed concentration of power plants in the lower Ohio River Basin." The entire ORBES project was initiated when a local special interest group raised questions concerning the planning and construction of nine power plants in the lower Ohio River Basin. These nine plants should have been the focus for the project since they were the only



EvD78-181
May 12, 1978

Mr. Boyd R. Keenan
Mr. James J. Stukel

Page 2

proposed plants in the lower Ohio River Basin. Apparently, the researchers took it upon themselves to project beyond 1985, a total of 159 additional power plants and to expand the region to incorporate one side of the middle Ohio River Basin.

Next, there is a fundamental problem in the definition of the study region. The decision to include the entire southeast portion of Ohio in the study region and exclude the portions of West Virginia which are just across the river from the study region is totally indefensible. In effect, this definition says that the impacts and benefits of a power plant located along the Ohio River in southeast Ohio somehow magically stop at the Ohio River and do not affect West Virginia and vice-versa. This is not only indefensible from a physical sense, but also, from an economic and sociological sense. While the remote counties (in relation to the Ohio River) of Ohio, Indiana, Illinois and Kentucky may contribute to the Ohio River runoff and contain appreciable amounts of mineable coal, I believe that the impact of the West Virginia counties on the ORBES region is as great or greater than the remote counties, and that their exclusion from the study area is unjustifiable.

WORK FORCE

In analyzing the impact on the work force, the researchers included the entire labor force from northern counties of Ohio, Indiana and Illinois on the basis that workers are quite mobile and may commute across both county and state lines. They did not, however, consider that workers from West Virginia and western Pennsylvania are also likely to cross state lines for employment on the other side of the Ohio River. Such an obvious oversight is unjustified and infers a lack of knowledge about the fluidity of the labor market. If it is assumed that workers 200 miles north of the Ohio River will have an effect on the employment statistics, then it is inane to believe workers that live on the other side of the river would have no effect.

Further, the "finding" that the high-energy growth scenario would employ three times as many workers during peak construction as would the low-energy growth scenario is a function of the researchers time-phasing of power plant construction and demonstrative of their complete misunderstanding of the subject being studied. The schedules given for the high-energy scenarios were done with no regard to the actual experience of the industry. In several cases the scheduled dates are blatantly impossible because of the regulatory process alone; this does not take into account such matters as legal delays, siting, etc.



Mr. Boyd R. Keenan
Mr. James J. Stukel

Page 3

It should be noted that the likelihood of boomtowns developing in the ORBES region was a subject of controversy even among the researchers themselves. "Relatively uniform population density" in the ORBES region would make few locations susceptible to "boomtown conditions". I question the characterization of the ORBES region as having a uniform population density. The well developed transportation network in the ORBES region may have more of an impact in alleviating any "boomtown conditions."

IMPACT ASSESSMENT

The highlight of the researchers self-delusion is contained in the following statements from the Interim Findings: "The projected lower levels of residuals from the electric utility sector under the low-energy growth scenarios would be offset to varying degrees (depending on the pollutant) by increases in residuals from the industrial combustion of fossil fuels. That is, in order to both maintain gross national product and conserve electrical energy under the FTF scenarios, industries in the region would produce their own power directly through combustion of coal and natural gas." In other words, the researchers admit that it is impossible to meet the FTF scenario load-growth without forcing industry to generate their own power. Furthermore, the power generated by industry is not counted as part of the overall electrical energy produced in one case (FTF) and is in the other (BOM).

The researchers have often reiterated that they were not attempting to predict what will happen, but rather, they were examining plausible futures. Given the futures, or scenarios, the researchers would then attempt to assess the various environmental, social, and economic implications. The 100 percent coal and 100 percent nuclear scenarios are certainly not plausible, the siting configurations are impossible, and thus, any assessments which follow lack credibility.

The impact assessments are for the most part a classic example of use of unsubstantiated value judgments, incorrect data, and misunderstanding of fact. The following example will establish the point at issue. In one report, in an assessment of the Trimble County Generating Station is a statement which reads as follows . . . "It is seen that terrain surrounding the stack is, in places at the same elevation as the stack outlet." Examination of the data presented reveals that stack height is 800 feet and the height of the surrounding terrain is a maximum of about 850 feet. Unfortunately, the plant is not being built at sea level, as apparently assumed by the researchers, but at an elevation of about 500 feet. Thus, the statement that the stack height is the same as the surrounding terrain is wrong, and the conclusions which result, also wrong.



Mr. Boyd R. Keenan
Mr. James J. Stukel

Page 4

A "major" finding states as follows . . . "If power plants continue to be built at preferred sites in the region, a dense pattern of these emission sources along river corridors would result. Because these corridors tend to be aligned with persistent wind directions, pollutant concentrations would build up as the air mass moves downwind." The researchers are obviously referring to their preferred sites which in no way resemble the utility industry's preferred sites. Thus, the dense patterns of emission sources along river corridors are a direct result of their primitively applied siting methodology. There are many river corridors in the ORBES region which do not align with persistent wind directions. In regards to pollutant concentration build up downwind, let me quote from the air modeling efforts undertaken by the researchers in Phase I: "Unfortunately, time did not permit an analysis of the period of time the wind would need to persist to allow full development of the cascading effect throughout the corridor. Nor was the meteorological data available to substantiate the persistence time for a particular case's wind conditions. Thus, the corridor model should be viewed as hypothetical." When one considers the lack of supportive data necessary for air quality modeling, errors in the location of existing plants, identical assumptions regarding all stack parameters, and the errors such as those applied to the stack height previously mentioned, it is obvious that the researchers "major" finding rests on a very shaky foundation.

SITING CONFIGURATIONS

Regional and subregional wind corridors may exist, however, the build-up of high emission sources along these corridors are a direct function of the regional siting configurations. The siting configurations chosen by the university researchers are a travesty upon the art and science of power siting and perhaps the best example of the misuse of data and lack of appreciation of the complexity of the subject at hand. This is particularly distressing because at the specific request of the researchers, CSOE provided several copies of a regional siting survey used to identify sites for actual evaluation and acquisition. In our survey, procedures were detailed and criteria and data were documented. In examining the regional siting configurations, it becomes obvious that either the researchers did not understand the information or they did not bother to use the information at all. Most certainly they do not understand current technology and/or utility power siting practice.

Apparently the researchers did not realize that improper selection of candidate counties, and illogically designating the type of plant within a county, pre-determines the results of the impact assessments. Since the regional siting configurations are the basis for the entire assessments that follow, it is apparent that the credibility of the study is destroyed.



Mr. Boyd R. Keenan
Mr. James J. Stukel

Page 5

One assumption that perhaps demonstrates the degree of naivety of the researchers best is the assumption that the availability and accessibility of transmission lines present no problem in regard to plant siting. This could only be the case with a group of researchers who have never attempted to site a transmission line, let alone a power plant. Furthermore, it is obvious that the researchers' own list of general constraints for siting energy facilities was not adhered to. For example, looking at air and water quality, the selection of both Franklin County and Pickaway County, Ohio, for 2000 MWe of coal-fired plants flies in the face of any logic whatsoever. The problem is then compounded by the selection of counties such as these for the BOM configurations and then either not using these counties or drastically reducing the capacity in the FTF configurations. This action has the effect of forcing the reader to a particular and unwarranted conclusion. The travesty is then further amplified by the mechanisms used to apportion plants within the counties. The assumptions used were stated in one report to be as follows:

- "1. If the county was bordered by a river, then the plants were located along the river at approximately an equal distance apart,
2. For the counties not bordered by a major river, the plants were located randomly within the county, and
3. No two plants were given the same site."

These assumptions are complete nonsense and indicative of the researchers predetermined conception of what the study would conclude. The selection being accomplished in this manner clearly magnifies impacts along the rivers and minimizes impact in the interior counties thus forcing the reader to the now obvious predetermined conclusions of the researchers.

WATER QUANTITY AND QUALITY

Water quantity and quality are concluded to be potential problems locally during periods of sustained low-flow conditions. What the research team neglected to investigate was the possibility of "capturing" water which would ordinarily be carried from the ORBES region, by utilizing storage reservoirs. Water could be released from the reservoirs to augment water supplies during sustained periods of low flow. Furthermore, navigational problems resulting from the widespread use of irrigation would be more appropriately addressed as a policy issue, rather than a conclusion. The extent of future irrigation development in the Ohio River Basin is highly speculative.



Mr. Boyd R. Keenan
Mr. James J. Stukel

Page 6

The water consumption rates were based on an assumption that new generating plants would be equipped with wet cooling towers and existing plants would be retrofitted. Recent results from 316(a) studies have shown that many plants can comply with thermal regulations without going to wet cooling towers. If it can be demonstrated that more traditional cooling techniques can comply on a case-by-case basis, the water consumptive losses projected in the ORBES region can be drastically reduced.

The relative impacts of water consumption were assessed for the Ohio River and its major tributaries and characterized in the undefined terms of light, moderate, or heavy. I must again reiterate that although the assessments may be correct based on the methodology of the researchers, the fact that the methodology is totally invalid makes any assessments meaningless. It is no wonder the impacts on water consumption are so heavy in the Scioto River, 8000 MWe were located along this tributary of the Ohio. This is absolutely fantasy.

The Interim Findings state that: ". . . no data are available on non-point sources that contribute to TSS . . .". However, a conclusion is drawn that if non-point sources of water pollution are taken into account, significant differences between the high-growth and low-growth scenarios might be found in the concentrations of two (TSS and TDS) of the four water pollutants examined. This is an example of a conclusion arrived at without the benefit of a data base.

GRAPHICS

Figures F-1-5 attempt to show graphically the existing and projected electrical generating facilities in the ORBES region. To begin with, units and not facilities are shown. This misrepresentation has been brought to the study group's attention time and time again. Furthermore, some existing facilities are not depicted while others are located incorrectly.

LAND USE

I must object to the conclusion that transmission takes significant amounts of land out of production. Transmission corridors are compatible with agricultural land use. Productivity may decrease slightly due to compaction but this is temporary in nature and only the areas around the structure bases are taken out of production. Furthermore, the relocation of residents during power plant development is very minimal since this criteria is used in determining the site location.



EvD78-181
May 12, 1978

Mr. Boyd R. Keenan
Mr. James J. Stukel

Page 7

GENERAL

There are dozens of land use conflicts which have potentially as great or greater impacts on agricultural, scenic, and recreational land, e.g., highways. Since the researchers have chosen to evaluate land use conflicts from power plants in a vacuum, the conclusion can only mention the conflicts associated with mining and conversion. The result, therefore, is that the reader is again, led down the path to the researchers predetermined conclusions.

MINERALS

The researchers concluded that sufficient quantities of limestone would be available to meet the projected requirements for new flue-gas desulfurization systems. However, the quality of limestone must also be considered and this information is not apparent in any of the Phase I research.

A percentage reduction will most likely be required regardless of the sulfur content of coal. Low sulfur coal is not considered the best available technology and economic constraints on its use have been imposed in at least one ORBES state. It is, therefore, highly unlikely that there will be a trend to accelerate importing increasing amounts of low sulfur coal for new power plants.

The researchers conclude that there is a sufficient amount of coal in the ORBES region to last several hundred years if coal requirements level off after 2000. What the researchers did not examine was the usability of this coal. The Clean Air Act Amendments could restrict the marketability of this coal and thus, much of this resource may remain undeveloped.

PUBLIC HEALTH

There appears to be no justification within the study for the researchers' conclusion that "The high-energy growth option would more than double the expected number of premature deaths over those expected under the low-energy growth option". With the exception of nitrogen oxides, the researchers' own results show that no appreciable difference occurs between the high-growth and low-growth scenarios regarding air and water pollutants in the year 2000. Furthermore, the assumptions that people under the high-energy growth option will consume higher calorie foods and exercise less is unbelievable and does not warrant the above conclusion.

Furthermore, I must disagree with the classification of nuclear accidents as a first-order impact on public health. The nuclear accident risk level is actually less than that of most available alternatives in use today. The past nuclear safety record speaks for itself!



Mr. Boyd R. Keenan
Mr. James J. Stukel

Page 8

The Interim Findings allude to security risks inherent in the nuclear fuel cycle of commercial nuclear power. It must be noted that there are at least eight different ways to produce nuclear weapons grade material. The commercial nuclear power route is the most expensive, requires the highest level of support technology, and the broadest base of support industry. To put all weapon proliferation emphasis on the commercial reactor program is naive. The following analogy will make my point: If a dike is leaking in at least eight places, and someone comes along, plugs up the smallest hole, and then announces that the leaking has totally stopped, he still better know how to swim.

Turning to sabotage, there are many safety systems built into a nuclear facility and an individual with specialized knowledge may be able to cause a plant to shut down. However, this must be separated from the incidents which may cause a public health hazard. The amount of radioactivity release that would threaten public health must be considered along with the high degree of teamwork which would be necessary to carry out a sabotage operation. When one considers the relative costs of other means to create public havoc, the low probability of a successful sabotage operation cannot be considered seriously as a major social threat.

INDUCED GROWTH

In several instances throughout the Phase I studies, energy facilities are alluded to being developed to induce growth. Indeed, one is led to believe that power plants are constructed to allow more residential, commercial, and industrial development. This is not the case. Specifically, utilities have a legal responsibility to supply future needs and that this need must be demonstrated prior to construction.

CAPITAL AVAILABILITY

The technique for estimating the capital availability requirements of the various scenarios are, at best, confusing. It would be difficult to speculate on what is included in the general expenses category or how transmission and distribution costs were determined. However, based on the type of unjustified and speculative assumptions apparent throughout this study, one can easily imagine similar problems in this area.

ASSUMPTIONS

Many of the assumptions listed in Appendix F of the Interim Findings are absolute nonsense and two of the assumptions appear to actually contradict each other. The first assumption states that the percentage of electrical energy produced in the ORBES region as compared to the nation as a whole will remain constant. The third assumption then goes on to say that electrical energy demand in the ORBES region is not necessarily a direct indication of energy demand in the nation as a whole.



Mr. Boyd R. Keenan
Mr. James J. Stukel

Page 9

The assumption which states that existing government regulations will remain in effect through the year 2000 may best typify the myopia with regard to the dynamics inherent in governmental regulations.

Still another assumption, under the BOM scenario, states that the regulation of strip mining will not be overly restrictive. The researchers were apparently unaware of existing stringent state regulations in some states and the recently enacted Federal Surface Mining Control and Reclamation Act of 1977. Further, many inconsistencies exist when comparing the BOM and FTF scenario assumptions. The BOM scenarios assume that the role of solar energy and conservation will be ignored while the FTF scenario does not make these assumptions. Additionally, the researchers assume that annual energy consumption in the year 2000 will be 31 percent greater for the BOM scenario relative to the FTF scenario and, at the same time, assume a difference of only 1 million people nationally.

POLICY ISSUES

The policy issues addressed at the end of Chapters 3-6 reveal the true view of the researchers and can be summed up as follows: If some government control is good, then more government control must be better, and total government control must be best. Perhaps cooling technology will serve to illustrate this logic of the researchers best. USEPA has for all practical purposes mandated the use of cooling towers rather than once-through cooling to mitigate the thermal effects on aquatic life; the researchers are concerned that this potentially creates a water consumption problem; the researchers, therefore, identify this problem and then propose as their solution--more government control on cooling technology.

The statement of the researchers that ". . . some believe that the only real purpose of the procedures (permits and hearings) is to promote and license energy facilities" again lends little credence to the ORBES project. To insinuate that public hearings are merely forums to promote energy facilities does great injustice to the public hearing process and is another example of the misunderstandings and subjective judgments which so permeate this study.

A careful examination of these policy issues reveal that they are so generic that they could have been raised by any research group at any time without the benefit of any research whatsoever. Indeed, it is difficult to see how any research of the Phase I study logically leads to any of these specific issues.

CONCLUSIONS

In conclusion, I will quote from Page 128 of the Interim Findings: "The character of this . . . study is so complex that any ultimate management arrangement by necessity must be an experiment in the sense that its results



EvD78-181
May 12, 1978

Mr. Boyd R. Keenan
Mr. James J. Stukel

Page 10

can in no way be predicted at this time." I can only conclude that the experiment was a failure and the patient died.

Finally, it should be pointed out that in any review it is possible to "nitpick" a report to death. However, this is not what this review has done; neither is the review all encompassing. This review has provided examples of the basic errors which so riddle the study that the credibility, objectivity, and usefulness of the entire product is regretfully destroyed. It should also be made clear that at the specific request of the researcher this advisor provided both constructive comments and large quantities of data (including several volumes of siting material) throughout Phase I, and has now regretfully concluded that little attempt was made by these same researchers to incorporate the comments or use the data.

Respectfully yours,

A handwritten signature in cursive script, appearing to read 'J. P. Apel'.

J. P. Apel
Vice President
Environmental

JPA:DEL:dp
cc - Lowell Smith, USEPA



OWEN LENTZ, Executive Manager

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May 15, 1978

Dr. Boyd R. Keenan
and
Dr. James J. Stukel
ORBES Project Office
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Urbana, Illinois 61801

Gentlemen:

Subject: Comments on the ORBES Phase I: Interim Findings, Volume I-A

Throughout the course of the Phase I Ohio River Basin Energy Study, representatives of electric utilities in the ECAR area were continually appraised of the project teams' activities, research, and findings. Thus, the following is a consolidation of comments obtained not only from electric utility advisors, but their staff members and others not serving directly as advisors.

Our first comment pertains to the format of the report. As indicated, Chapter 1 summarizes potential environmental, social, and economic impacts that might result from varying levels of electric energy facility developments. It provides a listing of first-year findings based on your review and interpretation of three university team reports.¹ Chapters 3, 4, 5, and 6 discussed in more detail how the various segments of our society might be impacted. These chapters each conclude with a section identified as "Illustrative Policy Issues" listing what we interpret to be your views as to policy issues that are raised by the ORBES report. We believe these concluding sections should be deleted from the report. If any of the items under "Illustrative Policy Issues" can be related to the basic research of the three team reports, they should be brought forward and presented as findings in Chapter 1.

¹We would call attention to the fact that the authors did not limit their summarization to the three university team reports. On Page V of the Preface the authors state: "In preparing the report, we have exercised prerogatives as co-directors for the ORBES Experimental Management Plan under our own EPA grant. When appropriate we have consulted non-ORBES findings available from other EPA-sponsored research and from outside sources." Deletion of all such material completed after Phase I from this interim report which is purported to summarize Phase I activities would be in order.

12

MEMBERS OF EAST CENTRAL AREA RELIABILITY COORDINATION AGREEMENT

Appalachian Power Company - The Cincinnati Gas & Electric Company - The Cleveland Electric Illuminating Company - Columbus and Southern Ohio Electric Company - Consumers Power Company - The Dayton Power & Light Company - The Detroit Edison Company - Duquesne Light Company - East Kentucky Rural Electric Cooperative - Indiana & Michigan Electric Company - Indiana Kentucky Electric Corporation - Indianapolis Power & Light Company - Kentucky Power Company - Kentucky Utilities Company - Louisville Gas and Electric Company - Monongahela Power Company - Northern Indiana Public Service Company - Ohio Edison Company - Ohio Power Company - Ohio Valley Electric Corporation - Pennsylvania Power Company - The Potomac Edison Company - Public Service Company of Indiana, Inc. - Southern Indiana Gas and Electric Company - The Toledo Edison Company - West Penn Power Company

Most of the issues listed (and many other issues not listed) could have been tabulated without benefit of the three university team reports. Any knowledgeable person through reading various types of material, technical and/or non-technical, pertaining to energy development and energy facilities, could have identified the issues that have been listed and formulated similar questions, such as: What forum and/or who should address these issues for resolution?

Our request for deletion is not to suppress publication of such policy issues since these and many others have surfaced and have been well publicized in numerous arenas and reports. We believe a listing of such generalized issues is outside the scope of the ORBES report. Illustrative of an unrelated issue is the one raised on Page 54, "Should rate structures for electricity recognize that increased future demand will require the construction of significantly more costly power plants than those currently in use, thereby raising the average per unit cost even when an individual consumer's demand remains constant?" The philosophy of rate structures has been discussed many, many times covering unique questions such as raised in the foregoing. Similarly, it could have been noted that the cost to serve each consumer differs, and this raises the "issue": "Shouldn't the rate for each consumer be based on his cost of service?" Issues of this type have been well recognized and have been discarded as being highly impractical to incorporate in a rate structure. However, returning to our main point, we see no relationship between this issue and the area of research as covered by the ORBES studies.

Another example of a vague, generalized "issue" is on Page 53, Chapter 4, "Should new legislation address the question of safety and safeguards in transporting nuclear materials?" This is suggestive that there is either no legislation, that present legislation is inadequate, or that present legislation has not been adequately enforced. Did the ORBES study provide any basic research or analysis leading to such conclusions and the need to identify such an issue? If it is a valid conclusion, then wouldn't it be more appropriate to list the item as a finding in the Summary of Chapter 1?

Rather than continue with additional examples, we would note that the issues listed in most cases are so general in nature that they are open to an interpretation that they would support two diametrically opposite viewpoints. Furthermore, it is not apparent, in most cases, as to what is the basic issue and the validity of it as an issue. It is suggested that the authors review the items under "Illustrative Policy Issues" to insure that the potential issues published (and if published, be incorporated under findings as recommended previously) can be directly drawn from factually based ORBES research. This is an obligation to those who will review the report without a basis for judging the adequacy of the source. Otherwise, the credibility of the Phase I effort will be held in doubt by peers who have working knowledge of the environmental, social, and economic impact of the energy sector.

A description of the two basic scenarios appears in the second paragraph on Page 15. The postulations or basic assumptions that Gross National Product (GNP) would be or had to be equal for both the Bureau of Mines and Ford Foundation projections and the conclusion that a different mixture of goods and services would materialize under one scenario as compared to the other scenario such that GNP would be equal, are not supportable by the ORBES studies. This unsupportable theme carries over into other sections of the report where it is stated on Page 46, "On a national basis little difference in total employment under the high- and low-energy-growth scenarios would be expected."

The coupling (or correlation) between energy consumption and GNP is well documented in statistics compiled by governmental agencies in this country and in other industrial nations. Obviously, the coupling "factor" between GNP and energy consumption can change--more efficient use of energy to produce the same amount of goods reduces the coupling factor. On the other hand, more emphasis on use of energy rather than manpower causes the coupling factor to move in the opposite direction. We believe the authors should provide more support or rationale as to why the Nation can expect the same level of economic activity under the two widely divergent scenarios and as to why other types of services and industries will be able to develop and sell products to fill the void that would be created if the high-energy growth scenario is not realized. In the absence of any supporting rationale reviewers can only conclude the foregoing postulations were arbitrarily decided upon.

Many of the observations or findings of Chapter 1 could be identified as "truisms" which need little or no supporting data. As an example, refer to the findings relating to "Potential land-use conflicts exist between coal mining and crop production, particularly in Illinois, and between coal mining and forest and recreational areas in the Appalachian portions of Kentucky and Ohio." It would be just as logical to say that there is a potential land use conflict between any physical facilities whether it be a power plant, shopping center, or recreational structure with any piece of land, whether it be highly desirable farm land or land that is considered to be marginal in terms of present use.

Such findings as "The high-energy-growth option would more than double the expected number of premature deaths over those expected under the low-energy-growth option." on Page 7, is a very vague, generalized statement that is not supported by any analysis in the ORBES study. Possibly the authors reached this conclusion on the basis that if it can be statistically proven that "X" number of deaths result for every power plant, a "Y" number for every ton of coal mined, then doubling the number of power plants and doubling the amount of coal mined, means twice as many deaths. This seems inconsistent with some of the study assumptions that GNP and employment will be at the same level for both high- and low-energy growth. What proof is there that the postulated growth in other industries and services as noted above to maintain equal GNP will not also result in premature deaths equal to or greater than those with the high-energy-growth scenario?

The ORBES study is presumably a result of the directive from Senate Appropriations Committee to conduct "...an assessment of the potential environmental, social, and economic impacts of the proposed concentration of power plants in the lower Ohio River Basin." Yet the study seems to present broad energy scenarios including mobile sources, trucks and automobiles, selectively presented to highlight the adverse impact. (Page 67) This is another example of deviating from the scope of the study as defined by the Senate.

Of paramount concern to the utility advisors is the context in which the ORBES air quality studies are framed and the emphasis on "corridor effects." The subject report on Page 73, states under "Cascading Effect of Siting Corridors: Subregional Effects," the following: "In order to examine the air quality impacts of these siting configurations, a theoretical model (the Air Quality Display Model) was implemented to determine the level of atmospheric pollutant concentrations if a persistent wind blew along any of these siting corridors."

For the reasons set forth below, we take exception to the methodology employed in the various ORBES scenarios in projecting regional and statewide air quality impacts:

1. It should be noted that the Air Quality Display Model (AQDM) was one of the forerunner models developed by Federal EPA to ascertain primarily, annual SO₂ concentrations, and it was not intended to be used in predicting short-term pollutant levels, i.e., the 12-hour concentrations stated on Page 74, so as to depict a "corridor" effect.
2. The Federal EPA's own Guidance Series, OAQPS No. 1.2-080, "Interim Guideline on Air Quality Models," October 1977, Page B-4, recognizes a limitation of the AQDM where it notes that it is "Useable for urban areas only." Thus, the application of this model to power plants which are presently located in many of the predominantly rural areas within the Ohio River Basin and new plants to be located in similar areas would be of little relevance.
3. The document, "Air Quality Display Model, TRW System Group" PB 189194, November 1969, Page 2-1, reveals that "...before using the AQDM to estimate regional air quality, the atmosphere diffusion model should be calibrated with existing air quality data (various calibration options are provided in the AQDM.)" The air quality analysis undertaken in ORBES Phase I was predicated on theoretical modeling exclusively without having calibrated the model used in the analysis. Since no air quality and meteorological data were incorporated into this work, the "cascading" hypothesis is suspect, at the minimum, if not totally invalid.

An overall impression which one can gather in reviewing the ORBES air quality analysis presented in the interim document is that data and assumptions are loosely supported from a technical standpoint. In citing a specific example, the ORBES interim document (Page 74) states that, "...under the cascading effect of a south wind these allowable ambient concentrations could be exceeded three to six times a year. Another recent study reports similar results (23)." In this document, wind persistence data were examined, but no air quality analysis was undertaken to lend support to the theory of ORBES "corridor" effects. That referenced document (23), compiled by Teknekron, Inc., of Berkeley, California, in no way supports this statement.

We fully appreciate that the Phase I effort had to cover a broad scope in a limited time frame. The project team throughout the Phase I study stressed that the Phase I effort had to be considered as preliminary in nature--that the objective of the analysis was to sort out those items and matters that should receive more in-depth study in Phase II. However, the preliminary nature of Phase I seems to be lost in the summary report which now conveys a high degree of finality on many subjects. Our concern for this is evident by the following specific comments.

Page 18--The "...expressed concern over the assumptions implicit in the development of scenarios, particularly in areas of health and safety as related to nuclear-fueled facilities." needs to be isolated from emotional expression. Researchers who expressed such concern can hardly be regarded as experts in the field of nuclear technology. This concern would have been meaningful if the researchers who are also experts in the nuclear field had expressed their views supporting these alleged concerns.

Page 19--The alleged conflict between commitment of land to energy and food in the ORBES region is indeed highly dramatized. From all Phase I study results, there appears to be enough land available to adequately meet not only these two needs, but many others. ORBES region will not encounter any food shortages resulting from insufficient land.

Page 24--The land requirement estimates to store scrubber sludge are optimistically shown to be less than one-half the actual land area (acre feet) currently utilized. It is further stated that such land use is reversible to the extent that the land can be returned to its previous use. This again seems not to be the case wherever scrubber sludge is currently stored.

Page 27--The assumption that evaporative cooling towers would be employed by all plants--even existing ones--appears to be aimed at obtaining a most adverse impact. States like Indiana are viewing the issue of projected uses of water resources more realistically. If once-through cooling would conserve this valuable resource and reduce its consumptive use, then it is that option and not just an arbitrary assumption that must be evaluated.

Extensive development of irrigation is a very remote and highly unlikely possibility. Even if irrigation were to become extensive, it would very likely utilize ground water and not river water.

Page 33--"...only 50 percent or less of the (uranium) ore in the deposit would be recoverable." is a highly erroneous statement. In general, over 90 percent of the ore is recoverable in underground mining.

Page 36--Clean Air Act Amendments of 1977 have provided sufficient legislation to protect land areas (private as well as public) from adverse effects of electric energy generating facilities. This should no longer remain a policy issue.

Page 37--The policy issue on the use of local and regional coal has already been addressed and appropriate measures spelled out in the 1977 Clean Air Act Amendments.

Page 49--Alleged shortage of construction workers is projected in this report. If this hypothesis is correct, this could be considered a desirable situation for the United States instead of a severe problem as stated.

Page 58--It is incorrectly stated that states currently are not required to meet secondary standards within any specified period. In Indiana, for example, Regulation AFC 14 requires compliance with secondary standards at all times and has been in effect at least since 1972.

Page 63--It is stated that secondary particulates constitute from one-tenth to one-third of the mass of total suspended particulates normally found in the ORBES region. There were, however, no data generated or made available during Phase I to support this statement and the two ensuing paragraphs. EPA has the Congressional mandate to protect public health from such pollutants. If the issues indicated in these two paragraphs are purported to be as harmful, then EPA does not seem to be as alarmed from these. The issue of alleged plant damage has already been incorporated by EPA in setting secondary standards established at levels below the harmful threshold.

Page 65--It is erroneously stated that "Sulfur oxide emissions under the high-energy-growth scenarios in the year 2000 would increase about 7 percent relative to 1972 levels. Many sections of the ORBES region were nonattainment for sulfur oxides in 1972. However, all these must and will achieve attainment by 1982 per the Clean Air Act Amendments. Therefore, compared to 1972 sulfur oxide emission will be reduced substantially long before the year 2000.

Page 66--The acid rain theory appears to be yet another "what if" hypothesis. Actual pH measurements of waters in the ORBES region do not support it.

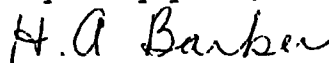
Page 74--The first paragraph clearly indicates that 12-hour persistent winds from the west-southwest could be expected once in two years, while from the south the expected frequency would be three to six occurrences per year. The second paragraph indicates that 1000 micrograms per cubic meter would be expected under either persistent wind direction. With the wind direction from west-southwest and the given frequency of occurrence this indicates that the primary 24-hour standard value would be exceeded once every two years--this does not constitute a violation of air quality standards, since one exceedance per year is allowed. The hypothetical sulfur dioxide concentration extremes cannot and will not be allowed under existing National Ambient Air Quality Standards and State Implementation Plans. Therefore, the entire discussion that such exceedances could occur appears irrelevant.

Page 92--It is reported that 2400 acre feet would be required to store the flyash and scrubber sludge from a 1000 MWe plant. Current technology requires 4900 acre feet to 5800 acre feet just to store the scrubber sludge. No supportive data have been presented to indicate this vast improvement in land use.

Pages 94 and 95--The discussion on such issues as secondary unregulated pollutants, secondary standards, "capture" of clean air allotments, and low level radiation emitted routinely from nuclear-fueled and coal-fired plants appears to be an effort to "create" issues where there are not any. The Clean Air Act of 1970 has given EPA a clear mandate to protect public health. The Amendments of 1977 further strengthen the EPA position. Secondary standards, prevention of significant deterioration, and periodic revisions to existing standards are the avenues that EPA has been utilizing effectively to correct not only these hypothetical issues, but also the real ones.

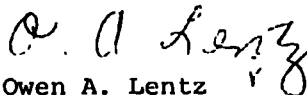
In closing, we must, as in prior comments on the three university team reports, express dissatisfaction with the limited time frame (a couple of weeks) which has been extended to us by ORBES in their soliciting constructive inputs regarding the manner in which utilities might be eventually impacted, and conversely, how the ORBES region might be affected by electric companies. Along with this, the interim report (while understandably "relatively brief"), the findings of which are written in such general terms and loosely-referenced, leave the reader with no other recourse but to pour through voluminous support documents in a limited time frame so as to either consent with, or refute, sundry technical issues often of a controversial nature. A comprehensive critique of the ORBES Phase I Interim Findings and supporting reports has proven to be impossible in the time allotted.

Very truly yours,



Hugh A. Barker

Member-ORBES Phase I Advisory Committee



Owen A. Lentz

Member-ORBES Phase I Advisory Committee

Route 2 Box 251
Hanover, Indiana 47243

May 9, 1978

Dr. James J. Stukel
Dr. Boyd R. Keenan
345 Advanced Communications Building
1011 West Springfield Avenue
Urbana, Illinois 61801

Dear Boyd and Jim:

I received your Volume I-A Draft Interim Findings of the ORBES Study just as I was leaving for New Haven for a Committee meeting. I looked forward to reading it and must say it reflects a very great deal of work.

As a general overall comment, I must say that I am disappointed in the clear bias towards nuclear energy which is shown overall in the work. My chief criticism of this overall apparent bias is that nuclear pollution is cumulative and not biodegradable and that for this reason the damage it does is irreversible and therefore irreparable. And it seems to me that this needs to be brought out very clearly in any report on the subject.

I can understand the need for you to point out on pages iv and v in your Preface that you were up against the problem of making choices and had to use your own judgment. This is certainly completely defensible and could not be any other way. This is one very large gap in the Study which I find difficult to accept and that is that there is no "scenario" which relies entirely on the impact of rational, carefully planned and carefully promoted conservation of energy. It could very well be that if the facts were gathered it would turn out that conservation would release so much energy that is now wasted that we could get along to the year 2000 without building any more power plants.

I think also that you need a section on ethical impact and that means particularly the ethics of technology assessment. I am trying to write up such a statement and if I am successful I will send it to you as a contribution to the project.

I will now make a few comments about the body of the text in the spirit of your first paragraph on page 1 in which you invite comments on technical merit and policy implications. I feel sure that you are going to be deluged with comments.

I think your best statement in Chapter 1 is the very last paragraph on page 8.

On page 17, the second paragraph, the amount of additional megawatts of installed capacity that would be required to meet demand in the year

Dr. James Stukel
Dr. Boyd Keenan

Page 2
May 9, 1978

2000 is undoubtedly exaggerated. This is why a discussion of conservation as an acceptable "scenario" is essential. I feel quite sure that this figure that is given is based on unrealistic projections. The policy implications of this section would be that plants need to be built. It seems to me that this is an underlying bias of the entire report and I am not at all sure that it is justifiable. The reason I say this is that according to the Environmental Action Foundation's Report "Utility Scoreboard" 1978, the utilities of this region are congenital overprojectors. For example, Public Service Indiana, at the beginning of 1976, projected an increase in demand of 12.9%. By the end of 9 months the actual increase had been 0.3%. That is to say by the end of the year it was of the same order of magnitude and the overprojection was well over 12%. Over the years 1974-75-76, the company overprojected on the average 11.6% each year. This kind of behavior, reflecting an inability to learn, is what makes me very nervous about the whole policy implications of this ORBES Draft Report. This is not to say that you are to blame but to imply that the input from industry has been perhaps given more weight than it should be given and to underline the need to examine such input with very great care.✦

(There are a lot of small things which I could call attention to--misprints, statements which are not quite exact, but still not very bad, but I will forego this, otherwise this letter would become impossibly long.)

On page 30 I fail to find in the discussion of mineral resources a proper discussion of the possibility of using, in place of the lime or limestone FGD systems, those which recover the sulfur from the coal in a usable form such as solid sulfur or an acid. It seems to me that this option has been continually underplayed and should be paid much more attention to. This omission becomes particularly noticeable on page 32 in the second paragraph.

I have the impression that under the section on Electric Utility Capital beginning on page 45 somewhat more emphasis needs to be placed on the difficulty of getting money under the very high demands of a high energy production "scenario". The Ford Foundation Report gave this matter considerable play.

With respect to labor, I realize that quite probably you were not able to include in your consideration, work such as that on "Values in the Electric Power Industry" edited by Kenneth Sayre, University of Notre Dame Press, 1977. In this book there is an interesting chapter which points out that the industry carefully planned with respect to conservation might find itself with an increased number of jobs, for example. There is also in this book a very interesting essay which questions the identification of actual need with demand. It is pointed out, for example, that a utility is not required to provide all the services that a customer might possibly want, although it is mandated to serve the public. In connection with this section on labor, is the statement

* The attached clipping from N.Y. Times, May 9, 1978 reinforces my comments about overprojection. Some public service commissions are catching on! @

in the first chapter, that "Contrary to what is usually assumed, decreased energy consumption could lead to increased employment and to a higher standard of living." Unfortunately, of course, you are writing a publication which when it appears is "fixed" at the same time the field is one which is developing very fast and for this reason you will always be behind--and often behind an eight-ball!

In Chapter 5 there is one omission which I think is important and that is that you do not seem to discuss what is, admittedly, not conventionally considered a pollutant, namely moisture. The importance of this moisture is usually minimized. But one has to ask what is a pollutant and it must be something that appears in an excessive quantity and does injury.

Consider the proposed plant at Marble Hill. If it were finally built and operating it would exude something like 50 million tons of moisture into the atmosphere. This is in a valley which is already quite humid. The annual average relative humidity at Louisville ranges from 57% to 79%, respectively at noon and midnight. I believe that it is unconscionable to contemplate large releases of moisture into this kind of an atmosphere.

But the situation is made much worse if one adds in the proposed Wise's Landing Plant. This is proposed to take up 150 million tons of water per year from the river at the total maximum peak intake rate. It is calculated that evaporation from the proposed cooling towers and from drift loss would be 50 million tons of moisture per year. What is not mentioned is that in addition 10.5 million tons will be produced from the combustion of the coal and would be exhausted from the stacks which would mean that this proposed plant would release to the atmosphere 60.5 million tons of moisture per year and this just across the river and not very far from the proposed Marble Hill plant. I think that the ORBES group could do a real service to this area if it would point out and get some action on considering moisture as a pollutant from power plants.

It seemed to me that the discussion of particulates, pages 62ff, is a good one considering the space limitations. I suspect that one of your big problems has been that you had to cut things down and omit a great deal in order to come out with something that was of reasonable size. You might have to end up with still shorter statements made up of categorical statements with references to the data which has been gathered.

I must say that this whole chapter--apart from the omission of consideration of the effects of moisture--is excellently done. It would be good if we could convince EPA to pay some attention to your findings.

It might seem to you that I was particularly harsh in my strictures with respect to bias towards nuclear energy, but I would like to give you an example of why I have this reaction. If you will look on page 94, paragraph 2, you will find that at the end of that paragraph, it says "In addition, it is anticipated that those scenarios which emphasize coal usually would have more severe impact than those which emphasize nuclear fuel." This is a quite incorrect statement. In the first place, coal

pollution is on the whole biodegradable. Nuclear pollution is not biodegradable nor is it reversible. Further, and this is the most important point in connection with this particular quotation, would you consider that having danger and emissions and watchfulness required in perpetuity for nuclear waste negligible? This is certainly far more severe in impact than would be any impact of the pollution from coal. At least it would be in my estimation.

Another example might be in paragraph 3, page 96, which should certainly have an addendum to it or another section dealing with nuclear. The same strictures can be applied to nuclear. The nuclear dumps continue to give off radiation for more than just centuries and there is nothing that can be done about it. Things can be done about mine drainage I am told. So here again is a kind of omission which suggests the pro-nuclear bias which I have already mentioned.

Still another example is on page 97 in the second sentence of the first paragraph where after the word coal, uranium should be added. The hazards of mining uranium are hardly ever mentioned. Yet it is well-known that uranium miners have a high incidence of cancer and other health ailments due to the radon and other materials which they inhale. There is sufficiently long history of this, especially coming to us from European experiences and from the early mining that was done in this country, that there is no question on the danger, the occupational health risks, of uranium mining. So they should be added to the coal so as not to produce the kind of bias which I have sensed in this report. And, one might add, that nothing is said about uranium problems under the section on mining starting on page 98.

The importance given to the Rasmussen study on page 104, first paragraph, is very unfortunate in my opinion. This study is not the only comprehensive study that has been carried out. There were much earlier studies which were suppressed by the Atomic Energy Commission when it was discovered that they were inimical to the aims of the Commission in building nuclear plants. The Rasmussen study was done by employees of the Atomic Energy Commission and has been very seriously questioned. For an examination of it I recommend to you Science of Vol. 197, First of July 1977, page 29ff.

One important matter which I think should be discussed in the next report is the military hazard of building large plants, especially when they are built close together. This is a matter which is not often mentioned and yet it seems to me that given the present state of the world it is of the essence. Some melioration of the problem could be achieved by building small plants well dispersed.

I would raise a question about the table on page 107 because no accounting seems to be taken in the lag in cancer development--which may amount to as much as 20 years--or the mining accidents and occupational hazards of uranium.

There are a few additional small things, which I should mention, in the Appendices. For example, Appendix F 4, does not seem to me to be reasonable. It seems to me that it is most likely that if a Marble Hill plant

Dr. James Stukel
Dr. Boyd Keenan

May 9, 1978
Page 5

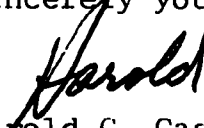
were to be built, the energy would be sent to Chicago, that is to say, outside of the ORBES Region. With respect to item 20 on page 143, it may be of some interest to note that Public Service Indiana has already talked about increasing the size of the Marble Hill Plant to four units and has enough land available to go to an energy farm.

On page 144 I found to my amazement that the role of solar energy will not be taken into account and that energy conservation will not be taken into account. This I think really should be corrected if you wish to have this report just not gather dust on library shelves.

Well, Boyd and Jim, I have given you my first impressions of this draft report. I hope they will be useful. You should not take these as personal remarks and they are not meant in any sense. I feel that this ORBES report is potentially a tremendously valuable thing for the people living in this area and therefore I would like to see it develop its potential more than appears to have occurred so far. I realize, of course, that you have a terrific pressure on you from all sides--including Save The Valley, I hope--and have to bring these together. It is a problem which I do not envy you.

With best regards,

Sincerely yours,



Harold G. Cassidy
Professor-At-Large
Hanover College

HGC/db

Board Orders Rehearing on Its Approval of Building Nuclear Power Plant on the Shore of Lake Ontario

By HAROLD FABER

Special to The New York Times

ALBANY, May 4—Only five months after it approved construction of a \$1.1 billion nuclear plant at Sterling on the shore of Lake Ontario, the State Siting Board today suddenly ordered a rehearing of the case, questioning whether the added electricity was needed.

The board's unexpected action, involving the only case it has decided since it was formed in 1972, illustrated the wide economic impact of new revised figures, prepared by state public utilities, drastically cutting their estimates of how much electric power the state would need in the next 20 years.

The decision came shortly after the Public Service Commission prepared a summary showing that every new electric power plant under construction or planned in the State was either being delayed or deferred because its output was not needed now or in the near future.

Summarizing the situation before an Assembly committee yesterday, Charles A. Zielinski, chairman of the commission, said the state had a "fat" reserve of electric capacity in contrast to only five years ago, just after the brownouts and blackouts in New York City and just before the Arab oil embargo.

He told the committee:

"We stand today with electric generating capacity 20 percent in excess of the 22 percent reserve required by the New York Power Pool for adequate reliability."

In the case of the Sterling plant, proposed by the Rochester Gas and Electric Corporation and three other upstate utilities, the 1978 long-range forecast showed excess electric capacity in 1986, the target date for completing the plant.

"It seems obvious to us," the board said in a unanimous decision, "that these figures, which are the utilities' own estimates, provide a proper basis for re-examining our findings of public need."

The action by the Siting Board, which bears the formal title of the State Board on Electric Generation Siting and the Environment is sure to add to an already heated controversy on building new power plants, involving billions of dollars and thousands of jobs.

It also seems to support the position of environmental groups, which have been opposing new power plants, especially nuclear plants, on several grounds, including the contention that they were not needed.

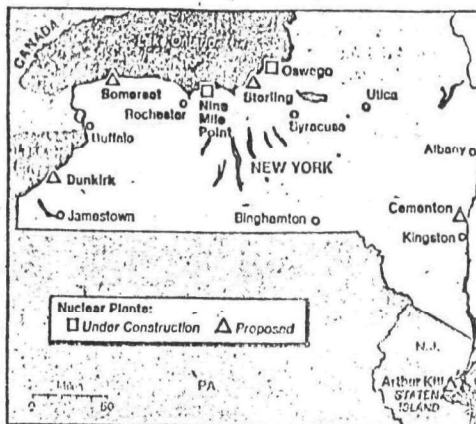
New York's seven public utilities and the State Power Authority now produce enough electricity to meet the expected peak load of 21,000 megawatts this summer, about the same load as last year. But the actual consumption will be 6,000 megawatts less than had been forecast in 1973 for this year.

Reasons Given for Forecast

In addition, the expected peak usage for 1993, based on this year's estimates, will be 36,500 megawatts, about the level forecast five years ago for 1983—a difference of 15 years in the rate of increasing use of power.

According to one commission official, the reasons for the dropoff are conservation and the use of power.

According to one commission



According to one commission official, the reasons for the dropoff are conservation by consumers and industry, the sub-normal economy of the state and the revised forecast by the utilities.

In his testimony, Mr. Zielinski explained that consumers had responded to increases in electricity rates by cutting their use following the rise in oil prices by the members of the Organization of Petroleum Exporting Countries in 1973.

"The steady 6 percent and 7 percent increases in peak electricity loads that had characterized the 1960's and had been projected for the 1970's, disappeared," he said. "And this situation has made the need for all of those [new] plants—something tantamount to being presumed five years ago—a difficult issue in many cases."

Mr. Zielinski was testifying before an Assembly committee considering a bill to extend the life of the Siting Board, which was set up to balance the public need for power against environmental effects and to expedite generating plant applications.

Membership of Board

The five-member board is made up of the commission chairman, the Commissioners of Commerce, Health and Environmental Conservation, and a public member appointed from the area in which a plant is being considered.

In its first decision, last December, the board voted 3 to 2 in favor of a 1,150-megawatt nuclear plant at Sterling in stead of a coal-fired plant at Ginna, 12 miles east of Rochester.

It was expected then that the approval would clear the way for a backlog of five other proposed power plants awaiting decision, but today's order may delay consideration of the other cases.

Three proposed plants are near the decision stage according to a commission spokesman. They are a nuclear plant at Jamesport, L. I., proposed by the Long Island Lighting Company and the New York State Electric and Gas Corporation; a coal-fired plant at Somerset on Lake Ontario, proposed by the Niagara Mohawk Corporation; and another coal plant at Dunkirk on Lake Erie, also proposed by Niagara Mohawk.

Two other plants, both proposed by the Power Authority, are in the hearing stage, one a coal-and-rubbish-fired plant at Arthur Kill on Staten Island and the other a nuclear plant at Cementon in Greene County in the mid-Hudson Valley.

Three major power plants are under construction in the state, all years behind schedule. At Shoreham, L. I., L.I.E.C. is building a nuclear plant, originally scheduled for 1977, but now set for 1980; Niagara Mohawk, a nuclear plant at Nine Mile Point on Lake Ontario, delayed from 1978 until 1983; and Niagara Mohawk, an oil-fired plant at Oswego, delayed from 1976 until 1979.

The New York Times
yesterday

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TENNESSEE VALLEY AUTHORITY

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May 16, 1978

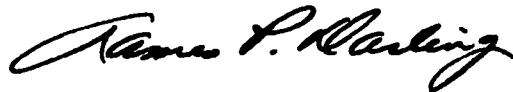
/ Mr. Boyd R. Keenan
Mr. James J. Stukel
Project Office
Ohio River Basin Energy Study
345 Advanced Computation Building
1011 West Springfield Avenue
Urbana, Illinois 61801

Gentlemen:

We have reviewed the summary report entitled ORBES Phase I: Interim Findings sent by your memorandum dated April 20, 1978. Our comments are enclosed and are based on review of the summary report and previous review of the individual team reports. Our concern in reviewing the various Phase I material was for issues or statements of major or obvious variation either with our experience and information or with our perception of the purposes of the ORBES. Therefore, the comments submitted do not necessarily include all of our questions or concerns.

Very truly yours,

TENNESSEE VALLEY AUTHORITY



James P. Darling, Director
Division of Power Resource Planning

Enclosure

The report entitled ORBES Phase I: Interim Findings summarizes in easily readable form the results of the various studies that have been done to date in the ORBES. The comments here are based on review of this report and previous review of the individual team reports. Our primary concerns with the summary report are really concerns we had with the Phase I work as a whole. They relate to the organizational approach of the ORBES, the basis and accuracy of the data used to make projections and subsequent assessment of generic impacts, and the sense of bias that seemed to permeate some of the research.

Regarding the organizational approach, it seemed to be too much of a duplication of resources (in terms of money, research personnel, advisory committee personnel, etc.) to have three study teams with the same basic charge. Granted, it was theoretically advantageous to have input from universities in different locales of the ORBES region, but it appears that this input could have been incorporated without the duplication of effort, introduction of confusion, and extra work for condensation that resulted from three independent study teams. The amount of time that was required to produce the summary report is indicative of the added complexity, and perhaps perplexity also, of the study approach. Furthermore, it would appear that the advisory committee could have given much more meaningful input with less material to review. The organizational concept that is planned for Phase II appears to be a much more promising one.

The second major concern as noted above relates to the base data used in making the various projections. Some of the base data used is inconsistent with

TVA's experience and practice. For example, the land requirements noted for coal versus nuclear plants (page 23, paragraph two) do not reflect that increased storage requirements associated with scrubber wastes can actually result in larger acreage requirements for coal-fired than nuclear generating facilities. Furthermore, the estimate of waste storage requirements (page 92, paragraph two) for a 1,000 MWe plant of 2,400 acre-feet (80 acres, 30 feet deep) is smaller by a magnitude of seven than the estimates TVA uses in siting practice. On the basic requirement of .56 acre-feet required per MWe per year of operation, we would estimate that 16,800 acre-feet would be needed for a 1,000 MWe plant for 30 years of operation. From this it would appear that the ORBES assessment of land use impacts of energy conversion is greatly underestimated. This discrepancy also creates some concern regarding the accuracy of the other quantitative estimates in the ORBES which were not as noticeable or readily checked.

Related to the above problem are repeated references in the summary report (page 24, paragraph one; page 92, paragraph two; page 96, paragraph five) and in the earlier reports concerning reclamation and use of scrubber waste and its storage areas. It is stated that procedures for returning waste storage areas to productive uses are available, but the actual procedures and their costs are not discussed at all. Various research is now being conducted in this area, but we are not aware of any procedures which have yet been proven either technologically or economically.

Finally, regarding bias, we believe that the credibility of the ORBES project is lessened by inclusion of the passage from volume II-C on page 18 of the summary report. Its presence immediately recalls the entire discussion from

where it came. A discussion with such obvious neglect for the scientific method and objectivity has no place in a university research document. Surely, particular technologies can be evaluated and recommendations made, but all discussion must be objectively made and referenced material should never be taken from context as it was in some sections of volume II-C. If a discussion of the disadvantages of nuclear usage is pursued, it must be couched in an overall objective discussion which includes adequate treatment of the advantages of nuclear as well as the advantages and disadvantages of coal usage. Basically, however, we do not believe that the ORBES is the appropriate forum to advocate or denunciate a particular fuel type.

In progressing with Phase II of the ORBES, it is hoped that the problems noted above are avoided. Additionally, it appears to us that more time should be spent in understanding utilities and the context in which they operate. This is especially true considering the "grass roots" origins of the ORBES project. It is important to recognize that no matter what the technological mix in the future (coal or nuclear, low or high growth), the impacts of energy development will be significant. Utilities are charged with the responsibility of providing electricity to meet demand, and they must plan to meet future demand. Surely, conservation is of utmost concern, and utilities are presently promoting its role and importance. However, conservation cannot be forced through limiting supply. In other words, utilities cannot "turn off" electricity in order to curb demand unless governmental/societal priorities change.

Given this situation, it seems essential that people be informed of the utilities' situation in fulfilling their responsibility. Electrical energy development occurs in a complex environment where controls and constraints are increasing,

along with energy demand. This is not to say that the controls are unwarranted, but rather to illustrate that adequate communication between utilities and the general populace would help people to better understand energy development and its associated impacts. Perhaps, the ORBES should work toward the establishment of this communication. Additionally, better understanding of utility operations by the ORBES research team might clarify some of the policy issues raised in the summary report.



OHIO RIVER BASIN COMMISSION

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May 10, 1978

Mr. Boyd R. Keenan
Project Office
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1011 W. Springfield Ave.
Urbana, IL 61801

Dear Mr. Keenan:

The ORBC staff has reviewed the draft report, ORBES Phase I: Interim Findings. You and Mr. Stukel are to be commended on an admirable job of combining the findings of so many different researchers. Most of the summary findings are generally accepted truths and, with a few exceptions, we do not take issue with them.

The finding that there are potential conflicts between power plant sites and bottomlands along the Ohio River is not supported by the Commission's recently completed Ohio Main Stem Study and its adopted plan. These indicate that since the majority of the bottomlands available are not wetlands or scenic and recreational areas, there should be no conflict, on a regional basis, between preservation of such critical areas and industrial development including power plants. There is, of course, always the possibility of conflict in specific instances, but this was known before any study.

Those findings which indicate possible problems with water for navigation due to increases in irrigation and power production are in conflict with the ORBC regional plan. The best information available to the Commission indicates no foreseeable problem, even assuming the high energy senario and a reasonable level of irrigation.

Thank you for the opportunity to comment on this draft.

Sincerely,

Fred E. Morr
Chairman



UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
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MAY 30 1978

Dr. Boyd R. Keenan
Dr. James J. Stukel
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University of Illinois
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Dear Drs. Keenan and Stukel:

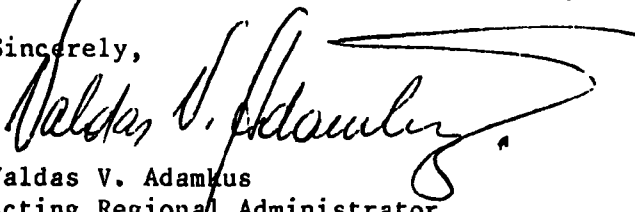
In response to your request of April 20, 1978, I am pleased to transmit the attached comments on the report, ORBES Phase I: Interim Findings. Let me preface them by saying that, generally, those who reviewed the report on behalf of the U.S. Environmental Protection Agency (EPA), Region V, found it thought-provoking and well-written. The report has put many important questions before not only this Regional Office and EPA, but the many people of diverse interests who will be reading it.

We have one significant reservation. The chief concerns of the environmental groups which initiated requests for the study were air quality and conversion of farmland to other uses. In general, we do not believe either of these issues has been addressed adequately yet.

The attached comments are organized by chapter and page number. Some comments may be relevant at several places. I know that some of the matters which we have raised are being considered in Phase II; however, the comments are included as a way of reinforcing our interest in the questions to which they pertain. Several suggestions were made for research on solutions to technical problems that were discussed in the Phase I report. As the detailed investigation of them is beyond the scope of the report, they have been given to the Regional R&D Representative for consideration by the EPA Office of Research and Development in its future program planning.

I know that you and the other members of the core team are already well into the second phase of the ORBES study, and we will all follow your work with interest. Jim Phillips and Susan Walker will continue to work with you. Please feel free to call upon other Region V staff, through them, for additional assistance that you might need.

Sincerely,


Valdas V. Adamkus
Acting Regional Administrator

Attachment

ATTACHMENT

Table of Contents should be more detailed; include at least the items that are used as side headings within chapters.

Chapter 1 (Summary)

This chapter and the rest of the report would be easier to use, and possibly some questions would be avoided, if summaries of the basic features of the scenarios were given near the beginning, rather than left for the appendix.

p. 1 The statement that this report "should not at this point be construed to represent agency policy" is misleading, because such reports are never considered agency policy, even after final publication.

How much of the projected conversion to urban uses depends on provision of a certain level of power? If such conversion is assumed to be an independent variable, what evidence exists for the projection?

p. 2 Is the statement about "regionwide" availability of water accurate regardless of the number of plants and types of cooling systems that they use?

p. 3 Does the statement about transportation account for rolling stock and other features besides the total mileage of road, track, etc.?

p. 4 Are the last two assertions applicable to the ORBES region as well as nationally?

p. 5 Does the statement about labor supply apply to the ORBES region, the nation, or both?

Area sources and fugitive emissions were substantially lacking from the emission inventory. Also, changes in emission factors and inventory methodology have taken place. Therefore, the emissions shown appear to reflect obsolete methodology, and the conclusions drawn could be erroneous.

How is the discrepancy between the levels of particulate removal and of sulfur oxides removal explained? What level of SO₂ removal is assumed?

pp. 5-6 If utilities are assumed to be "industries," as they have been referred to earlier, is the figure for sulfur oxide emissions of 35 percent from industry correct, even for the FTF 100 percent nuclear scenario? Where is the rest coming from?

None of these seems to take into account controls on other facilities.

p. 6 Why would concentrations of secondary particulates increase under the low-growth option (especially 100 percent nuclear)? What difference, if any, would the mix of fuel sources make?

Neither the material in this chapter nor the later discussions address the air quality problem: the impact of the present and projected air emissions in the local area, the ORBES region, adjacent parts of the same

States, or other States. We are seriously concerned about the ability to attain and maintain air quality standards. This is one of the most important questions for the study to address. It should also consider the adequacy of existing standards and the need for revisions and/or additional standards for pollutants like acid sulfates. This comment also applies to p. 56.

p. 7 What assumptions are made about the efficacy of the 208 (non-point source control) program?

There should be a statement comparing the expected death rates under either scenario with current rates.

Population density has previously been stated as low; therefore, what is the basis of the statement that "boomtown" conditions would be expected in few locations (regardless of density)?

p. 8 The first statement appears to contradict the last statement on p. 7.

The implication of the next-to-last statement is that the more one knows about how energy is produced, the less concern one has. This is not necessarily true.

Although it may be true that no institutional solutions are available for some problems, is it true that none are available for any? Possibly, the usefulness of existing solutions has not been tested.

p. 12 How much fuel shifting had actually taken place at the time of the embargo? The implication is that the Clean Air Act and environmental restrictions were entirely responsible; however, the impact of the Clean Air Act had yet to be felt significantly, and price and other factors may have had more to do with shifts that had occurred.

The observation that begins "if coal were to be..." is not accurate.

This discussion obscures the fact that the conclusions presented are those of the utility industry. The arguments of the opponents of energy facility location in the Ohio River Valley should be given equal attention.

p. 14 If Illinois coal production outside the Basin was taken into account, should not that in the parts of other ORBES states which are outside the geographic bounds of the study (e.g., northern Ohio) be considered also?

p. 16 Although methods of power generation other than conventional coal and nuclear fueled plants may not be in widespread use in the ORBES region by the year 2000, greater attention should be paid to them in this report. Thus, for example, there should be more discussion of fluidized bed combustion and other emerging technologies for using coal, and of forms of power generation like solar and hydro.

p. 18 In general, the issues surrounding increased generation of power by nuclear plants have been insufficiently treated, as compared to those

which are raised by coal-fired plants, notwithstanding the disclaimer on this page.

The quotation from the University of Louisville report improperly emphasizes only one side of the argument. It should be deleted or the other side should be added with equal emphasis.

Chapter 2 (Impacts on Natural Resources)

p. 21 The rationale underlying the figures for coal extraction and processing in the two FTF scenarios should be explained.

p. 22 The remainder of the paragraph on subsidence seems to contradict the first sentence.

p. 24 For purposes of comparison, amounts of land required for disposal of radwastes should be stated.

p. 27 Do water-removal operations during mining invariably increase the base flows of streams?

Additional evidence should be given for the conclusions in the first paragraph under "water use."

In the second water use paragraph, the percentage figure is confusing. Both municipal and industrial use are likely to increase.

p. 27 The assumption that all powerplants, including those presently on line, will use off-stream cooling may be overstated. Several plants on the Ohio and its tributaries employ once-through cooling and it is not certain that they will retrofit; nor is it certain that all new plants will use closed-cycle cooling.

Chapter 1 implies that irrigation could become "widespread"; therefore, the "role of irrigation" should be accounted for here.

p. 29 The problems that could arise under low-flow conditions are not limited to navigation, but may include recreation, fishery resources, and potable water supply.

p. 30 Because many existing plants will be in service until the end of the period, or close to it, their water consumption should have been taken into account in calculating impacts.

p. 30 Lime and limestone are reactants with sulfur oxides or sulfates, not fuel.

The study should not assume that all plants which burn high-sulfur coal will be using lime or limestone scrubbers after 1985.

p. 33 Is the statement about additional exploration and the reserve base an accepted fact or an assumption? Would this be likely to be surface mined, or would underground mining be necessary?

p. 36 The question of State and local government roles goes beyond just selection of disposal sites, because they have regulated or attempted to regulate other matters like transportation of radwastes.

p. 37 The question of water rights and uses is broader than this set of questions implies. The consideration of water allocation might be expanded to cover upstream uses. Also, re-use of water (e.g., municipal waste treatment plant effluent for irrigation) might be considered.

Chapter 4 (Impacts on Developed Resources)

pp. 38-39 The environmental effects of barge and train unloading facilities are ignored; however, they can be locally significant.

p. 39 In the paragraph about transportation of nuclear material, the use of the phrase "flexibility available for routing trucks" is odd. Transportation around, rather than through, cities may be required. (Trucking is flexible only as compared to railroads, but there is no flexibility in being forced to change routes.)

p. 46 The cost figures for uranium, and the resultant comparison with coal, are misleading because the costs of enrichment to make uranium a usable fuel have not been considered. Electric power demand for this purpose is huge.

p. 47 Why is employment in the construction industry higher in the FTF scenario than in the BOM? This appears to contradict statements on pp. 48-49.

p. 53 An additional question would be: "Should explicit or implied subsidies granted to private users of transportation facilities be modified or revoked in order to make costs more realistic?"

p. 54 The questions about rates and forecasts do not get at the basic matter of regulating demand. Also, there should be a question about the roles of state regulatory agencies and the factors that go into rate-making.

Chapter 5 (Impacts on the Biological and Ecological Environment)

p. 56 The statement about emission rates appears to contradict p. 5. The criteria for "preferred" sites, as the term is used in this paragraph, should be explained.

p. 57 The implied conclusion at the end of the first paragraph that replacement of old sources by new will result in improvement in air quality beyond NAAQS requirements may be faulty, in part because fugitive emissions were not considered.

The second sentence in the last paragraph appears not to be directly related to the rest of the paragraph. Formation of secondary particulates should be the subject of a separate discussion.

"PSD" requirements are used on a "local scale" insofar as they may be applied to individual plants which may be distant from each other, but the implications and effects of the policy are not just local.

The existence of the "offset policy" should be mentioned.

p. 59 There is no column of net totals for future years; therefore, the reader cannot understand how much air pollution would be present.

p. 62 It would be more appropriate to define the terms "primary" and "secondary" particulates here, where they are first used, rather than later. The fact that these particulates are from point sources should be stated.

p. 63 The reference to "secondary" particulates (constituting 1/10 to 1/3 of the mass) should be to "fine" particulates.

p. 64 There is no citation for the reference to conversion of sulfur in western coal to sulfur dioxide. EPA Region V Enforcement uses 95 percent for eastern coal.

The report appears to be based on the questionable assumption that the current NSPS limitation on SO₂ emissions will remain. The limitation is likely to become more stringent.

p. 66 The impact of sulfur oxides on vegetation, etc., has been established; therefore, the use of the word "may" is inappropriate.

p. 67 The postulated increases in NO_x emissions by the year 2000 range from 68 to 93 percent. As they would result in violations of ambient standards throughout the ORBES area, it is not likely that such increases would be allowed.

p. 69 Because the inventory does not account for 20 percent of the HC emissions, the conclusions may be faulty.

p. 72 CO is primarily, but not exclusively, an urban problem; substitution of the word "local" might be appropriate.

p. 72 The scenarios studied indicate that the SO₂ emissions will result in a 7 percent increase or one percent decrease relative to 1972. In light of the mandate given to EPA by Congress to achieve ambient air quality standards, and their nonattainment today in the ORBES region, the results cast doubt on the scenarios used in the study. The numbers of new fossil-fueled power plants indicated by projected electrical demand cannot be built in the Ohio River Valley, under present regulations mandated by Congress, if the standards are not met and maintained.

pp. 73ff The discussion of the "cascading effect" should be expanded and broadened. At the same time, care should be taken to ensure that models used to determine this effect are accurate. Although the models are referenced in the appendix, discussion of methodology would be useful here.

p. 76 Effluent limitations are established for both industrial and municipal discharges, and applied regardless of the quality of the receiving waters. In addition, the phrase "...standards to be set for all major surface waters..." is too narrow, and is not contained in the Act.

The last two sentences of the first water quality paragraph imply that issuance of permits is solely a State function. As of May 1, 1978, 30 States administer the program and EPA issues permits in the rest.

p. 82 What is meant by "the nature of the receiving waters" (first full paragraph, line 4)?

p. 83 Evidence should be given for the statement at the top of the page that "nearly all phytoplankton...are killed...." This is not necessarily true.

p. 84 If the statement about organic chlorides is meant to refer to chlorinated organics, it is wrong.

Although total net BOD levels may decrease with improved treatment, population increases may more than offset the effects of treatment.

p. 85 Additional evidence should be cited for the assertion in the second paragraph that production of COD from all sectors except forest products and fisheries will decrease.

p. 86 Some estimates of the contribution of non-point sources to TSS should be made, because it can be significant.

p. 88 As on p. 84, population growth is likely to more than offset treatment effects; thus, the reductions mentioned here will not occur.

pp. 92-93 The discussion of waste disposal for the nuclear fuel cycle overlooks evidence of accidental releases and/or leakage of radioactive wastes. In addition, it ignores the controversy over both existing and future disposal sites, and the problem of perpetual, as well as complete, confinement.

p. 94 The question about institutional mechanisms implies that existing mechanisms are inadequate. In addition to consideration of changing institutional patterns, thought should be given to accommodating existing mechanisms to new problems.

p. 95 The rationale for a regional siting mechanism should not be solely the avoidance of regional-scale impacts. In addition, this question and the third question appear to be virtually identical.

The 1977 amendments to the Clean Air Act moot the second question.

p. 96 What is meant in the first question by "water quality goals?" How do they differ from standards?

p. 97 Public health is a different question from economic and social impacts, and a separate chapter should be devoted to it.

p. 104 The paragraphs on loss-of-coolant accidents and safety in general are too sketchy. The discussion of the criticisms of the Rasmussen report (about which EPA had serious reservations, expressed in a letter to the Atomic Energy Commission on November 27, 1974, signed by the Deputy Assistant Administrator for Radiation Programs, and subsequent correspondence) is inadequate.

In the last sentence, not only are the long-term effects of waste disposal uncertain; the questions about methods and siting of waste disposal are unresolved.

p. 107 Is the assumption of a zero occupational disease rate in the coal-fired cycle reasonable?

p. 108 Some of the energy facilities envisioned in the scenarios, particularly BOM, are quite large. Could not their configurations resemble a "power park" and thus possibly induce "boomtown" conditions?

P. 112 Additional evidence should be given for the conclusion that urbanizing, economically diverse, etc., communities "will probably be most receptive to energy facility development...", as opposed to best able to accommodate it.

p. 117 There is not necessarily a conflict between local and regional policy in energy facility decision making, although that might occur.

p. 119 To the second question might be added the clause, "and if so, which level?"

In the first question, the tradeoffs are not just, as this implies, between health abuse and employment, but health abuse and the need for energy.

INDIANAPOLIS POWER & LIGHT COMPANY

25 MONUMENT CIRCLE P O BOX 15958

INDIANAPOLIS, INDIANA 46206

CARL B. VANCE
EXECUTIVE VICE PRESIDENT
OPERATIONS

May 12, 1978

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Dr. Boyd R. Keenan
and
Dr. James J. Stukel
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Subject: Comments on ORBES Phase I
Interim Findings Volume I-A, 1977

Gentlemen:

There is no doubt that the compilation of the widely diverse ORBES Phase I study is a monumental job. The opportunity to serve on the Advisory Committee for this group is an honor and a challenge. Having attended, or been represented, at many of the Core Team meetings, I feel the obligation to point out some of the areas where it is felt that the study findings deviate from the work presented at the Core Team meetings. Although there are many points which can be addressed, I have attempted to address those of a more general nature rather than a full editorial commentary or critique of the integrated summary report.

One of the most striking problems that appears in the summary report is the negative approach taken on many of the issues where both positive and negative factors occur. As an illustration of this point, consider the extensive discussions regarding the problems expected under the high energy growth scenario with respect to the labor necessary for maintenance of high growth. After reading such a discussion one is lead to believe that it will pose insurmountable problems in developing such a labor force. However, the positive side of the same findings is that many additional jobs will be created and a healthy stimulation of the economy will occur because of the creation of such demand for labor.

It is disturbing to note the means of presentation of the high and low growth studies as being options available to the reader. It is strongly recommended that the word "option" be replaced with the more correct word "scenario," which was nearly always used in the explanation of the two growth patterns selected for the study. Neither was presented as an option to be controlled or otherwise interjected upon the economy, but as boundaries between which the ORBES researchers felt that the actual growth conditions would occur. The presentation of such boundary conditions as options is inconsistent with the philosophy of the scenario development. The handling of the designation of "growth options" versus "growth scenario" is inconsistent throughout the integrated summary report and should be edited to replace "option" with "scenario."

An underlying assumption is the economic analysis of the ORBES Phase I report that remains unsatisfactorily supported is the assumption that the gross national product under either the high energy or low energy scenario will remain the same. It is difficult to imagine that the ORBES region gross national product will remain the same with both the high and low growth scenarios. The very factors alluded to in the study regarding the much more extensive demands on labor and capital to maintain the higher energy growth scenario would lead any reader to believe that the economy and gross national product of the region would be greater under the high energy growth scenario. The massive sum projected to be spent on capital equipment and labor, both operational and construction, must roll through the regional economy to create substantial multiplying effects, which can be easily visualized. However, to assume in the low energy growth scenario that other sectors of the economy will somehow magically increase to produce the same multiplying stimulus upon the economy does not appear likely or reasonable. In short, the scenario development on the effects on regional/national employment under the two energy scenarios does not wring out when testing both scenarios for the same gross national product. Quickly comparing the employment chart on page 47 of the report shows apparent inconsistencies in the forced national product equality assumption. Household appliances being ranked No. 1 in increased employment effect appear to be inconsistent with the idea that per capita electric energy is available for public use. Water and sewer companies are among the bigger electric users and are ranked No. 2, while a multitude of service and building sectors are ranked high in the increased employment areas. These same sectors have traditionally stimulated the greatest electric demand growth, and as such appear inconsistent with the reduced employment and growth in the electric utility sector. In further questioning this assumption, I am attaching for the record the remarks of Mrs. Margaret Bush Wilson, Chairman, National Board of Directors, National Association for the Advancement of Colored People, given in Houston, Texas on April 10-12, 1978. This statement directly relates the effect of energy policy upon the minority employment and is an area wholly unaddressed by the ORBES study. It appears that some comparison of the high energy versus low energy scenarios regarding the employment on large minority groups is in order. It is my considered opinion that the higher energy growth in reality will provide much better opportunities for employment of such minorities and all other social sectors of the economy. The indictment of the high energy growth scenario ignores these effects and rather assumes that the low energy growth scenario will magically develop other opportunities for employment. The question that arises immediately is what happened to the unemployed sector of the economy?"

The section entitled "Illustrative Policy Issues" is not a finding and as such should not be included in an interim findings report. Most are questions which have faced society for many years and the re-statement of such questions as ORBES findings are neither correct nor appropriate.

COMMENTS ON INDIVIDUAL REPORT ITEMS

The following comments are not all inclusive, but reflect items which are questionable regarding the Phase I Interim Findings.

The findings in the "Public Health, Economic, and Social Impact" sections are rather vague regarding their meaning and tend to mislead the reader. For example, the findings that "the high energy growth option would more than double the expected premature deaths when compared to those expected under the low energy growth option only addresses a portion of the question and recites an obvious finding. That is, if on the average one person is killed during the construction of an energy facility then if twice the number of facilities are built twice the expected premature deaths occur. However, the oversight in the study is that if jobs and industrial developments occur in other sectors of the economy under the low energy growth option to maintain the gross national product these will also result in some premature deaths. No job or work category is completely without risk and the increase in other sectors may well be interpreted as increasing the expected premature deaths in the other sectors. Likewise, the comments regarding "most experts agree under normal conditions, the coal fuel cycle is responsible for more premature deaths than is the nuclear fuel cycle" is neither profound nor unexpected. The greater employment in coal mining and transportation facilities obviously leads to greater exposure because of the greater employment. If more people are out of work, there will likewise be fewer job related mortalities. To couch the coal fuel cycle as being responsible for more premature deaths than the nuclear fuel cycle is similar to comparing the number of premature deaths occurring on the job between the hours of 8 a.m., and 5 p.m., as compared to the number of premature deaths occurring on the job between the hours of 12 midnight and 8 a.m. Although some validity remains with the argument that certain jobs inherently contain higher risk than others, intensive investigation of such items is not apparent. It is my opinion that all deaths are premature, but many means are being explored by both the government and industry to reduce the inherent risk in all jobs via corporate safety planning and OSHA regulations.

The statements regarding the reclamation of land requiring many years for farmland to be returned to reasonable level of productivity is incorrect. Under the Surface Mining, Recovery and Control Act any miner is mandated to return land to within 90% of its original productivity within five years. This appears to be a requirement of the Act for mining and not merely a goal to be attempted.

Under "Water Use" page 27 a great deal of study has been conducted regarding the consumptive use of the plants. In actuality what has been termed consumptive use is the evaporation from the generating system cooling towers installed to reduce the effect of any heated discharge on the rivers. This evaporation at any given point may appear to be a loss; however, this water, as with other water evaporated, is returned to the ground in the form of precipitation and is not truly consumed. It would be naive to think that none of the evaporation from a plant along the lower Ohio valley would not be reprecipitated within the ORBES region. Likewise, some of that evaporated in the upper Ohio might well move into other water regions as might also be expected to occur into the ORBES regions from other air movements. Although these effects may not lend themselves to adequate quantification they may not be omitted as not in reality occurring. It is recommended that "consumptive losses" be changed to evaporative uses. The problems posed regarding irrigation are not as profound as might be expected.

If attempts were made in the development of massive irrigation projects, it would require substantial quantities of electric energy to move the water from the rivers to the irrigated land. If enough irrigation is pursued the river will be lowered, in which case society will be faced with balancing the distribution of the water resource.

Under the "Coal Designation" on page 31, the statment is made that most utilities would choose to import low sulfur coal than employ flue gas desulfurization. Regardless of what most utilities choose the Clean Air Act Amendments of 1977 leave the utilities with no alternative as far as flue gas desulfurization.

The section regarding "Regional Employment" on pages 48 thru 53 was discussed earlier in these remarks. Here again, only the negative aspects of the increased employment is discussed and the problems of using "scenario" versus "option" is apparent. The graph on page 51 does not present two distinct options but represents the boundary conditions identified in the study assumptions by the ORBES researchers.

With regard to the impact of sulfur dioxide alluded to on page 66, it should be noted that these negative impacts are only discernable above certain concentration levels, as alluded to in the last sentence of the third paragraph. In addition, some sulfurate depositions may have beneficial impact in certain areas where the farmers must periodically treat fields with sulfur bearing compounds to neutralize the ground.

The discussion regarding sulfur oxides and nitrogen oxide emissions from power plants on page 68 although mathematically correct, does not reflect the reality that a shift in emission sources from tall power plant type stacks to automotive and shorter industrial sources may reflect in the case of the low energy scenario substantially worse ground level concentrations than would be expected from the 14% higher total emission which would be emitted from taller utility sources.

On page 72 and 73 the discussion regarding the corridor effect/sub regional effect contains several problems. The adequacy of the wind data used in determining the corridor effects by Tecknekron is subject to significant question. In addition, the models used to project the concentration were never calibrated or validated for such extensive distances as the corridor shown. In addition, the report leaves significant question by quoting 12 hour concentration rather than 24 hour, which are the basis for the ambient air standards.

The discussion of NO_x on page 102 is approaching a medical opinion over which there is considerable controversy. EPA has little unequivocal data upon which they can rely to such standards. Most of the human studies show no health effect at low levels of NO_2 and those that do (VonNieding and Orehek) have serious deficiencies and have not been replicated. Delving into such medically related health studies appears to be beyond the scope of the ORBES charge.

Dr. Boyd R. Keenan
and
Dr. James J. Stukel

5

May 12, 1978

I hope the above suggestions will be of assistance in your revision of the draft ORBES Phase I Interim Findings. If you have questions regarding my comments or we may be of assistance, please contact me or Mr. McKnight.

Very truly yours,

INDIANAPOLIS POWER & LIGHT COMPANY

CB Vance *RAM*

Carl B. Vance
Executive Vice-President - Operations

CBV:RAM:1b

COMMENTS BY

PHASE I RESEARCHERS

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T&L NO. 812-337-9485



24 May 1978

TO: Boyd Keenan
James J. Stukel

FROM: John F. Fitzgerald

A handwritten signature in cursive script, reading "John Fitzgerald".

SUBJECT: Comments and suggested changes on Interim Report

- p. iii - The first paragraph of the preface states, "Funding for the project is being provided through grants from the U. S. Environmental Protection Agency (EPA) to the Universities involved. The statement should read ". . . EPA and the Universities involved." Indiana University can document many thousands of its own hard dollars that have been put into the ORBES effort including and in excess of the required 5% cost sharing provisions of the contracts. Most of the other Universities can do the same.
- p. iii - The third paragraph of the preface, first sentence should read, "Concerns of residents living on the shores of the Ohio River prompted Congress, through Senator Birch Bayh, to support the project.
- Chapter 1, page 2 - Add to "potential land use conflicts" the continuing conflicts between unwilling property sellers and the utility-courts bloc under eminent domain i.e., the continuing involuntary loss of homesteads and other property by citizens.
- Chapter 1, page 3 - The second item reads, ". . . there is a sufficient amount of this fuel (coal) in the ORBES region to supply regional energy conversion facilities for several hundred years." It is noted that the impact of such utilization is not mentioned under the Chapter 1 headings, "Impacts on Developed Resources," or "Impacts on Ecological and Biological Environment." For continuity of examination of "several hundred years" of utilization, some sort of extrapolation should be made in these additional areas.

Chapter 1, page 3 - The discussion on uranium prices should not be couched with cost of uranium use. These items "price" and "cost" will probably be separate items of discussion. In the former only the exchange value of the resource will be a consideration. When looking at cost, however, other items not internalized in "price" should be considered. Price can fluctuate widely for an exchangeable commodity dependent upon production costs associated with extraction, transportation, conversion, waste disposal, etc. Cost can include these items but may additionally include external costs not necessarily associated with price which typically reflects only internal costs. External costs should also be valued e.g., environmental (aesthetic) degradation, health care costs, depression of competing money competitors and subsequent multipliers, etc.

It would be advisable to make these "price" and "cost" considerations carefully not only with uranium but also with other energy resources that are considered. External costs are often the same as social costs and these are the preeminent issues to be studied in the formulation of public policy. In fact, the determination and management of social costs are the only business of public policy makers. When the final report for the ORBES is written this will be the focus of the conclusions and policy recommendations to the Congress and EPA. The study should avoid the tendencies to place too much analytical effort on identifiable internal costs that are themselves subject to wide variation in both short and long time periods.

Chapter 1, page 8 - On local acceptance of power plant construction: Is acceptance a function of perceived economic benefits or an absence of an environmental ethic? Can communities be identified by the exposure to environmental and conservation education and correlations drawn on acceptability of industrialization? This is an area that deserves more exploration i.e., does exposure to a different perspective alter the perceptions and preferences of people in an economics-or-environment situation? Who should be involved in the public education process relating to environmental protection and values? The primary schools? The university? State government? Public interest groups? Should this environmental ethic be promoted at all as opposed to a development ethic? What kinds of induced stimuli should the population receive in the energy-environment question? If it is permissible to induce reactions with commercial commodity marketing, is it also permissible to do the same for public policy issues? Is it already being done by the energy companies or environmentalists?

Chapter 2, page 9, third paragraph - This is redundant; it is already in the introduction and in Appendix E.

Chapter 2, page 18 - The last two sentences of this page are superfluous. Are the authors writing a report or an apology?

Chapter 3, page 36 - Under the land use category in illustrative policy issues, are all of the points subsets of the fifth item? "How can individual rights best be balanced against the use of eminent domain for energy related facilities to promote the public good?"

Chapter 4, page 45, 1st paragraph, last sentence - The word "entirely" should be eliminated and the word "possible" should be placed in front of the word "order." This sentence should convey the tentative nature of long term economic projections. Even this tentative statement remains generally true only if market adjustments do not occur; there is little chance of that happening.

JFF:dv

cc: J. C. Randolph

University of Illinois at Urbana-Champaign

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May 15, 1978

Professor James J. Stukel
Professor Boyd R. Keenan
Ohio River Basin Energy Study
345 Advanced Computation Bldg.

Jack Desmond and I have reviewed Volume I-A of the Ohio River Basin Energy Study entitled "Phase I: Interim Findings" dated November 1977. The report was also distributed and comment solicited from the Urbana participants in Phase I, Task 2. Since the report has been distributed to Professor James Hartnett of the Circle campus, I will assume that he and his group will respond directly to you.

The general reaction is a favorable one acknowledging that the integrating process was clearly a very difficult one. We were delighted to see much of the Illinois report in evidence in the current volume. On behalf of the Urbana group I would like to convey to you two specific concerns raised by individual members of our research group.

The first is a statement prepared by Professor Wayne Davis who served on the Urbana task group and dealt primarily with an assessment of impacts upon air quality. Professor Davis' statement is as follows:

As a contributing researcher to the ORBES report, I find the basic presentation of the air quality section credible, but with one major fault. In the detailed discussion of the emissions arising from the proposed scenarios (which constitutes the major portion of the section), aggregate data was presented for the ORBES region as a whole. Though it poses some interesting insights, particularly when this data is compared to the national average data, it does not represent the true consequence of either scenario and its associated siting configuration.

Under either of the proposed scenarios, there will be a congregation of new power generating facilities along the river corridors in ORBES region. The percentage increase in emissions along these corridors will be far more significant and assuredly greater than that for the ORBES taken as a whole. The effect of presenting the data as given in this report is to average these increases over an area which includes subregions that are unlikely to be significantly influenced by the short-range transport phenomena of the primary pollutants from a nearby source. It will be admitted, however, that the total region must be affected to some degree by the long-range transport of secondary pollutants. Thus, it is felt that a similar analysis for primary pollutants with specific subregions, particularly the river corridors, would be far more enlightening.

It should be stated that the above observation was the major reason for this researcher's proposing to investigate the cascading effect of the proposed new sources along the river corridors. It is realized that the models utilized in the discussion of this effect were rather crude yet they did indicate air quality problems on the horizon. One important point should be emphasized: the model (the results of which are discussed in this section of the ORBES report) included increments in ambient pollution levels resulting from new power generating facilities only. Time did not permit an attempt to ascertain the present level of pollution in the region. Nevertheless, recent developments in the Ohio River corridor highlight the current situation.

1. Several existing facilities (which are unlikely to be retired under any scenario in the near future) are in violation of present standards and are the subject of current administrative action by the EPA.
2. Already in some areas along the Ohio River either action is pending or has been taken to severely limit the emissions from any new source in the area.

The above statements provide one important conclusion: the air quality along many of these river corridors is already significantly deteriorated. This leads to one final conclusion by this researcher that neither of the proposed scenarios can or should be implemented.

It seems to me that Professor Davis makes a very valid point. One of the significant contributions of our group to the Phase I Study was the identification of both the cascading and the corridor affects and while the present reports touches on subregional impacts, most of the findings are weighted toward averaging pollution levels for the entire region. Professor Davis' work provided us with a warning which could be better highlighted. Present and potential pollution levels require that the utmost care be used in siting future power plants to avoid the subregional concentrations which are likely to occur.

Professor Judith Liebman who assessed impacts upon transportation facilities in Phase I wishes to submit the following statement:

I disagree strongly with the summary statement on page 3 that 'the transport of coal and of industrial supplies and products within the ORBES region would not overly stress the existing regional transportation system.' It might not overly stress an efficient transportation system--but the existing system is far from efficient. I think that, for example, there is very little additional capacity in the waterways. As for the railroads, enough lead time to build the necessary hardware would be needed.

Here again, I believe that a valid point is made. The potential problems of burdening our existing transportation systems have been under emphasized in the present report.

Now I would like to provide some general reactions to the report. While the document is clearly labeled as one dealing with interim findings, I see no

May 15, 1978

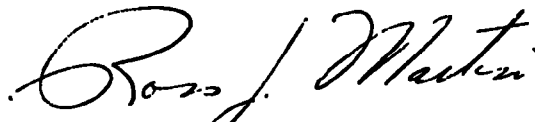
statement in the document (which we were always careful to include in our own reports) that the approach of Phase I was one of a mini-technology assessment which gives great emphasis to breadth of the work rather than its depth. Phase I was predicated upon the research philosophy of identifying the boundaries of many problems as a preface to the deeper work which would be conducted in Phase II.

Within this framework, the summary conclusions assembled in Chapter 1 flow fairly well; that is, one begins to get a bounded view of the kinds of problems that are likely to exist in the year 2000 under a set of prescribed alternate futures. Phase I provided a valuable foundation for the work which must follow.

I have some difficulty with the sections dealing with illustrative policy issues. They strike me as a series of very broad rhetorical questions. Consequently, I can find no solid ground upon which to argue against or defend the propositions raised. I have particular difficulty with issues raised which appear to have no antecedent coverage in either the narrative or the summary findings. I find it a bit disconcerting without any prior discussion to find subjects such as the wisdom of the continued use of eminent domain and need of "protecting" the public interest with regard to the breeder reactor mentioned for the very first time in the issues section. In addition, I am not sure what implication one is suppose to draw from these lists of questions. Is it intended that they be dealt with in more definitive fashion in Phase II?

My own preference would have been to include illustrative policy questions which followed rather directly from the narrative and preliminary findings.

Irrespective of this expression of concern, I think the Phase I work and the integrated report which has been assembled provides a most valuable prelude to the much more intense research which is being conducted in Phase II.



Ross J. Martin
Associate Dean and Director

RJM/ph

cc: W. J. Davis
J. J. Desmond
J. P. Hartnett
J. C. Liebman
J. S. Liebman



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COLLEGE OF ARTS AND SCIENCES
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May 9, 1978

TO: Boyd R. Keenan
James J. Stukel
ORBES Project Office
345 Advanced Computation Building
1011 West Springfield Avenue
Urbana, Illinois

FROM: K. S. Shrader-Frechette
ORBES Phase I Researcher
University of Louisville

RE: Comments on ORBES Phase I Integrated Summary Report

Enclosed are my nine pages of comments, "The Ohio River Basin Energy Study: Methodological and Ethical Problems," regarding the ORBES Phase I: Interim Findings. I appreciate this opportunity for Phase I researchers to have their unedited remarks published as Volume IV of the Phase I Report to be forwarded to EPA.

Since the Interim Findings (pp. 18, 103) indicated that problems regarding nuclear power and low-level radiation will be treated in Phase II, I am most interested in seeing further volumes of the ORBES reports. Key social, ethical, and policy issues still need to be addressed, and the ORBES team must include health-radiation physicists, biologists, political scientists, environmental lawyers, and philosophers, if these questions are to be treated adequately. Best wishes for ORBES success.

Sincerely,

K. S. Shrader-Frechette
Associate Professor

KS-F:ehw

cc: H. T. Spencer
C. Leuthart
F. Hauck

The Ohio River Basin Energy Study: Methodological and Ethical Problems

K. S. Shrader-Frechette
Associate Professor
Philosophy of Science
University of Louisville

1.0 Introduction

The purpose of this analysis is to present a methodological critique of the Ohio River Basin Energy Study, Phase I. Although a great many positive remarks could be made regarding this multi-volume, multi-university, multi-disciplinary study, the object of this discussion will be to provide a context for improving the quality and objectivity of the final technology assessment given in the ORBES summary. To this end, two key questions will be investigated: (1) Were all factual or scientific parameters of major relevance to the study taken into account? (2) Were there any questionable evaluative assumptions implicitly built into the technology assessment? Question (1) addresses the completeness of the scientific methodology employed in the study, whereas question (2) focuses on the objectivity of the ethical and evaluative presuppositions implicit in it.

2.0 ORBES Methodology and the Criterion of Completeness

Completeness is an important criterion for evaluating any technology assessment since policy alternatives, such as those provided by the four energy scenarios of this study, usually involve highly complex tradeoffs. The relative value of any component in the tradeoff can be skewed if the overall problem is defined incorrectly or incompletely. Ignoring one of several key parameters could mean that other factors are given undue weight and that an apparently desirable policy option is in fact undesirable once all relevant parameters are understood.

In the case of the ORBES Phase I Report, this lack of completeness is especially evident in Chapter Six of the assessment, "Public Health, Economic, and Social Impacts."¹ There are key omissions of data in each of these three categories; once these defects are remedied, it is possible to draw conclusions quite different from those of ORBES Phase I regarding the health, economic, and social impacts of the various energy scenarios.

With respect to health impact, at least four basic types of data, essential to evaluation of nuclear technology, were not included: (1) complete information on the probability of a core melt, as taken from the Rasmussen Report, WASH 1400; (2) health effects of a core melt as taken from the update of WASH 740, the Brookhaven Report; (3) The American Physical Society Study on Light-Water Reactors; and (4) results of tests on the emergency core cooling system (ECCS) for nuclear reactors. Treatment of (1) is essential since the current ORBES Phase I report

¹J. J. Stukel and B. R. Keenan, ORBES Phase I: Interim Findings, Washington, D. C.; Office of Research and Development, U. S. Environmental Protection Agency, November, 1977, pp. 97-121.

is misleading regarding accident probabilities. It states that "the Rasmussen Report predicts that a core melting accident has a probability of about 1 in 20,000 per reactor year."² While correct, this statistic gives only a year-by-year probability of a core melt for one reactor. Using the same Rasmussen data,³ it is more meaningful to compute the probability that a core melt will occur in one of the 60 plants now operating during their 30-year lifetime. Using the formula for the probability of mathematically independent events, P (a core melt in at least one of 60 reactors over a 30-year lifetime) = $1 - P$ (no core melt in any of the 60 reactors over a 30-year lifetime), one obtains P (core melt) = $1 - (1 - (1/20,000))^{1800} = 1 - .9139 = .086$. Thus even if reactors now under construction and now planned are not built, there is still an 8.6% probability of a core melt in the 30-year lifetime of one of the reactors now operating. Given this 8.6% probability, the chance of a core melt is approximately 1 in 12. Using the same mathematical formula and the same Rasmussen probability (1/20,000) per reactor-year, one obtains the following results. The probability of a core melt in the 30-year lifetime of 100 plants (assuming 60 now operating and 40 under construction) is .1393 or 14%. This means that for 100 reactors, the chance of a core melt is approximately 1 in 7. Similarly, the probability of a core melt in the 30-year lifetime of 350 plants (assuming 60 now operating, 40 under construction and 250 being planned) is .4085 or 41%. Thus for 350 reactors there is almost a 50/50 chance of a core melt some time in the 30-year lifetime of the plants. Given this more accurate mathematical data regarding core melt probability, it is misleading for the ORBES Phase I report to provide only single-year, single-reactor probabilities, and then to conclude that nuclear accidents "have a comparatively low probability of occurrence."⁴

A second respect in which the ORBES Phase I report provides incomplete information regarding the health impact of a nuclear accident is in its omission of data from the Brookhaven Report, WASH 740. Updated in 1965, the Brookhaven Report contradicts statements made in the ORBES Phase I findings that a core melt accident could "cause 110 early fatalities, 300 early illnesses, and property damage of \$3 billion," and "would necessitate decontamination of about 3200 square miles and relocation of the population over an area of about 250 square miles."⁵ According to the Brookhaven Report, there would be 45,000 early fatalities, not 110; 100,000 early illnesses, not 300; from \$17 billion to \$280 billion in property damages, not \$3 billion; and contamination of an area the size of Pennsylvania, not merely contamination of 250 square miles.⁶

²Stukel and Keenan, op. cit., p. 104.

³See U. S. Nuclear Regulatory Commission, Reactor Safety Study - An Assessment of Accident Risks in U. S. Commercial Nuclear Power Plants, Report No. WASH-1400 (NUREG-75/014), Government Printing Office, Washington, D. C. (1975).

⁴Stukel and Keenan, op. cit., p. 97.

⁵Stukel and Keenan, op. cit., p. 104.

⁶Brookhaven statistics are given in James Elder, "Nuclear Torts: The Price-Anderson Act and the Potential for Uncompensated Injury," New England Law Review, 11 (Fall, 1975): 111-135, esp. 127. See also Summary Report of the U. S. Atomic Energy Commission, "Reactor Safety Study," Atomic Energy Law Journal, 16 (Fall, 1974): 201-202.

ORBES omission of the WASH 740 data is even more significant when one realizes that the ORBES findings also omitted the American Physical Society report on Light-Water Reactor Safety. The APS results are consistent with those of the Brookhaven Report. Moreover the APS study was done at the same time as the Rasmussen Report; it was performed by a group of the most prestigious nuclear scientists in the world, while the Rasmussen Report was done by nuclear proponents under AEC contract. The APS explained why WASH 1400 was able to reduce predicted catastrophic effects of a nuclear accident, viz., it ignored relevant data treated in WASH 740. Because of the mathematical errors inherent in the obsolete "fault-tree analysis" of the Rasmussen Report, and because of a number of implausible assumptions (e.g., complete evacuation; downward fuel melt; no incidence of sabotage; no irradiation of special tissues; downwind radiation lasting only one day; no resource contamination through land and water, etc.), the APS rejected the Rasmussen Report.⁷ The independent, American Physical Society estimates of deaths, cancers and genetic damages arising from a nuclear accident are as much as 100 times greater than those given in the Rasmussen Report and cited in the ORBES Phase I findings. It is not clear why the ORBES Phase I results failed to treat the only reactor safety study done by a non-advocacy group (the APS) and why it included the Rasmussen, but not the Brookhaven findings.

A fourth respect in which the ORBES assessment (of energy-related health impacts) is incomplete is in its failure to cite results of tests of the emergency core cooling system (ECCS) of nuclear reactors. Disastrous consequences, such as those cited above, are avoidable only in the event that the ECCS functions properly. Hence the ECCS is, in one sense, the most essential parameter relevant both to assessing the numerous studies on light-water reactor safety and to evaluating the health impact of nuclear plants. In making the assumption that a nuclear accident has an extremely low probability of occurrence,⁸ the ORBES Phase I report erred in not mentioning a second assumption essential to the first, viz., that the ECCS functions as intended. The ECCS, however, was not mentioned at all; this omission appears significant for at least three reasons. First, no full-scale empirical tests of the ECCS have ever taken place.⁹ Secondly, all of the small, scale-model tests (six of six) of the ECCS have failed.¹⁰ Third, the full-scale model tests would be "possibly very destructive" and nuclear proponents are unwilling to take this risk.¹¹

⁷Lewis, H.W., et al. "Report to the American Physical Society by the Study Group on Light-Water Reactor Safety," Reviews of Modern Physics, 47(Summer 1975), S1-S124. Study Group on Light-Water Reactor Safety, "Nuclear Reactor Safety - the APS Submits Its Report," Physics Today, 128(July 1975): 38-43.

⁸Stukel and Keenan, op. cit., p. 97.

⁹Sheldon Novick, The Electric War, San Francisco, Sierra, 1976. J. Primack and F. Von Hippel, "Nuclear Reactor Safety," The Bulletin of the Atomic Scientists, 30(October 1974): 7-9. See also M. Bauser, "United States Nuclear Export Policy: Developing the Peaceful Atom as a Commodity in International Trade," Harvard International Law Journal, 18(Spring, 1977): 51.

¹⁰Primack and Von Hippel, op. cit., pp. 7,9. J.J. Berger, Nuclear Power; Palo Alto, Ramparts Press, 1977.

¹¹Nuclear proponents F.H. Schmidt and D. Bodansky (The Energy Controversy: The Fight Over Nuclear Power, San Francisco, Albion, 1976, pp. 139-42) explain clearly that high risk is the reason for failure to conduct proper ECCS tests. Novick, op. cit., p. 192 also quotes industry and government leaders who subscribe to the same explanation.

In addition to the omissions regarding health impacts, the ORBES Phase I findings are incomplete in their assessment of the social consequences of energy development options. At least two important impacts in this area have been neglected, viz., civil liberties problems arising from the uranium/plutonium fuel cycle, and possible due process violations resulting from the federal preemption doctrine as applied to Nuclear Regulatory Commission jurisdiction.

Although the ORBES Phase I assessment of social impacts mentions the possibility of terrorism and sabotage of nuclear installations,¹² there is no treatment of civil liberties violations which might ensue as a result of safeguarding reactors and fuel against such threats. Although this problem is not quantifiable, it is a very real legal-political-social "cost" of nuclear generation, and hence must be included in any cost-benefit analysis of social parameters affected by development of nuclear energy. Several authors have already pointed out that in Texas and California, local police forces have kept an eye on people at the request of power company officials, and that, although the authority was refused, the Virginia Electric Power Company recently asked the state legislature for police power which would allow it to arrest people and search their homes.¹³ Carl Walske, President of the Atomic Industrial Forum (and hence the top spokesperson for nuclear industry), thinks we need a new federal police agency solely to deal with problems related to plutonium and enriched uranium. The Nuclear Regulatory Commission also contends that balancing the need for public protection against the necessity for intrusion of government into personal liberties is "one of the most difficult and delicate questions confronting the Commission."¹⁴

A second major difficulty with the "social impact" section of the ORBES Phase I study is its omission of the legal, political, and social consequences relevant to increased controversy over the federal preemption doctrine. Largely as a result of several landmark cases, such as Marshall v. Consumers Power Company, First Iowa Hydro Electric Cooperative v. Federal Power Commission, In re Consolidated Edison Company of New York, Inc., and Northern States Power Company v. Minnesota, the federal government has attempted to preempt state regulation of the nuclear power industry.¹⁵ The states, as in the Northern States case, for example, have attempted to control nuclear plant radiation emissions more stringently than the NRC, and have argued that they have the right to protect the public health and safety, especially since the NRC is not doing an adequate job of nuclear power regulation.¹⁶ Despite the fact that the

¹²Stukel and Keenan, op. cit., p. 105.

¹³Novick, op. cit., p. 308. See also R.W. Ayres, "Policing Plutonium: The Civil Liberties Fallout," Harvard Civil Rights-Civil Liberties Law Review, 10(Spring 1975), 369-443.

¹⁴Walske and the NRC position are cited in V. Gilinsky, "The Need For Nuclear Safeguards," Atomic Energy Law Journal, 27(Summer 1975), 149-50.

¹⁵See J.K. Brydon, "Slaying the Nuclear Giants: Is California's New Nuclear Power Plant Siting Legislation Shielded Against the Attack of Federal Preemption?" Pacific Law Journal, 8(July 1977): 741-82; Comptroller General of U.S. to Joint Committee on Atomic Energy, "Regulating Users of Radioactive Materials," Atomic Energy Law Journal, 15(Summer 1973): 63-132.

¹⁶Brydon, op. cit., p. 762. K.M. Rhoades, "Environmental Law," Washburn Law Journal, 16(Winter 1977): 521-22. P.A. Parenteau, "Regulation of Nuclear Power Plants: A Constitutional Dilemma For the States," Environmental Law, 6(Spring 1976): 675-728. See also Berger, op. cit., pp. 336-38.

NRC claims jurisdiction over nuclear plants, more than 50 new state laws were passed in 1976 to regulate this industry. This was a 1/3 increase over the 1975 state laws passed for this purpose. Moreover in 1976 alone, six states included on their ballots proposals to provide more stringent safety requirements over use of nuclear power than that required by the NRC.¹⁷ Hence the net effect of continued or increasing reliance on nuclear energy is likely to be an escalation of the social-political-legal controversies plaguing our cities, states, legislatures, and courtrooms as a result of the preemption doctrine. Moreover apart from how this issue is resolved legally, there remains the ethical and public policy issue of how individual citizens can be assured a voice in siting and licensing decisions. There is no question that the individual citizen feels he has been disenfranchised,¹⁸ and that his discontent is likely to escalate with the building of more power plants. The sheer bulk of legal cases,¹⁹ in addition to the continuing nuclear regulatory controversy, is sufficient reason to include the social consequences of the preemption conflict within the ORBES "social impact" assessment.

In addition to its omissions regarding health and social impacts, one of the most serious deficiencies of the ORBES Phase I report is its incomplete analysis of the economic impact of various energy scenarios. The Price-Anderson Act is central to any discussion of the economics of nuclear power, and yet no mention of this legislation was made in the ORBES Phase I: Interim Findings report. Since the Price-Anderson Act limits the liability of the nuclear industry to \$560 million in damages for any one accident,²⁰ although government estimates of losses for a single nuclear incident go as high as \$280 billion (according to the Brookhaven Report, WASH 740), this means that as much as 99.8% of the damages resulting from a nuclear accident might not be covered. In other words, up to \$279,440,000,000 in losses from a nuclear accident is in principle uninsurable. Apart from the question of whether the Price-Anderson Act is ethical or legal (a Supreme Court decision on its constitutionality is now pending),²¹

¹⁷Brydon, op. cit., pp. 741-42. Berger, op. cit., pp. 336-38. A.W. Murphy and D.B. La Pierre, "Nuclear Moratorium Legislation in the States and the Supremacy Clause: A Case of Express Preemption," Columbia Law Review, 76(April, 1976): 392-456. See also Novick, pp. 222-239.

¹⁸E.D. Muchnicki, "The Proper Role of the Public in Nuclear Power Plant Licensing Decisions," Atomic Energy Law Journal, 15(Spring, 1973): 38-47. G.C. Coggins, "The Environmentalist's View of AEC's 'Judicial' Function," Atomic Energy Law Journal, 15(Fall, 1973): 176-93. Brydon, op. cit., p. 767. Novick, op. cit., pp. 222-23. G.B. Karpinski, "Federal Preemption of State Laws Controlling Nuclear Power," Georgetown Law Journal, 64(July, 1976): 1335-36. R.B. Stewart, "Paradoxes of Liberty...", Environmental Law, 7(Spring, 1977): 469.

¹⁹See, for example, Brydon, op. cit., pp. 741-82, who reviews many of these cases; Elder, op. cit., pp. 113-16; Karpinski, op. cit., pp. 1323-41; Murphy and La Pierre, op. cit., pp. 392-456; Mark S. Young, "A Survey of the Governmental Regulation of Nuclear Power Generation," Marquette Law Review, 59(1976): 836-55.

²⁰AEC Staff Study of the Price-Anderson Act, Part I, Atomic Energy Law Journal, 16(Fall, 1974) 220. Robert Lowenstein, "The Price-Anderson Act," Forum, 12(Winter, 1977): 594-604. Joseph Marrone, "The Price-Anderson Act," Forum, 12(Winter, 1977): 605-11. W.S. Caldwell, et al., "The...Price-Anderson Act," Rutgers-Camden Law Journal, 6(Fall, 1974): 360-386.

²¹See Berger, op. cit., pp. 145-46. See also Coggins, op. cit., pp. 176-93; R. Wilson, "Nuclear Liability and The Price-Anderson Act," Forum, 12(Winter, 1977): 612-21; and Robert Drinan, "Nuclear Power and the Role of Congress," Environmental Affairs, 4(Fall, 1975): 595-627.

there is no doubt that it has great economic consequences. A nuclear accident would have a massive impact on the economy of the region and state in which the problematic plant was located. In fact the Price-Anderson legislation is one of the prime reasons why so many state legislatures have sought to enact nuclear moratorium legislation.²² Individual citizens and entire states fear the losses they would have to sustain in the event of such a disaster. Given the magnitude of the risk borne by certain states and by individuals within a given radius of a nuclear power plant, it is unclear why the economic impact of the Price-Anderson Act was not included in the ORBES Phase I assessment.

3.0 ORBES Methodology and Ethical/Evaluative Presuppositions

In addition to the omission of data relevant to the health, social, and economic impacts of various energy scenarios, the ORBES Phase I results are problematic in a second respect. While failing to address the ethical aspects of a number of energy policy decisions, such as that regarding the Price-Anderson Act and whether it violates Fifth and Fourteenth Amendment guarantees of protection of property, the ORBES Phase I study nevertheless employs a number of implicit, highly questionable ethical assumptions. Although ORBES procedures limit the length of my remarks, I will attempt to address as many as possible of these questionable presuppositions.

One of the most obvious assumptions throughout the report is that any factors not susceptible to precise quantitative formulation are not important enough to be included in the assessment. The 22-page summary of the ORBES Phase I findings, for example, contains exactly six sentences in the section treating "Social and Institutional Factors" relevant to the impact of various energy scenarios.²³ It is unclear why legal, political, sociological, psychological, and ethical impacts are limited to such a brief evaluation while physical, chemical, and biological impacts receive a relatively better treatment. Moreover the Task 4 Study of the energy impact on "Quality of Life" is described as "Subjective Quality of Life" in the ORBES organization chart.²⁴ This again suggests that social or qualitative parameters are of little import to the ORBES research; the implicit assumption is that only quantitative, physical-science variables are essential to the ORBES conclusions. This presupposition is especially apparent in the Phase I discussion of the Rasmussen Report findings regarding the probability of a nuclear accident.²⁵ The study cites the WASH 1400 data and then states that the probability of a catastrophic accident is low. Nowhere, however, is the qualitative or ethical question, of whether this risk ought to be taken, evaluated. Likewise the ORBES report "justifies" emissions of low-level radiation from nuclear power plants by noting that such emissions provide less radiation than that received from flying in an airplane, watching a color TV, etc.²⁶ Again, these ORBES remarks address only quantitative aspects of a problem and fail to raise important ethical concerns. Some of these ethical questions are whether one ought to add further to the low-level radiation burden; whether there is an ethical difference between radiation hazards voluntarily chosen (e.g. by flying in a plane) and those imposed involuntarily (e.g. because of a nearby power plant); and

²²See Brydon, op. cit., pp. 74-82; Elder, op. cit., pp. 111-35; Karpinski, op. cit., pp. 1323-41; Murphy and La Pierre, op. cit., pp. 392-456; Parenteau, op. cit., pp. 675-728.

²³See Stukel and Keenan, op. cit., p. 109.

²⁴See Stukel and Keenan, op. cit., p. 129.

²⁵See Stukel and Keenan, op. cit., p. 103-106.

²⁶See Stukel and Keenan, op. cit., p. 103.

whether economic criteria can ever be said to justify the increased cancer hazard delivered by even a small amount of low-level radiation.

Failure to address these and other ethical issues, relevant to the ORBES Phase I study, constitutes a classic instance of what philosophers have termed "the naturalistic fallacy."²⁷ This fallacy is committed whenever one supposes that mathematical or scientific "facts" can produce ethical directives. Neither mathematical remarks about the probability of a core melt, nor scientific facts about the pervasiveness of low-level radiation, constitute sufficient reasons for ethical directives regarding nuclear power. In order to arrive at such directives, the ORBES assessment needs to encompass a broader evaluation of ethical, legal, political, and sociological impacts of energy development. My earlier remarks relevant to the Price-Anderson Act and the doctrine of federal preemption suggest several important legal and public policy questions which need to be addressed. Another way to provide a framework bearing on ethical considerations is to include an assessment of the psychological impact of various energy scenarios. There is already a vast amount of literature available on the relationship between environmental properties and psychological well being.²⁸ Holmes, Gunderson, Dubos, Rivers, Montague, and others have studied the effects of technological change upon the incidence of depression, impotence, mortality, and other factors related to mental and physical health. It is precisely this sort of psychological impact, both which is essential to a complete analysis of all energy scenario "costs" and "benefits", and which is needed in the ORBES research.

A second ethical presupposition, implicit throughout the ORBES research, is that acceptance of policy decisions regarding construction of more power plants is primarily dependent upon possible economic benefit to the community.²⁹ Apart from whether economic parameters are in fact the determining ones, any study based on the presupposition that such factors are or ought to be the major ones, is itself implicitly employing a utilitarian ethic. The difficulty with the ORBES presupposition of a utilitarian calculus, viz., "the greatest amount of economic good to the greatest number of people," is that such a calculus (and therefore the ORBES research) is insensitive to considerations of equal justice and equal protection under the law. In other words, it is possible for minority rights to be violated within a utilitarian framework, so long as such a violation contributes to the economic good of the majority. Both this economic criterion for energy policy and the Price-Anderson limitation on liability raise a grave question regarding the adequacy of utilitarian ethics. This question is whether "all the public or a disproportionate segment thereof shall bear the risks for an activity that purportedly benefits everyone."³⁰

²⁷See Albert Einstein, "The Laws of Science and the Laws of Ethics," in H. Feigl and M. Brodbeck (eds.), Readings in the Philosophy of Science, New York, Appleton-Century-Crofts, 1953, p. 779.

²⁸See for example, H.H. Iltis, O.L. Loucks, and P. Andrews, "Criteria for an Optimum Human Environment," in R.T. Roelofs, J.N. Crowley, and D.L. Hardesty (eds.), Environment and Society, Englewood Cliffs, Prentice-Hall, 1974, pp. 88ff; and P.D. Pahner, "A Psychological Perspective of the Nuclear Energy Controversy," Vienna, International Institute for Applied Systems Analysis, RM-76-67, August, 1976.

²⁹See Stukel and Keenan, op. cit., p. 8, where this assumption is made explicitly.

³⁰J.C. Bodie, "The Irradiated Plaintiff: Tort Recovery Outside Price-Anderson," Environmental Law, 6(Spring, 1976): 896.

As a number of authors have pointed out, to the extent that energy-policy decision-making is utilitarian, its policies share the major weaknesses of this ethical theory. Some of these deficiencies include a general insensitivity to considerations of equity; a disregard for future generations; a tendency to equate desires with need; and an assessment only of quantifiable goods and bads.³¹ The utilitarian presupposition of ORBES that power plant acceptance is a function of economic benefit to the community, has a potential for two consequences of questionable ethical character. First, it might cause noneconomic benefits, e.g., aesthetic and health-related goods, to receive no consideration at all. Secondly, it might cause overall maximization of economic benefits even though economic inequities or hardships are visited upon a given minority within a community. Because it sanctions the maximization of economic good, rather than equity, this ORBES presupposition (and the utilitarian ethic underlying it) are at odds with any ethical scheme based on a theory of equal rights.

Several other presuppositions in the ORBES study are questionable, not because of their underlying ethical frameworks but because they purport to be scientific while being purely evaluative. There are at least three such presuppositions, stated without any substantiation, that need to be investigated further. These are the statements (1) that there exist sufficient supplies of uranium for all nuclear plants to be built up to the year 2000;³² (2) that the probability of release of radioactive wastes into the atmosphere is low;³³ and (3) that coal-fired plants have a worse impact on land quality than do nuclear plants.³⁴ In the interests of objectivity, each of these evaluative statements should be either substantiated or retracted. There are several reasons suggesting that the latter is the more desirable option. (1) above is questionable because a number of nuclear advocates, including Alvin Weinberg, maintain that there is not enough uranium to last more than ten years from the present.³⁵ In the face of an acknowledged shortage of uranium which has been admitted by ERDA, the U.S. Geological Survey, and the utilities, statement (1) above seems questionable. Also doubtful is statement (2), regarding the low probability of accidental release of radioactive wastes. This thesis is not documented or substantiated in ORBES Phase I: Interim Findings and there are several facts suggesting it is inaccurate. First, as is admitted in the ORBES report, there are "no permanent storage sites for high-level wastes" and "the long-term effects of high-level waste disposal are quite uncertain."³⁶

³¹See Alasdair MacIntyre, "Utilitarianism and Cost-Benefit Analysis: An Essay on the Relevance of Moral Philosophy to Bureaucratic Theory," in K.M. Sayre (ed.), Values in the Electric Power Industry, Notre Dame, Univ. of Notre Dame Press, 1977, pp. 217-37; Sayre and Goodpaster, "An Ethical Analysis of Power Company Decision-Making," in Sayre op. cit., pp. 238-88.

³²Stukel and Keenan, op. cit., pp. 31, 142.

³³Stukel and Keenan, op. cit., p. 93.

³⁴Stukel and Keenan, op. cit., p. 94.

³⁵Alvin Weinberg, "The Short Term Nuclear Option," Report of the Cornell Workshops on the Major Issues of a National Energy Research and Development Program, 1973, Ch. III, p. 183. Acting Federal Energy Administration (FEA) Deputy John Hill, testifying before Joint Committee on Atomic Energy, Bureau of National Affairs, May 8, 1975. Mason Willrich, Global Politics of Nuclear Energy, New York, Praeger, 1971, pp. 70, 73, 78. Schmidt and Bodansky, op. cit., p. 34. See also C.C. Howard, "Uranium Sales Contracts," Rocky Mountain Mineral Law Institute, 22(1976):389-403; and P.L. Joskow, "Commercial Impossibility, The Uranium Market, and the Westinghouse Case," Journal of Legal Studies, 6(January 1977):119-76. See also F. Von Hippel and R.H. Williams, "Energy Waste and Nuclear Power Growth," Bulletin of the Atomic Scientists, (December 1976), p. 54.

³⁶Stukel and Keenan, op. cit., p. 104.

Given these two unknowns, it is unclear on what basis (2) above can be asserted. Moreover hundreds of thousands of gallons of high-level radioactive waste, temporarily stored in several areas of the country, have already leaked and contaminated the areas surrounding the storage sites.³⁷

ORBES statement (3) above, that coal-fired plants have a worse impact on land quality than do nuclear plants,³⁸ is also problematic. As mentioned previously, this remark was not substantiated, nor is it clear what criteria might be employed to assess its correctness or incorrectness. At a minimum, the basis of this claim must be made explicit. Such an evaluation would have to include, for example, a comparison of long-term effects of both types of plant on land quality and costs of decommissioning the nuclear plant and decontaminating land area around it. In the absence of such quantitative and comparative studies, statement (3) merely begs the question.

4.0 Conclusion

While space limitations of ORBES procedures have precluded an in-depth analysis of the topics outlined above, these remarks may be helpful in two respects. First, they may enable the ORBES team to correct misleading aspects of the current Phase I report. More importantly, they suggest a number of areas which ORBES research so far has not touched and which ought to be accomplished in the future. Some of these areas include legal, ethical, political and psychological impacts of various scenarios.

³⁷Novick, op. cit., pp. 178-79, and E. Nathanson, "International Management of Radioactive Wastes," Environmental Affairs, 5(Spring, 1976): 365.

³⁸Stukel and Keenan, op. cit., p. 94.