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March 18, 1980

To: AQ-9 Task Force

Attached please find a copy of the minutes of the February 9, 1980 AQ-9 Task Force meeting. Please inform me of any errors or omissions.

Cordially,

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

Attachment--minutes

/mi

CO₂ AND CLIMATE TASK FORCE (AQ-9)

Minutes of Meeting

9:15 a.m.
Friday, February 29, 1980

Manhattan Room
LaGuardia Airport
New York City, New York

MEMBERS PRESENT

K. Blower, Chairman
B. Bailey
H. Shaw

SOHIO
Texaco
Exxon R&E

OTHERS PRESENT

J. Laurman
J. Nelson
C. Showers

Consultant
API/EAD
SOHIO

OPENING REMARKS

K. Blower, Chairman, opened the meeting by listing the following goals of this meeting:

1. Increase industry's understanding of the CO₂ and climate problem.
2. Determine if there are feasible and valuable research projects that could be accomplished by API.
3. Establish a mechanism to prepare any needed issue papers.

B. Bailey added the following items for consideration:

1. This Task Force should be the focal point and establish a basis for providing API comments on CO₂ and climate matters.
2. An overall goal of the Task Force should be to help develop ground rules for energy release of fuels and the cleanup of fuels as they relate to CO₂ creation.

CONSULTANT REPORT

Dr. J. A. Laurman, a consultant and a recognized expert in the field of CO₂ and climate, made a presentation to the Task Force entitled, "The CO₂ Problem; Addressing Research Agenda Development."

An outline is included as Attachment A.

In addition, a complete technical discussion, led by Dr. Laurman identified the problem, discussed the scientific basis and technical evidence of CO₂ buildup, impact on society, methods of modeling and their consequences, uncertainties, policy implications, and conclusions that can be drawn from present knowledge. A series of summary charts are attached as Attachment B.

API RESEARCH NEEDS

One area of possible API research was identified: Preparatory research to be able to answer questions dealing with the CO₂ problem and synthetic fuels.

COMMENTS ON DOE TECHNICAL PAPER

K. Blower and Bruce Bailey will modify the draft API letter back to DOE concerning an article submitted to the Task Force for comment. When the Task Force has approved the letter, it will be coordinated within API staff.

OTHER BUSINESS

The Task Force should set up a rationale and system for review of technical articles and responses to inquiries.

One potential area for R&D was discussed by the Task Force: "Investigate the Market Penetration Requirements of Introducing A New Energy Source into World Wide Use." This would include the technical implications of energy source changeover, research timing and requirements.

The meeting was adjourned at 4:25 p.m.

Prepared by:



Jimmie J. Nelson

THE CO₂ PROBLEM; ADDRESSING RESEARCH AGENDA DEVELOPMENT

The difficulties of dealing with the pragmatic questions related to the CO₂/fossil fuel problem all relate to certain general features, these having A) high impact cost, B) large uncertainty, and being C) far distant and D) global. The problem is interdisciplinary in its scientific aspects and it has ramifications in many economic sectors and in most nations. Therefore, not only is addressing it difficult in analytic terms, but the multiplicity of possible interest groups that can be affected means that choice of what constitute the critical research issues depends on the user. In the most general terms we can subdivide the motivational aspect into those who see the need as to

- A) better understand the CO₂/climate system, resulting in an ability to predict a) short range and b) long range effects.

or to

- B) assess the present day importance of the future impact, as viewed
 - i) from a world viewpoint
 - ii) by national entities
 - iii) by specific industrial sectors or interest groups

Highest priority investigations depend on which of these groups is involved. In particular, a highly relevant aspect for all of these groups is the influence of present and future information on public perception and governmental attitudes regarding the problem and the resultant effect on energy policy.

Instead of attempting to research all aspects of the CO₂ problem that bear on the concern of any particular group, we may select a feature that appears to be particularly important to that sector - for example, nuclear energy proponents might wish to address the problem of market penetration time lags as the most critical for making their case.

A) Reducing uncertainty in projectionsCO₂ input

- a) deforestation, past present and future.
- b) effect of various energy use policies - coal, oil shale, nuclear, biomass, solar, synthetics.

- c) turn-around scenarios for non-carbon based fuel use, impact calculations.
- d) remedial measures: biomass, scrubbing, bacterial enzymes, fertilizing oceans.

Carbon cycle

- a) CO₂ growth and photosynthesis
- b) missing CO₂ since - detritus, humus, regrowth of deforested areas, oceans, non-stationary biosphere.
- c) validity of box-model projections in short (50 yr) range.
- d) organic material in oceans (detritus, dissolution, nutrient limitations)
- e) estuarian regions
- f) ground water
- g) carbonate distribution
- h) use of tracers
- i) cataloguing on the biosphere
- j) climatic change feedback effects - ocean temperature, plant growth.

Climate modeling

- a) ocean dynamics
- b) simplifying models
- c) feedback effects : clouds, sea ice, vegetation change(albedo).
- d) regional climatic change

B) Impact of climatic change

Socio-economic

- I) General problems:
 - a) how to make estimates of costs of large perturbations, even assuming climatic changes are known?
 - b) how do we discount the future?
 - c) geopolitical problems, either from climatic change or from remediation measures



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d) building in resilience. Can severity be versed in terms of critical rates of change of forcing of the societal system? Is a generic non-specific formulation possible?

II) Immediate policy questions. The physical facts agree on the probability of large effects 50 years away, but with large probable error. Source of the uncertainty arises from deforestation, poor climate models and uncertainty in CO₂ input (energy projections). The first may be settled in a year or two; the second will not. Hence we have to treat an unsure situation, which may be possible via decision analysis if error distribution can be quantified. This has not been done for impact costs, so first a) can it be? If yes, there still remain two major difficulties: b) what are market penetration times for new energy sources? and c) what future (social) discounting rate should be used?

If fossil fuel use rates are reduced to 2% p.a. or under, it looks as if the immediate problem is considerably eased (but needs checking). So another question is

d) what is the 50 year future of fossil fuel use?

Of more parochial interest is

e) what roles do the different catagories of fossil or synthetic fuel play in future projections?

The Natural Biosphere

The Managed Biosphere



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THE NATIONAL

REASONS FOR INCREASED CONCERN WITH THE CO₂ PROBLEM

- DEVELOPMENT OF RELIABLE ATMOSPHERIC CO₂ GROWTH RATE MEASUREMENTS
- ITS CORRELATION WITH GLOBAL INDUSTRIAL CO₂ EMISSIONS, MOSTLY FROM FOSSIL FUEL COMBUSTION
- SCIENTIFIC CONSENSUS ON THE POTENTIAL FOR LARGE FUTURE CLIMATIC RESPONSE TO INCREASED CO₂ LEVELS
- REALIZATION THAT REMEDIAL ACTIONS WOULD TAKE A LONG TIME TO BECOME EFFECTIVE

OBSERVATIONAL EVIDENCE - CONCLUSIONS

- TWENTY YEARS OF GOOD CO₂ DATA, BUT ESSENTIALLY FROM ONE SOURCE
- PRESENT ATMOSPHERIC CO₂ CONCENTRATION = 335 ppm
PRE-INDUSTRIAL (1860)" " ≈ 290 ppm
- CURRENT GROWTH RATE = 4.3% p.a. OF INCREASE SINCE 1860
- STRONG EMPIRICAL EVIDENCE THAT RISE CAUSED BY ANTHROPOGENIC RELEASE OF CO₂, MAINLY FROM FOSSIL FUEL BURNING
- ATMOSPHERIC RETENTION IS 56% OF RELEASE, ASSUMING NO EFFECTS FROM DEFORESTATION

ENERGY USE PROJECTIONS - CONCLUSIONS

- AVERAGE GROWTH RATE 3-4% p.a. FOR NEXT FIFTY YEARS, FOSSIL FUEL SLIGHTLY LESS
- THIS IS NOT CONSISTANT WITH LONG TERM PAST TREND
- PROJECTED CO₂ RELEASE ^{INCREASE} RATE (PROPORTIONAL TO INTEGRATED FOSSIL FUEL OUTPUT)
CLOSE TO 3% p.a. UNTIL MID-21ST CENTURY; SUBJECT TO ERROR OF
ABOUT \pm 1% p.a.
- EFFECT OF FOSSIL FUEL DEPLETION MINOR IN NEXT FIFTY YEARS

CARBON CYCLE - CONCLUSIONS

- POSSIBLE CO₂ RELEASE CONTRIBUTION FROM DEFORESTATION, PERHAPS RIVALLING FOSSIL FUEL SOURCE
- ALL CARBON CYCLE MODELS BEHAVE LINEARLY UP TO 3-4 TIMES PRE-INDUSTRIAL ATMOSPHERIC CO₂ LEVELS
- HENCE GIVE THE SAME PROJECTED ATMOSPHERIC CO₂ LEVELS FOR THE SAME INPUT
- FOSSIL FUEL DEPLETION EFFECTS SMALL
- DEFORESTATION EFFECT ON PROJECTIONS ONLY SIGNIFICANT IF IT BECOMES DEPLETED
- CO₂ "DOUBLING" DATE IS 2038 AT A 3% P.a. GROWTH OF ATMOSPHERIC RELEASE RATE
- ERROR IN THIS ESTIMATE IS SMALL COMPARED WITH OTHER SOURCES OF ERROR

CLIMATE MODELING - CONCLUSIONS

- GLOBAL AVERAGED 2.5° C RISE EXPECTED BY 2038 AT A 3% p.a. GROWTH RATE OF ATMOSPHERIC CO₂ CONCENTRATION
- LARGE ERROR IN THIS ESTIMATE - 1 IN 10 CHANCE OF THIS CHANGE BY 2005
- NO REGIONAL CLIMATE CHANGE ESTIMATES YET POSSIBLE
- LIKELY IMPACTS:
 - 1° C RISE (2005): BARELY NOTICEABLE
 - 2.5° C RISE (2038): MAJOR ECONOMIC CONSEQUENCES, STRONG REGIONAL DEPENDENCE
 - 5° C RISE (2067): GLOBALLY CATASTROPHIC EFFECTS

UNCERTAINTY IN ESTIMATES

- 1) CARBON CYCLE MODELING - MINOR
- 2) DEFORESTATION - MAJOR EFFECT ONLY IF RATE IS LARGE AND DEPLETION SETS IN
- 3) NATURAL CLIMATE VARIABILITY - SMALL, ABOUT 0.5° C IN 50 YEARS
- 4) OTHER ANTHROPOGENIC SOURCES - LESS THAN CO_2 , BUT POTENTIALLY MAJOR IF
CONSIDERED IN TOTO
- 5) EFFECT OF A $\pm 1\%$ VARIATION IN FOSSIL FUEL GROWTH RATE RELATIVELY MINOR
- 6) CLIMATE MODELING ERROR VERY LARGE; ALLOWANCE IN POLICY ANALYSIS ESSENTIAL

POLICY IMPLICATIONS

- GLOBAL PROBLEM, BOTH IN SOURCE AND FOR REMEDIES
- TIME SCALE FOR SIGNIFICANT IMPACT, VERY ROUGHLY 50 YRS
- HIGH RISK, HIGH UNCERTAINTY SITUATION, RELATIVELY FAR AWAY
- TIME FOR ACTION ? MARKET PENETRATION TIME THEORY SAYS
THERE IS NO LEEWAY

CONCLUSIONS

- AT A 3% PER ANNUM GROWTH RATE OF CO₂, A 2.5°C RISE BRINGS WORLD ECONOMIC GROWTH TO A HALT IN ABOUT 2025.

Even if this estimate is grossly wrong it is still probable that

- WHETHER THERE ARE GROUNDS FOR IMMEDIATE RESPONSE TO THE THREAT DEPENDS ON THE VALIDITY OF THE LONG MARKET PENETRATION TIME CONCEPT.
- EVEN IF THE LATTER IS APPLICABLE, PRESENT DAY SIGNIFICANCE OF THE IMPACT DEPENDS STRONGLY ON CHOICE OF A FUTURE DISCOUNTING FACTOR.
- NEED FOR IMMEDIATE POLICY ACTION HINGES ON THESE LAST TWO FEATURES.

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