

in file

Date 8/3/88

To: Dick

From: Joseph M. Carlson

Attached is a draft on the  
House effect. As you  
can see, most of it is taken  
from the Uge II material. I  
haven't attempted to recheck any  
of the facts, given Brian's  
absence. The first two  
items on the last page are  
intended to address the  
question "what do you think  
is the direct impact on Exxon's  
business. I haven't checked  
them into Corporate Planning  
as yet.

Joe

## THE GREENHOUSE EFFECT

### ISSUE

THE GREENHOUSE EFFECT REFERS TO ATMOSPHERIC GASES WHICH RETAIN REFLECTED SOLAR RADIATION, WHICH IS ESSENTIAL TO THE SUPPORT OF LIFE ON EARTH. CURRENT CONCERN IS ASSOCIATED WITH THE "ENHANCED" GREENHOUSE EFFECT, OR THE POSSIBLE INCREASE IN GLOBAL SURFACE TEMPERATURES DUE TO AN INCREASED RATE OF BUILD-UP OF GREENHOUSE GASES.

### BACKGROUND

- 0 THE GREENHOUSE EFFECT MAY BE ONE OF THE MOST SIGNIFICANT ENVIRONMENTAL ISSUES FOR THE 1990s.
- 0 GASES THAT FAVOR ABSORPTION OF INFRARED (IR) RADIATION: CARBON DIOXIDE, WATER VAPOR, METHANE, NITROUS OXIDE, CHLORO-FLUOROCARBONS, AND HALOGENS.

O THE PRINCIPAL GREENHOUSE GASES ARE BY-PRODUCTS OF FOSSIL FUEL COMBUSTION.

"ENHANCED" GREENHOUSE EFFECT

O MOLECULES OF CO<sub>2</sub> WHICH ARE EFFICIENT ABSORBERS OF REFLECTED SOLAR IR CAN CAUSE DISPROPORTIONATE WARMING OF THE ATMOSPHERE.

O THIS WARMING INCREASES THE EARTH'S SURFACE TEMPERATURE, IN TURN INCREASING WATER VAPORIZATION.

O WATER VAPOR MOLECULES ARE ALSO EFFICIENT IR ABSORBERS AND GREATLY MAGNIFY THE ORIGINAL CO<sub>2</sub> EFFECT. OTHER ATMOSPHERIC GASES LIKE TRACE QUANTITIES OF CHLORO-FLUOROCARBONS CAN TRIGGER THE WATER VAPOR WARMING CYCLE.

O THERE IS NO CONSENSUS ON THE NET EFFECT OF THESE PROCESSES.

O THERE IS SCIENTIFIC AGREEMENT ON TWO POINTS:

- ATMOSPHERIC CO<sub>2</sub> IS INCREASING AND COULD DOUBLE IN 100 YEARS.

- FOSSIL FUELS CONTRIBUTE ABOUT FIVE BILLION TONS/YEAR OF CO<sub>2</sub>. DEFORESTATION ADDS TWO-FIVE BILLION TONS PER YEAR.

## CLIMATE MODELS

- o MOST DEBATE CENTERS ON PROJECTING FUTURE IMPACT USING CLIMATE MODELS.
- o THESE MODELS ARE EXTREMELY COMPLEX AND REQUIRE TRACKING CO<sub>2</sub> INTERACTIONS IN THE ATMOSPHERE AND BIOSPHERE AND MUST ADDRESS THE ROLE OF TRACE GASES, OCEANS, CLOUDS, BIOMASS AND LARGE ICE FORMATIONS AT THE POLES. THESE INTERACTIONS ARE NOT WELL UNDERSTOOD.
  - THE CLIMATE MODELS ARE NOT VERY RELIABLE BECAUSE APPROXIMATIONS ARE USED TO REPRESENT POORLY UNDERSTOOD INTERACTIONS.
- o CLIMATE MODELS PREDICT A 1.50 C TO 4.50 C GLOBAL TEMPERATURE INCREASE IN 100 YEARS - DEPENDING ON THE PROJECTED GROWTH IN FOSSIL FUEL USE.

- 0 SUCH WARMING COULD RESULT IN PARTIAL POLAR ICE CAP MELTING WITH ASSOCIATED SEA LEVEL RISE AND SINCE CO<sub>2</sub> AND H<sub>2</sub>O VAPOR AID PLANT GROWTH, THERE COULD BE AN ACCELERATION OR ALTERATION IN VEGETATION GROWTH PATTERNS FAVORING SELECTED SPECIES.
  
- 0 IT IS TOO EARLY TO SPECIFY THE SEVERITY OF THE POTENTIAL IMPACTS OF THE ENHANCED GREENHOUSE EFFECT.
  
- 0 ACTUAL MEASUREMENTS OF NORTHERN HEMISPHERE AVERAGE TEMPERATURES SHOW NO CLEAR PATTERN OVER A 20-YEAR PERIOD FROM 1960 TO 1980. WHEN PROJECTED AT A RATE CORRESPONDING TO ABOUT 2° C INCREASE OVER 100 YEARS, THE TREND DOES NOT ESCAPE FROM THE UNCERTAINTY BAND FOR ANOTHER 10 YEARS.

#### CURRENT MITIGATION EFFORTS

- 0 REDUCTION IN CHLORO-FLUOROCARBON EMISSIONS TO PROTECT OZONE IN THE UPPER ATMOSPHERE.

0 PROTECTION OF MAJOR GLOBAL FOREST RESOURCES.

0 CONTINUING THE EMPHASIS ON EFFICIENCY IN ENERGY GENERATION AND USE.

#### WORLDWIDE RESEARCH

0 NATIONAL AND INTERNATIONAL RESEARCH PROGRAMS ARE BEING ESTABLISHED TO MONITOR AND EVALUATE THE GREENHOUSE PHENOMENON.

0 IN THE U.S., ABOUT \$25 MILLION PER YEAR IS BUDGETED FOR DIRECT CO<sub>2</sub> GREENHOUSE RESEARCH.

#### EXXON RESEARCH

0 IN THE LAST FIVE YEARS EXXON HAS SUPPORTED BOTH IN-HOUSE AND THEORETICAL STUDIES AND OUTSIDE RESEARCH PROGRAMS AT KEY INSTITUTIONS.

- LAMONT DOHERTY GEOLOGICAL OBSERVATORY

- COLUMBIA UNIVERSITY CLIMATE CENTER (TOTAL FUNDS FOR BOTH ABOUT \$.6 MILLION)

O EXXON SCIENTISTS ARE INTERACTING WITH KEY GOVERNMENT AGENCIES INCLUDING THE UNITED NATIONS' ENVIRONMENTAL PROGRAM, IPECA, OECD, DOE, AND U.S. EPA.

O EXXON IS PROVIDING LEADERSHIP THROUGH API IN DEVELOPING THE PETROLEUM INDUSTRY POSITION.

EXXON POSITION

O EMPHASIZE THE UNCERTAINTY IN SCIENTIFIC CONCLUSIONS REGARDING THE POTENTIAL ENHANCED GREENHOUSE EFFECT.

O URGE A BALANCED SCIENTIFIC APPROACH.

- 0 DUE TO CURRENT SCIENTIFIC UNCERTAINTY, EXXON IS NOT CONDUCTING SPECIFIC IMPACT STUDIES WITH RESPECT TO PARTICULAR COMPANY OPERATIONS OR GEOGRAPHIC REGIONS.
  
- 0 EXXON HAS NOT MODIFIED ITS ENERGY OUTLOOK OR FORECASTS TO ACCOUNT FOR POSSIBLE CHANGES IN FOSSIL FUEL DEMAND OR UTILIZATION DUE TO THE GREENHOUSE EFFECT.
  
- 0 RESIST THE OVERSTATEMENT AND SENSATIONALIZATION OF POTENTIAL GREENHOUSE EFFECT WHICH COULD LEAD TO NONECONOMIC DEVELOPMENT OF NONFOSSIL FUEL RESOURCES.