

THIS SPEECH REFLECTS THE VIEWS
OF THE AUTHOR AND DOES NOT
NECESSARILY REFLECT THE VIEWS
OF THE DEPARTMENT OF THE NAVY
OR THE DEPARTMENT OF ENERGY

"ENVIRONMENTAL PERSPECTIVE"

BY

ADMIRAL H. G. RICKOVER, U. S. NAVY

AT A MEETING OF THE

PUGET SOUND NAVAL BASE ASSOCIATION, INC.

BREMERTON, WASHINGTON

16 NOVEMBER 1979

COPYRIGHT 1979, H.G. RICKOVER

NO PERMISSION NEEDED FOR NEWSPAPER OR NEWS PERIODICAL USE.

ABOVE COPYRIGHT NOTICE TO BE USED IF MOST OF SPEECH REPRINTED.

LONG BEFORE THE TERM ENVIRONMENTALIST BECAME A HOUSEHOLD WORD, I WAS CONCERNED ABOUT OUR ENVIRONMENT. EARLY IN MY CAREER I BECAME CONCERNED THAT OUR NATURAL RESOURCES WERE BEING CONSUMED TOO RAPIDLY; THAT THE WORLD'S FINITE SUPPLY OF PETROLEUM WOULD EVENTUALLY BE DEPLETED; THAT THE HYDROCARBONS WE WERE BURNING FOR ENERGY WOULD BE DESPERATELY NEEDED BY FUTURE GENERATIONS AS RAW MATERIALS. BACK IN 1936, I HAD COMPUTED THAT THE OIL USED IN ALL HISTORY WAS ONE CUBIC MILE IN VOLUME. BY 1979, THE TOTAL OIL CONSUMPTION HAD REACHED 17 CUBIC MILES (463 BILLION BARRELS), A CUBE ABOUT 2.6 MILES ON A SIDE. THESE FIGURES SHOW HOW SMALL THIS PRECIOUS RESOURCE IS. IT MAY INTEREST YOU TO KNOW THAT IN THE CASE OF ANOTHER SCARCE MATERIAL, GOLD, ALL THAT MAN HAS AMASSED IN 6,000 YEARS CAN BE REPRESENTED BY AN 18-YARD CUBE.

FOR TOO MANY YEARS EVERY NEW HIGHWAY OR INVENTION WAS WELCOMED AS AN INDICATOR OF PROGRESS WITHOUT TAKING INTO ACCOUNT THE LONG-RANGE CONSEQUENCES. MANKIND HAS BEEN PROFLIGATE—AS IF WE WERE OWNERS RATHER THAN TRUSTEES OF THIS PLANET.

TODAY, THERE IS A GREATER AWARENESS OF THESE PROBLEMS, BUT NOT THE RECOGNITION OF THE LIMITS THAT NATURE IMPOSES. FROM MANY QUARTERS THERE ARE PRESSURES TO COME UP WITH A "SAFE" SOURCE OF ABUNDANT ENERGY. BUT EACH ALTERNATIVE HAS ITS LIMITATIONS. SOME, SUCH AS NUCLEAR POWER, ARE OPPOSED BY SINGLE INTEREST GROUPS THAT OFTEN VIE TO BE THE LOUDEST TO CRY DOOM. AS MORE ASPECTS OF EVERYDAY LIFE ARE BEING CHARACTERIZED BY ONE GROUP OR ANOTHER, AS INVOLVING HIGH RISK, ORDINARY CITIZENS ARE FINDING IT INCREASINGLY DIFFICULT—PERHAPS IMPOSSIBLE—TO GET THE ISSUES INTO PERSPECTIVE.

WITHIN SOME SPECIAL INTEREST GROUPS ARE THOSE WHO FAVOR RETURNING TO THE SIMPLER STYLE OF 100 YEARS AGO. THEIR OBJECTIVE IS CLEAR; THEY TEND TO BE AGAINST MOST FORMS OF ENERGY.

THE GREAT MAJORITY OF PEOPLE, HOWEVER, WANT TO SUSTAIN TODAY'S ADVANCED LIFE STYLE. FOR THEM THE PROBLEM IS ONE OF EVALUATING ALTERNATIVES—OF COMPARING RISKS AND WEIGHING THEM AGAINST BENEFITS,

THE MEDIA, IN SEARCH OF EXCITING NEWS, AND SPECIAL INTEREST GROUPS, ENCOURAGE EMBELLISHING AND SENSATIONALIZING FACTS. SINCE TOUGH FACTS ARE OFTEN BLAND AND HARD TO MARKET AS "NEWS," THE PUBLIC GETS A DISTORTED PICTURE OF ENVIRONMENTAL MATTERS. WE FACE A DANGER THAT PUBLIC POLICIES IN TECHNOLOGY WILL BE DETERMINED, IN EFFECT, BY THE MEDIA AND BY SINGLE INTEREST GROUPS.

WHILE THE PROBLEMS WE FACE TODAY ARE IMMENSE, THE INCREASED PUBLIC INTEREST IN ENERGY AND ENVIRONMENTAL MATTERS OFFERS AN OPPORTUNITY FOR PROGRESS TOWARD SOLVING THESE DIFFICULT, LONG-RANGE PROBLEMS. BUT THESE WILL HAVE TO BE DEALT WITH INTELLIGENTLY, NOT ON AN EMOTIONAL BASIS. SCIENTISTS, ENGINEERS, BUSINESSMEN, MEDICAL PEOPLE, LAWYERS, AND OTHERS WITH PROFESSIONAL KNOWLEDGE AND TRAINING ARE BEING CALLED UPON FOR FACTS AND ADVICE. IT IS ESSENTIAL THAT ALL INVOLVED TAKE TO HEART THEIR PROFESSIONAL RESPONSIBILITIES; THAT THEY FEEL DUTY BOUND TO CONVEY WHAT THEY KNOW AND WHAT THEY DO NOT KNOW, WITH BALANCE AND PERSPECTIVE. THAT IS NOT THE CASE IN MANY AREAS OF SOCIETY.

OUR SOCIETY NOW ABOUNDS WITH SO-CALLED EXPERTS WHO DEAL IN HALF-TRUTHS AND PLAY ON HUMAN FEARS OR SUSPICIONS TO FURTHER THEIR OWN SPECIAL INTERESTS. IN SO DOING, THEY ABROGATE THEIR PROFESSIONAL RESPONSIBILITY TO THE PUBLIC AND CLOUD IMPORTANT ISSUES. THOSE

WITHIN SOME SPECIAL INTEREST GROUPS ARE THOSE WHO FAVOR RETURNING TO THE SIMPLER STYLE OF 100 YEARS AGO. THEIR OBJECTIVE IS CLEAR; THEY TEND TO BE AGAINST MOST FORMS OF ENERGY.

THE GREAT MAJORITY OF PEOPLE, HOWEVER, WANT TO SUSTAIN TODAY'S ADVANCED LIFE STYLE. FOR THEM THE PROBLEM IS ONE OF EVALUATING ALTERNATIVES—OF COMPARING RISKS AND WEIGHING THEM AGAINST BENEFITS.

THE MEDIA, IN SEARCH OF EXCITING NEWS, AND SPECIAL INTEREST GROUPS, ENCOURAGE EMBELLISHING AND SENSATIONALIZING FACTS. SINCE TOUGH FACTS ARE OFTEN BLAND AND HARD TO MARKET AS "NEWS," THE PUBLIC GETS A DISTORTED PICTURE OF ENVIRONMENTAL MATTERS. WE FACE A DANGER THAT PUBLIC POLICIES IN TECHNOLOGY WILL BE DETERMINED, IN EFFECT, BY THE MEDIA AND BY SINGLE INTEREST GROUPS.

WHILE THE PROBLEMS WE FACE TODAY ARE IMMENSE, THE INCREASED PUBLIC INTEREST IN ENERGY AND ENVIRONMENTAL MATTERS OFFERS AN OPPORTUNITY FOR PROGRESS TOWARD SOLVING THESE DIFFICULT, LONG-RANGE PROBLEMS. BUT THESE WILL HAVE TO BE DEALT WITH INTELLIGENTLY, NOT ON AN EMOTIONAL BASIS. SCIENTISTS, ENGINEERS, BUSINESSMEN, MEDICAL PEOPLE, LAWYERS, AND OTHERS WITH PROFESSIONAL KNOWLEDGE AND TRAINING ARE BEING CALLED UPON FOR FACTS AND ADVICE. IT IS ESSENTIAL THAT ALL INVOLVED TAKE TO HEART THEIR PROFESSIONAL RESPONSIBILITIES; THAT THEY FEEL DUTY BOUND TO CONVEY WHAT THEY KNOW AND WHAT THEY DO NOT KNOW, WITH BALANCE AND PERSPECTIVE. THAT IS NOT THE CASE IN MANY AREAS OF SOCIETY.

OUR SOCIETY NOW ABOUNDS WITH SO-CALLED EXPERTS WHO DEAL IN HALF-TRUTHS AND PLAY ON HUMAN FEARS OR SUSPICIONS TO FURTHER THEIR OWN SPECIAL INTERESTS. IN SO DOING, THEY ABROGATE THEIR PROFESSIONAL RESPONSIBILITY TO THE PUBLIC AND CLOUD IMPORTANT ISSUES. THOSE

KNOWLEDGEABLE IN THE VARIOUS DISCIPLINES HAVE AN OBLIGATION TO SEE THAT THESE ISSUES ARE KEPT IN PERSPECTIVE, SO THEY CAN BE ADDRESSED INTELLIGENTLY BY OUR LEADERS AND UNDERSTOOD BY ORDINARY CITIZENS. CONSISTENCY IS NEEDED IN EVALUATING RISKS, AND IN PROVIDING PROPER PERSPECTIVE.

ENVIRONMENTAL RISKS

NOTHING WE DO IS WITHOUT RISK. RISK IS AN INHERENT AND ACCEPTED PART OF DAILY LIFE. THE PROBLEM LIES IN DETERMINING HOW GREAT ARE THE RISKS AND WHAT SHOULD WE TRULY BE AFRAID OF. FOR THIS, IT IS IMPORTANT TO ACQUIRE A SENSE OF PERSPECTIVE. SHOULD THE FALLING OF SKYLAB HAVE BEEN A MAJOR CONCERN? IT WAS ESTIMATED THAT THERE WAS ONLY ONE CHANCE IN 150 THAT SKYLAB DEBRIS WOULD HIT ONE PERSON IN THE ENTIRE WORLD. NEVERTHELESS, IN SOME AREAS EMERGENCY PREPAREDNESS CENTERS WERE ACTIVATED AND AIRPLANES GROUNDED. A MORE MEANINGFUL RISK TO ME WAS THAT I HAD ONE CHANCE IN SIX HUNDRED BILLION OF BEING HIT.

THE RISK FROM SKYLAB WAS INCONSEQUENTIAL. THE ENVIRONMENTAL RISK HAVING THE GREATEST EFFECT IN THE UNITED STATES TODAY IS SMOKING. SMOKING CAUSES US ABOUT 325,000 DEATHS EACH YEAR, HALF OF THESE ARE FROM HEART DISEASE, AND ABOUT ONE-QUARTER FROM LUNG CANCER. SIXTY YEARS AGO WE HAD LITTLE LUNG CANCER. TODAY MORE ARE DYING FROM IT THAN FROM AUTOMOBILE ACCIDENTS.

EACH CIGARETTE HAS BEEN ESTIMATED TO SHORTEN LIFE EXPECTANCY BY FIVE MINUTES. ANOTHER METHOD OF ESTIMATING THE RISK SHOWS THAT OF A GROUP OF 100,000 WHO CONTINUE SMOKING 1,600 DIE FROM THE EFFECTS.

ANOTHER MAJOR HEALTH PROBLEM IN THE UNITED STATES IS CAUSED BY OVERWEIGHT. EACH OUNCE ABOVE NORMAL WEIGHT IS ESTIMATED TO REDUCE LIFE EXPECTANCY BY TWO DAYS.

WE ACCEPT THE INEVITABILITY OF AUTOMOBILE ACCIDENTS. CHANCES ARE THAT A NUMBER OF PEOPLE IN THIS ROOM WILL BE SERIOUSLY INJURED THIS YEAR FROM AUTOMOBILES. BY BUILDING SAFER CARS OR FURTHER REDUCING SPEED, THE RISK COULD BE REDUCED. BUT EVEN A PARKED CAR IS NOT RISK FREE. REDUCING THE RISK OF INJURY FROM AUTOMOBILES TO ZERO REQUIRES MOVING TO A PLACE WHERE THERE ARE NONE.

THESE COMPARISONS SHOULD GIVE SOME IDEA OF THE RISK INVOLVED IN SMOKING, OR EATING, OR WATCHING SKYLAB FALL. THIS IS THE KIND OF PERSPECTIVE TO WHICH PEOPLE CAN RELATE. EVERYONE KNOWS LIFE IS RISKY. IF ONE HAS THE BASIS FOR JUDGMENT, ONE CAN DECIDE WHAT TO DO OR NOT DO.

RADIATION RISK

WHILE ACCEPTING THE MANY DAILY RISKS OF LIVING, MANY SEEM TO BE GETTING THE IDEA THAT THEIR DEMANDS FOR ENERGY SHOULD BE MET ON ESSENTIALLY A RISK-FREE BASIS. SINCE THIS IS IMPOSSIBLE, ATTENTION SHOULD BE FOCUSED ON TAKING REASONABLE STEPS TO SAFEGUARD THE PUBLIC, ON DEVELOPING REALISTIC ASSESSMENT OF THE RISKS, AND ON PLACING THEM IN PERSPECTIVE. ONE OF THE MOST WIDELY DISTORTED RISKS IS RADIATION.

AT THE START OF THE NAVY'S NUCLEAR PROPULSION PROGRAM IN 1946, I REALIZED THE NEED FOR CAREFUL ATTENTION TO RADIATION. IT WAS CLEAR TO ME THAT IF NUCLEAR SHIPS WERE TO BE VIABLE, THERE WOULD HAVE TO BE ASSURANCE THAT WORKERS AND CREWS NOT BE SUBJECTED TO EXCESSIVE RADIATION. TO EMPHASIZE THIS, I DESIGNED THE SHIELDING FOR OUR NAVAL NUCLEAR PLANTS TO BE MANY TIMES MORE STRINGENT IN REQUIREMENTS THAN STIPULATED IN THE STANDARDS THEN IN EFFECT. AS A RESULT, THE SHIELDING BUILT INTO THE FIRST NUCLEAR SUBMARINE, THE NAUTILUS, WAS FAR MORE THAN ADEQUATE TO MEET THE CONSIDERABLY LOWER RADIATION LEVELS PERMITTED TODAY.

INSOFAR AS THE ENVIRONMENT IS CONCERNED, NAVAL PLANTS HAVE BEEN SO DESIGNED AND OPERATED THAT IN EACH OF THE LAST EIGHT YEARS THE TOTAL GAMMA RADIOACTIVITY DISCHARGED INTO ALL HARBORS OF THE WORLD HAS BEEN LESS THAN TWO THOUSANDTHS OF A CURIE. THIS QUANTITY IS FOR THE OPERATION OF OVER 100 SHIPS AND OF ALL THEIR SUPPORT FACILITIES. TO GIVE YOU AN IDEA WHAT THIS MEANS, IF ONE PERSON WERE ABLE TO DRINK THE ENTIRE AMOUNT OF THIS RADIOACTIVITY DISCHARGED INTO ANY HARBOR IN ALL OF 1978, HE WOULD NOT EXCEED THE ANNUAL RADIATION EXPOSURE PERMITTED BY THE NUCLEAR REGULATORY COMMISSION FOR AN INDIVIDUAL WORKER.

THE WORD "RADIATION" HAS COME TO CONNOTE DANGER. IT IS OFTEN DESCRIBED AS SO DANGEROUS THAT ANY AMOUNT IS UNSAFE—AS IF THE ONLY QUESTION WORTH ADDRESSING IS "HOW FAST WILL RADIATION HARM YOU?" BECAUSE YOU CANNOT SEE, FEEL, TASTE, HEAR, OR SMELL RADIATION, IT HAS AN AURA OF MYSTERY. BUT THIS SAME MYSTERY APPEARS TO BE ABSENT FROM OTHER POTENTIALLY HAZARDOUS THINGS FOR WHICH WE HAVE A LACK OF SENSORY PERCEPTION, SUCH AS RADIO WAVES, CARBON MONOXIDE, AND SMALL CONCENTRATIONS OF NUMEROUS CANCER-CAUSING SUBSTANCES. THESE DO NOT GENERATE THE SAME DEGREE OF FEAR AS RADIATION.

THE FEAR INSTILLED BY RADIOACTIVITY TODAY IS AKIN TO THE FEAR OF ELECTRICITY FOLLOWING THE INVENTION OF THE ELECTRIC LIGHT BULB ONE HUNDRED YEARS AGO BY THOMAS EDISON. PUBLIC FEAR OF ELECTRICITY WAS INFLAMED. WALL PLAQUES HAD TO BE INSTALLED IN ROOMS WITH ELECTRIC LIGHTS, ASSURING PEOPLE THAT "THE USE OF ELECTRICITY FOR LIGHTING IS IN NO WAY HARMFUL TO HEALTH, NOR DOES IT AFFECT THE SOUNDNESS OF SLEEP." YET ELECTRICITY HAS HELPED TO TRANSFORM MAN'S LIFE FROM A SHORT ONE OF DRUDGERY TO ONE WHERE LONG LIFE AND HIGHER ASPIRATION CAN BE REALIZED.

SCIENTISTS HAVE STATED FOR DECADES THAT RADIATION CAN CAUSE HARM. HOWEVER, ALL OF US HAVE BEEN SUBJECTED TO RADIATION THROUGHOUT OUR LIVES FROM TIME OF CONCEPTION AND, IN FACT, EVEN PRIOR TO CONCEPTION. THE ENTIRE HUMAN RACE HAS BEEN SUBJECTED TO RADIATION, AS HAS EVERY LIVING THING, THROUGHOUT THE ENTIRE EVOLUTION OF OUR EARTH. THE AVERAGE PERSON IN THE UNITED STATES RECEIVES EACH YEAR ABOUT ONE-TENTH REM FROM NATURAL RADIOACTIVITY IN THE EARTH, IN HIS BODY, AND FROM COSMIC RADIATION.

THE UNIT OF RADIATION, REM, OUGHT TO BE REQUIRED KNOWLEDGE IN ALL TECHNICAL SOCIETIES. IT IS DEFINED IN TERMS OF ENERGY ABSORBED IN BODY TISSUES. RECEIVING ONE REM OF GAMMA RADIATION IS EQUIVALENT TO ABSORBING 100 ERGS OF RADIATION ENERGY FOR EACH GRAM OF BODY TISSUE. THERE ARE 454 GRAMS IN A POUND. AN ERG IS THE AMOUNT OF ENERGY REQUIRED TO LIFT A MOSQUITO WEIGHING ONE THOUSANDTH OF A GRAM ABOUT ONE CENTIMETER. IN TERMS OF ENERGY THE REM IS A SMALL UNIT. A DOSE OF ONE REM WOULD RAISE BODY TEMPERATURE ONLY TWO MILLIONTHS OF A DEGREE CENTIGRADE.

WE ARE NOT ACCUSTOMED TO FEAR BACKGROUND RADIATION; AFTER ALL IT IS PART OF OUR NATURAL ENVIRONMENT. YET IN SCIENTIFIC TERMS IT CAN BE SHOWN THAT ITS RISK IS NOT ZERO. MORE IS KNOWN ABOUT RADIATION THAN ALMOST ANY SUBSTANCE THAT CAN AFFECT HUMANS. MORE MONEY HAS BEEN SPENT TO LEARN THE EFFECTS OF RADIATION ON HUMANS THAN FOR ANY OTHER HAZARD IN OUR MODERN SOCIETY. THE MAIN EFFECT IS CANCER. EFFECTS OTHER THAN CANCER HAVE NOT BEEN FOUND FOR LOW-LEVEL RADIATION EXPOSURE TO ADULTS. WHILE GENETIC EFFECTS FROM RADIATION CAN OCCUR, THEY ARE SO SMALL THAT NONE HAVE BEEN FOUND IN 35,000 CHILDREN CONCEIVED AFTER THE NUCLEAR EXPLOSIONS, BY PARENTS IRRADIATED IN HIROSHIMA OR NAGASAKI IN 1945.

THE COMBINATION OF ONE-TENTH REM PER YEAR BACKGROUND RADIATION, TOGETHER WITH NEARLY THE SAME AVERAGE AMOUNT FROM MEDICAL DIAGNOSTIC RADIATION, IS ESTIMATED TO CAUSE ALMOST ONE PERCENT OF CANCER DEATHS IN THE UNITED STATES. IN AN AVERAGE GROUP OF 10,000 PEOPLE, 1,600 WILL DIE OF CANCER. SIXTEEN OF THESE DEATHS WILL BE FROM BACKGROUND AND MEDICAL RADIATION. IF THE LIFETIME RADIATION EXPOSURE OF 10,000 PEOPLE IS INCREASED BY AN AVERAGE OF ONE REM PER PERSON—A TOTAL OF 10,000 REM—IT IS ESTIMATED THAT ONE ADDITIONAL FATAL CANCER MAY OCCUR.*

THIS ESTIMATE OF RISK GIVES PERSPECTIVE ON WHAT RADIATION EXPOSURE MEANS IN THE FOLLOWING WAYS:

- OF ALL INDUSTRIAL AND MEDICAL RADIATION WORKERS IN THE UNITED STATES, ABOUT 15,000 DIE EACH YEAR FROM CANCER. THE TOTAL RADIATION EXPOSURE FROM THEIR WORK ADDS AN ESTIMATED 25 CANCER DEATHS PER YEAR.
- RADIATION FROM THE NUCLEAR ACCIDENT AT THREE MILE ISLAND MAY ADD ONE FATAL CANCER DEATH TO THE PUBLIC WITHIN FIFTY MILES. OF THE TWO MILLION PEOPLE LIVING WITHIN THIS FIFTY MILE RADIUS, 325,000 ARE EXPECTED TO DIE OF CANCER FROM CAUSES OTHER THAN THE RADIOACTIVITY RELEASED FROM THIS ACCIDENT.

THE PERSPECTIVE ON RADIATION CAN BE IMPROVED BY COMPARISON. FOR EXAMPLE, I KNOW AN APPARENTLY HEALTHY PERSON WHO FORTY YEARS AGO RECEIVED

*This risk estimate was made in 1977 by the United Nations Scientific Committee on the Effects of Atomic Radiation and by the International Commission on Radiological Protection. It is within the range of estimates in the 1979 draft report of the U.S. National Academy of Sciences Committee on Biological Effects of Ionizing Radiations, and in the 1972 report of this committee.

MORE RADIATION FROM MEDICAL CHEST X-RAYS THAN THE TOTAL EXPOSURE ALL 15,000 RADIATION WORKERS AT NINE SHIPYARDS RECEIVED IN 1978 FROM NAVAL NUCLEAR POWER PLANT WORK. OTHERS HAVE HAD SIMILAR RADIATION EXPOSURE, AND YEARS LATER ARE ALIVE AND WELL.

WITH THIS PERSPECTIVE YOU ARE IN A POSITION TO BETTER ANSWER THE QUESTION, "IS RADIATION SAFE?" IF SAFE MEANS ZERO EFFECT, THEN YOU HAVE TO CONCLUDE RADIATION IS UNSAFE. BUT TO BE CONSISTENT, YOU SHOULD ALSO CONCLUDE THAT BACKGROUND RADIATION AND MEDICAL RADIATION ARE UNSAFE. OR MORE SIMPLY, THAT BEING ALIVE IS UNSAFE.

"SAFE" IS A RELATIVE TERM. COMPARISONS ARE NECESSARY FOR ACTUAL MEANING. FOR A WORKER, SAFE MEANS THE RISK IS SMALL COMPARED TO OTHER RISKS ACCEPTED IN NORMAL WORK ACTIVITIES. ASIDE FROM WORK, SAFE MEANS THE RISK IS SMALL COMPARED TO OTHER RISKS ROUTINELY ACCEPTED IN LIFE. FROM WHAT I HAVE SAID, IT SHOULD BE CLEAR THAT THE RADIATION ENCOUNTERED IN OUR DAILY ACTIVITIES SHOULD NOT BE THE SCARY SUBJECT IT IS PROCLAIMED TO BE.

EXTRAPOLATIONS

IN RADIATION, AS IN OTHER AREAS, A MOST EFFECTIVE WAY TO FRIGHTEN PEOPLE IS TO PROCLAIM THAT NO ONE KNOWS WHAT THE EFFECTS ARE. THIS HAS BEEN REPEATED SO OFTEN THAT IT HAS BECOME AN ARTICLE OF FAITH THAT NO ONE KNOWS THE EFFECTS OF LOW-LEVEL RADIATION ON HUMANS.

ONE COULD WELL STATE, "NO ONE KNOWS THE RISKS OF SMOKING A FEW CIGARETTES," BUT THE RISKS OF SMOKING A LARGE NUMBER OF CIGARETTES ARE WELL KNOWN. IF 10,000 PEOPLE SMOKE AN AVERAGE OF FOUR CIGARETTES A DAY,

ABOUT 100 DEATHS WILL RESULT; DATA ARE NOT AVAILABLE FOR LOWER SMOKING RATES. FOR RADIATION, DOSES OF 100 REM TO EACH OF 10,000 PEOPLE WOULD BE REQUIRED TO CAUSE AN EQUAL NUMBER OF DEATHS. THE EFFECTS OF RADIATION ON HUMANS AT DOSES OF 100 REM ARE WELL KNOWN. THE MAJOR CONTROVERSY OVER RADIATION RISKS TODAY IS HOW TO EXTEND THE RISK ESTIMATES TO EVEN LOWER LEVELS. AS WE GET TO LOWER LEVELS, IT BECOMES MORE AND MORE DIFFICULT TO DETECT THE EFFECTS, AND THIS BECOMES A PROBLEM. WOULD IT BE POSSIBLE TO DETERMINE THE EFFECT ON THE DEATH RATE OF DOING ONE SITUP OR ONE PUSHUP A DAY?

USING THE FIGURES I JUST PRESENTED, YOU CAN EXTEND THE NUMBERS TO SHOW THAT ONE REM HAS ABOUT THE SAME RISK OF DEATH AS SMOKING ONE CIGARETTE PER MONTH. I MAKE THIS COMPARISON ONLY TO SHOW THAT FINDING OUT THE EFFECT ON THE DEATH RATE OF ONE REM OF EXPOSURE IS ABOUT THE SAME AS TRYING TO FIND OUT THE EFFECT OF SMOKING ONE CIGARETTE A MONTH.

THE POINT IS THAT THE EFFECT OF ONE REM IS EXTREMELY SMALL. THERE ARE PHYSICAL LIMITS TO HOW FAR WE CAN GO TO ASCERTAIN PRECISELY THE SIZE OF THIS RISK, BUT WE DO KNOW IT IS SMALL. THOSE WHO SING THE REFRAIN OF HOW LITTLE WE KNOW ABOUT LOW-LEVEL RADIATION DO A DISSERVICE. INSTEAD, THEY SHOULD EXPLAIN HOW MUCH WE DO KNOW ABOUT THE SMALL ACTUAL EFFECTS.

STUDIES

TODAY, THE UNIVERSAL ANSWER TO A CLAIMED LACK OF KNOWLEDGE OF ENVIRONMENTAL EFFECTS IS TO CONDUCT A STUDY—NEARLY ALWAYS AT GOVERNMENT EXPENSE. I AM NOT AGAINST STUDYING ENVIRONMENTAL OR HEALTH EFFECTS PER SE. BUT STUDIES MUST BE HIGH QUALITY; THEY HAVE TO COVER TENS OR HUNDREDS OF THOUSANDS OF PEOPLE, AND THEY MUST EXTEND FOR MANY YEARS.

TO HAVE ANY CHANCE OF VALIDLY DETECTING EFFECTS AS SMALL AS THOSE FROM LOW-LEVEL RADIATION. ONE WONDERS WHETHER THIS IS A PROPER EXPENDITURE TO TAXPAYER MONEY. ARE THERE NOT OTHER AREAS MORE DESERVING OF THIS KIND OF ATTENTION?

THE COMPULSION TO STUDY IS OFTEN USED TO QUELL PUBLIC FEARS. IT IS ALSO A WAY TO SHOW THAT SOMETHING IS BEING DONE. TOO OFTEN IT IS A WAY TO FORESTALL TAKING MEANINGFUL ACTION OR MAKING A DECISION. DOING A STUDY IS USUALLY DOING NOTHING. DEMONTAIGNE SAID "TOO MUCH STUDY SUFFOCATES THE ACTIVE PART OF UNDERSTANDING." STUDIES ARE FREQUENTLY USED TO QUIET AN OUTCRY. THE STUDY TAKES TIME. DURING THIS PERIOD THE CLAMOR DIES DOWN. THE STUDY IS ISSUED, FILED AND FORGOTTEN. MEANWHILE A NEW ISSUE HAS AROUSED THE PUBLIC. ANOTHER STUDY IS AUTHORIZED. THE REPORT IS FILED IN THE ARCHIVES, AND SO ON, AND SO ON.

INJURY CLAIMS

ANOTHER ASPECT OF RADIATION WHERE SCARE STORIES ARE CONTRIBUTING TO THE PROBLEM IS IN THE REALM OF RADIATION INJURY CLAIMS. HERE, AS IN OTHER AREAS, OUR APPROACH TO LIFE IS TO TURN FROM SELF-SUFFICIENCY TO EXCESSIVE RELIANCE ON GOVERNMENT. MANY HAVE COME TO PRESUME THAT ANY RISK, NO MATTER HOW SMALL, WARRANTS INDEMNIFICATION BY THE GOVERNMENT. I AM NOT AGAINST THE PAYMENT OF LEGITIMATE CLAIMS WHERE THE CAUSE CAN BE SUBSTANTIATED AND IT CAN BE CLEARLY SHOWN THAT THE GOVERNMENT WAS AT FAULT. BUT WHEN THE RISKS ARE MINIMAL, COMMON SENSE SHOULD PREVAIL.

IN 1978, A WORKER IN NEW MEXICO WAS AWARDED \$75,000 IN WORKER'S COMPENSATION BECAUSE HE FEARED RADIATION. NO PHYSICAL INJURY WAS CLAIMED. NO EXCESSIVE EXPOSURE TO RADIATION WAS CLAIMED. IN 1979, THE CONNECTICUT STATE SUPREME COURT AWARDED COMPENSATION TO A MUNICIPAL EMPLOYEE FOR

INJURING HIS ANKLE PLAYING PING PONG BEFORE HIS WORK SHIFT STARTED. A COMPENSATION CLAIM WAS APPROVED FOR A NAVY WORKER FOR HEADACHES ALLEGEDLY CAUSED BY SITTING AT A DESK WITH HIS HEAD DOWN. SUCH ABUSES ARE BECOMING COMMON. THE IMPLICATIONS OF THESE AWARDS ARE FAR-REACHING—NOT SIMPLY FOR THE MONEY INVOLVED BUT IN THE ATTITUDES BEING INCULCATED INTO LARGE NUMBERS OF AMERICANS.

THERE ARE ABOUT 65,000 EMPLOYEES IN GOVERNMENT-OWNED NAVAL SHIPYARDS. ABOUT 22,000 PAST AND PRESENT EMPLOYEES HAVE FILED CLAIMS FOR DAMAGE TO THEIR EARS FROM NOISE. THESE GOVERNMENT WORKERS ARE BEING PAID AN AVERAGE OF \$12,000 PER CLAIM. NO DISTINCTION IS MADE FOR NORMAL LOSS OF HEARING WITH AGE. NO EFFORT IS MADE TO DIFFERENTIATE HEARING DAMAGE CAUSED ON THE JOB FROM THAT CAUSED BY MODERN MUSIC PLAYED AT DEAFENING VOLUME. SECRETARIES WHOSE ONLY EXPOSURE TO NOISE WAS A TYPEWRITER OR COPY MACHINE ARE RECEIVING AWARDS. WORKERS APPARENTLY FEEL IT IS THEIR RIGHT TO RECEIVE THESE AWARDS FOR NORMAL WORK. IN THE LAST TEN YEARS, OVER \$75,000,000 HAS BEEN AWARDED TO NAVAL SHIPYARD EMPLOYEES FOR ALLEGED HEARING LOSS. THE GENERAL ACCOUNTING OFFICE HAS STUDIED THIS AREA AND FOUND IT RIDDLED WITH FRAUD AND ABUSE.

SINCE RISK FROM RADIATION CANNOT BE PROVEN TO BE ZERO, SUGGESTIONS HAVE BEEN MADE THAT THE GOVERNMENT SHOULD PAY ALL SHIPYARD WORKERS WHO GET CANCER JUST TO BE SURE THAT NONE WHICH MIGHT BE RELATED TO RADIATION ARE MISSED. AT A TYPICAL SHIPYARD, ABOUT 10,000 WORKERS HAVE RECEIVED RADIATION EXPOSURE FROM NAVAL NUCLEAR PROPULSION WORK SINCE THE BEGINNING OF THE PROGRAM. THEIR RADIATION EXPOSURE FROM SUCH WORK MAY ADD ONE OR TWO CANCER DEATHS TO THE 1,600 NORMALLY EXPECTED IN A GROUP THIS SIZE.

TO PAY COMPENSATION TO 1,600 INDIVIDUALS SO THAT ONE OR TWO POSSIBLY DESERVING ONES ARE NOT DENIED IS ABSURD AND UNAFFORDABLE.

DEMANDS HAVE BEEN MADE THAT ALL VETERANS WHO DEVELOP CANCER BE COMPENSATED BECAUSE THE CANCER MIGHT HAVE BEEN CAUSED BY RADIATION FROM NUCLEAR WEAPONS TESTS. THIS WOULD RESULT IN THE GOVERNMENT MAKING PAYMENT TO ALMOST 100,000 MEN WHO, ACCORDING TO NORMAL INCIDENCE, WILL DIE OF CANCER, SO THAT AN ESTIMATED TWELVE POSSIBLY VALID CLAIMS ARE NOT MISSED. MANY CLAIMS HAVE ALREADY BEEN FILED BY THESE VETERANS.

THE NAVY'S EXPERIENCE WITH HEARING LOSS CLAIMS DEMONSTRATES THAT AS LONG AS THERE IS MONEY IN THE U. S. TREASURY AND GOVERNMENT AGENCIES ARE WILLING TO HAND IT OUT, THERE WILL BE PLENTY OF CLAIMANTS. MANY ARE URGED ON BY UNSCRUPULOUS LAWYERS WHO PROMOTE FRIVOLOUS CLAIMS FOR A FEE OR A PERCENTAGE OF THE AWARD. ORDINARY CITIZENS, IF THEY KNEW WHAT WAS GOING ON IN SOME OF THESE PROGRAMS WOULD DEMAND A HALT TO SUCH GENEROSITY WITH THEIR TAXES.

TO THOSE WHO GET PAID, THIS KIND OF CANCER PAYMENT PROGRAM MAY SEEM LIKE GETTING SOMETHING FOR NOTHING—BUT THE TAXPAYER FOOTS THE BILL. IN MY VIEW, ENVIRONMENTAL ISSUES ARE BADLY OUT OF PERSPECTIVE WHEN WE END UP WITH A SYSTEM THAT PAYS TAX MONEY TO ALL WHO GET CANCER, MERELY TO TAKE CARE OF A FEW FOR WHOM THE REAL CAUSE WAS RADIATION.

NEWS MEDIA

THE NEWS MEDIA HAVE CONTRIBUTED SUBSTANTIALLY TO GETTING ENVIRONMENTAL ISSUES OUT OF PERSPECTIVE. IN THEIR EFFORTS TO GENERATE INTERESTING STORIES THAT HELP SELL NEWSPAPERS, MANY MEMBERS OF THE PRESS HAVE DISTORTED THE FACTS AND THE ISSUES. IN COMPLEX AREAS LIKE ENERGY AND ENVIRONMENT,

BARE FACTS ARE UNEXCITING. TO SPICE UP OTHERWISE DULL ARTICLES, THERE IS AT TIMES A TENDENCY TO BE SELECTIVE IN THE FACTS USED OR IN THE TOPICS COVERED.

TOO OFTEN, FACTS HAVE LOST THEIR PROPER SEPARATION FROM OPINIONS. MERELY BY CHOOSING WHAT STORIES ARE REPORTED, THE MEDIA EXPRESS OPINIONS. PUBLISHING A STATEMENT WITHOUT RESERVATIONS LENDS AUTHORITY TO THAT STATEMENT. SERIOUS ARTICLES ARE OFTEN WRITTEN BY THOSE WHO LACK THE TECHNICAL BACKGROUND TO UNDERSTAND EVEN THE AVAILABLE FACTS. AND SOMETIMES NEWS IS CONTRIVED. LET ME GIVE YOU EXAMPLES:

- DURING THE THREE MILE ISLAND EMERGENCY, RESIDENTS AND LOCAL OFFICIALS COMMENTED HOW USEFUL THE LOCAL NEWS REPORTS WERE, BUT THAT THE NATIONAL NEWS REPORTS WERE DISTORTED. FOR EXAMPLE, ONE NATIONAL TELEVISION CREW REQUESTED THAT AN ENTIRE STREET BE CLEARED SO THAT THEIR FILM COULD SHOW, BY THE EMPTY STREET, HOW FRIGHTENED THE PEOPLE WERE.
- A SO-CALLED DOCUMENTARY TELEVISION REPORT ON RADIATION WAS STRONGLY ANTI-NUCLEAR. IT LED TO A CONCLUSION IN WHICH THE REPORTER WAS SAID TO HAVE BEEN KILLED BY RADIATION. HOWEVER, NOWHERE IN THE REPORT OF HIS DEATH FROM LUNG CANCER WAS IT MENTIONED THAT HE WAS A LONG-TERM HEAVY SMOKER.

IN AREAS SUCH AS NUCLEAR POWER, EVEN INNOCUOUS EVENTS ARE FREQUENTLY BLOWN INTO ISSUES BY A ZEALOUS REPORTER OR EDITOR. NOT LONG AGO, A HOSE BROKE, SPILLING A FEW GALLONS OF PURE WATER INTO ONE OF OUR MOST POLLUTED RIVERS. BECAUSE THIS HAPPENED ON A NUCLEAR-POWERED SUBMARINE, THE STORY APPEARED THE NEXT MORNING IN THE NEWSPAPER.

THE FAILURES OF THE MEDIA—ITS PREOCCUPATION WITH THE SENSATIONAL AND ITS LACK OF BALANCE AND PERSPECTIVE—ARE UNDERSTANDABLE TO SOME EXTENT. NEWS IS LIKE FISH—IT MUST BE SOLD QUICKLY. BUT THESE STORIES CAN HAVE A HARMFUL EFFECT ON THE PUBLIC. DOCTORS REPORT THAT FOLLOWING A SERIES OF NEWS STORIES WHICH FAN THE FEAR OF RADIATION, THE RISK OF DEATH INCREASES FOR PEOPLE WHO WILL NOT TAKE X-RAYS THEY SHOULD TAKE.

OUR COUNTRY'S GROWTH HAS BEEN FUELED BY TECHNOLOGY. THE BULK OF THE INFORMATION ON THIS SUBJECT IS IN THE NEWS MEDIA. IT, THEREFORE, HAS A SPECIAL OBLIGATION TO EDUCATE, THROUGH RESPONSIBLE REPORTING. GIVEN THE FACTS IN PROPER PERSPECTIVE, THE PUBLIC CAN UNDERSTAND ENVIRONMENTAL ISSUES. THE TENDENCY OF THE PRESS TO OMIT FACTS INTERFERES WITH UNDERSTANDING THESE ISSUES. FOR PROPER PERSPECTIVE, THE NEWS MEDIA MUST EXERCISE SELF RESTRAINT, AND MAKE AVAILABLE ENOUGH INFORMATION SO THE PUBLIC CAN UNDERSTAND THE SIGNIFICANCE OF THE EVENTS REPORTED.

"EXPERTS" IN SCARE STORIES

MANY HAVE COME TO REALIZE THEY CAN MAKE NAMES FOR THEMSELVES BY SCARING THE PUBLIC ON RADIATION AND OTHER ENVIRONMENTAL RISKS. THIS APPROACH CREATES REPUTATIONS BECAUSE THE NEWS MEDIA PLAY THEM UP. IT CREATES RESEARCH GRANTS—WITH THE GOVERNMENT, OF COURSE, PAYING—TO EXPLORE THE NEWLY DISCOVERED PROBLEMS. TIME AND AGAIN A SO-CALLED "EXPERT" MAKES A STARTLING "DISCOVERY" FOLLOWED BY A NOT-SO-STARTLING CONCLUSION THAT HE IS THE ONE WHO SHOULD CONDUCT FURTHER RESEARCH AT GOVERNMENT EXPENSE.

I DO NOT INTEND TO DENIGRATE THOSE WHO ARE ADDRESSING VALID PUBLIC HEALTH ISSUES IN A RESPONSIBLE FASHION. BUT A TRUE PROFESSIONAL DOES NOT PUBLISH UNTIL HE KNOWS THE FACTS AND ACKNOWLEDGES THE SIGNIFICANCE OF

POTENTIAL ERRORS. THOSE WHO DO NOT FOLLOW THIS PATH OF CREDIBLE SCIENTIFIC INQUIRY ARE ACTING IRRESPONSIBLY. NOT EVERYONE WHO PROCLAIMS HIMSELF AN EXPERT, IS AN EXPERT. NOT EVERYONE WITH THE TITLE OF "DOCTOR" MERITS PUBLIC ESTEEM. NOT EVERYONE WHO CLAIMS TO BE ACTING IN THE PUBLIC INTEREST, IS ACTUALLY DOING SO. WE MUST GUARD AGAINST THOSE WHO IN THE NAME OF PUBLIC INTEREST PURSUE FAME THROUGH EXAGGERATION. IT IS EASY TO USE STATISTICS IMPROPERLY TO PREDICT LARGE PROBLEMS OR TO EMPHASIZE RISK, OUT OF CONTEXT. THOSE WHO DO SO CAUSE GREAT HARM BY PREVENTING A BALANCED ASSESSMENT OF THE RISKS, THEREBY DISTORTING PROPER PREVENTIVE AND REMEDIAL ACTIONS.

NUCLEAR POWER

THE PUBLIC PERCEPTION OF RADIATION HAS A DIRECT BEARING ON THE USE OF NUCLEAR POWER IN THIS COUNTRY. NUCLEAR POWER IS NOT EASY TO DEAL WITH IN THIS COUNTRY BECAUSE IT HAS BECOME A HIGHLY POLARIZED ISSUE. IT INVOLVES INDIVIDUALS' CONCERNS FOR THEMSELVES AND THEIR FAMILIES, AND IT IS A HIGHLY TECHNICAL, SOPHISTICATED TECHNOLOGY. ULTIMATELY, THE DECISION WHETHER WE SHOULD HAVE NUCLEAR POWER IS A POLITICAL ONE—IN THE TRUE SENSE OF THE WORD—THAT IS, ONE MADE BY THE PEOPLE THROUGH THEIR ELECTED REPRESENTATIVES. IT IS ESSENTIAL THAT THE DECISION BE MADE ON THE BASIS OF FACT, NOT RHETORIC, NOR CONJECTURE, OR HOPE; NOR AS A RESULT OF THE WIDESPREAD TENDENCY TO SENSATIONALIZE OR IGNORE THE TRUE LIMITS AND RISKS OF THE ALTERNATIVES.

ACCORDING TO THE ESTIMATES I HAVE ALREADY STATED, THE ACTUAL RADIATION EXPOSURE TO WORKERS AND TO THE PUBLIC FROM TODAY'S USE OF NUCLEAR POWER CAN BE ESTIMATED TO RESULT IN ABOUT ELEVEN EXTRA CANCER DEATHS PER YEAR OUT OF A TOTAL OF 360,000. ON THIS BASIS, TO ELIMINATE NUCLEAR POWER HERE WOULD THEN POTENTIALLY SAVE AN ESTIMATED ELEVEN LIVES PER YEAR, BUT

REDUCE THE ENERGY AVAILABLE. THIS LOSS OF ENERGY ITSELF, MIGHT WELL RESULT IN LOSS OF LIFE.

IF THE SAVING OF ELEVEN HUMAN LIVES WERE THE SOLE OBJECTIVE, BETTER RESULTS COULD BE OBTAINED FROM THE FOLLOWING, THAN BY ELIMINATING NUCLEAR POWER:

- REDUCE CIGARETTE CONSUMPTION FOR EACH SMOKER BY ONE CIGARETTE PER YEAR.
- REDUCE MEDICAL RADIATION EXPOSURE BY ONE PERCENT.
- MOVE THE POPULATION OF THE DENVER REGION TO COASTAL AREAS WHICH HAVE LOWER BACKGROUND RADIATION LEVELS.
- ELIMINATE STOCK CAR RACING.

SOME ANALYSTS HAVE REPORTED THERE MAY BE GREATER RADIATION EXPOSURE FROM OPERATION OF A COAL-FIRED CENTRAL POWER STATION THAN FROM A NUCLEAR POWER STATION. WHETHER THIS ASSERTION ON RADIATION IS OR IS NOT TRUE, ACCIDENTS IN MINING AND TRANSPORTING COAL, AND THE EFFECTS ON THE PUBLIC FROM SULPHUR AND OTHER POLLUTANTS, RESULT IN A DEMONSTRABLY HIGHER DEATH RATE FROM USE OF COAL THAN FROM NUCLEAR POWER.

CONCERN OVER A NUCLEAR ACCIDENT IS OFTEN CITED AS A REASON FOR PROHIBITING NUCLEAR POWER. OBVIOUSLY, A REPEAT OF THE THREE MILE ISLAND ACCIDENT CANNOT BE LIGHTLY ACCEPTED AND CORRECTIVE ACTIONS ARE CALLED FOR TO PREVENT RECURRENCE. I HAVE PROVIDED MY VIEWS TO CONGRESS AND TO OTHERS RESPONSIBLE FOR ASSESSING WHAT MIGHT BE DONE IN THE COMMERCIAL NUCLEAR POWER PROGRAM. THE RECORD AND RISKS OF THIS SOURCE OF ENERGY SHOULD BE PUT INTO PERSPECTIVE, AS COMPARED WITH OTHER RISKS WE FACE.

HERE ARE SOME EXAMPLES OF ACCIDENTS FAR WORSE THAN ANYTHING RESULTING FROM THREE MILE ISLAND, YET WITHOUT COMPARABLE REPERCUSSIONS ON PUBLIC POLICIES:

IN 1947, A SHIP LOADING AMMONIUM NITRATE FERTILIZER EXPLODED, KILLING 561 PEOPLE AND LEVELING MUCH OF TEXAS CITY, TEXAS.

MANY FIRES, EXPLOSIONS AND WRECKS HAVE OCCURRED IN WHICH MORE PEOPLE THAN THIS WERE KILLED.

FORTY-EIGHT EARTHQUAKES, FLOODS, TIDAL WAVES, AND STORMS HAVE BEEN RECORDED IN EACH OF WHICH 10,000 OR MORE PEOPLE WERE KILLED.

THE DC-10 AIRPLANE WHICH RECENTLY CRASHED, KILLED SEVERAL HUNDRED PEOPLE. NO ONE IS CONSIDERING ABOLISHING AVIATION—IT IS TOO IMPORTANT TO OUR WAY OF LIFE.

I AM NOT AWARE OF ANYONE ADVOCATING RELOCATING CITIES SUCH AS LOS ANGELES OR SAN FRANCISCO AWAY FROM GEOLOGICAL FAULTS WHICH MIGHT CAUSE EARTHQUAKES OR AWAY FROM RISK OF FLOOD OR STORM DAMAGE.

AS ANOTHER EXAMPLE, THERE ARE APPROXIMATELY ONE HUNDRED MILLION SHIPMENTS OF HAZARDOUS MATERIAL ANNUALLY IN THIS COUNTRY. HUNDREDS OF PEOPLE EACH YEAR ARE KILLED OR SERIOUSLY INJURED BY HAZARDOUS MATERIALS IN ACCIDENTS. MORE SCRUTINY IS BEING GIVEN TO THE APPROXIMATELY TWO MILLION RADIOACTIVE SHIPMENTS THAN TO THE OTHERS, YET NOT A SINGLE DEATH OR INJURY HAS OCCURRED FROM RADIATION OR RADIOACTIVITY IN THE MATERIAL BEING TRANSPORTED.

I AM NOT AN EXPERT OR PARTICULARLY KNOWLEDGEABLE IN THE AREAS OF ENVIRONMENTAL EFFECTS OF OTHER FORMS OF POWER GENERATION. HOWEVER, I AM AWARE THAT MANY KNOWLEDGEABLE PEOPLE CONCLUDE THAT THE TOTAL RISK INVOLVED IN THE USE OF NUCLEAR POWER IS NO GREATER THAN THAT OF ANY ALTERNATE SOURCE WHICH CAN MEET OUR NEEDS IN THE NEXT FEW DECADES.

TODAY MANY ARE OPTIMISTIC ABOUT THE POSSIBILITY OF WIDESPREAD USE OF SOLAR AND OTHER SO-CALLED "NATURAL SOURCES OF ENERGY." HOWEVER, IN

THEIR ENTHUSIASM THEY OFTEN DISREGARD THE LIMITATIONS AND ENVIRONMENTAL EFFECTS OF THESE SOURCES. OTHERS ADVOCATE EXPLOITATION OF SHALE OIL DEPOSITS WITHOUT MENTIONING THE VAST AMOUNTS OF WATER AND EARTH REMOVAL REQUIRED.

ANY LARGE-SCALE GENERATION OF ENERGY—WHETHER NUCLEAR OR FROM OTHER SOURCES—INVOLVES MAJOR ENGINEERING DIFFICULTIES AND POTENTIAL ENVIRONMENTAL IMPACTS. IT IS INCORRECT TO ASSUME THAT TECHNOLOGY AND INCREASED GOVERNMENT SPENDING CAN OVERCOME LIMITS NATURE IMPOSES.

I REMEMBER THE OPTIMISTIC PROJECTIONS MADE FOR NUCLEAR POWER WHEN IT WAS FIRST BEING DEVELOPED. IT WAS PREDICTED THAT ELECTRICITY FROM NUCLEAR POWER WOULD BE TOO CHEAP TO METER. THESE PREDICTIONS SPRANG FROM HOPE, FROM IGNORANCE OF THE ENGINEERING PROBLEMS THAT WOULD BE ENCOUNTERED IN USING NUCLEAR POWER.

IN SIMILAR VEIN, MANY ADVOCATES EXAGGERATE THE BENEFITS AND IGNORE THE PROBLEMS OF THE ENERGY SOURCES THEY ARE PROMOTING. THE SOLUTION TO OUR ENERGY NEEDS IS NOT JUST OVER THE HILL AT THE END OF THE RAINBOW. NATURE ALWAYS DEMANDS ITS PRICE; PROVIDING ADEQUATE AMOUNTS OF ENERGY WILL EXACT ITS PROPER PRICE.

CONCLUSION

THE TECHNICAL PROBLEMS INVOLVED IN DEVELOPING ADDITIONAL SOURCES OF ENERGY ARE GREAT, AND WILL REQUIRE OUR BEST TALENT.

I AM NOT A PROPONENT OF NUCLEAR POWER OR OF ANY OTHER ENERGY SOURCE. ALL ALTERNATIVES HAVE THEIR OWN LIMITATIONS; NONE ARE WITHOUT RISK.

IN ADDITION TO THE TECHNICAL PROBLEMS OF GENERATING THE ENERGY, ENVIRONMENTAL CONCERNS MUST BE FACTORED INTO THE EQUATION. WHETHER THESE CAN BE SOLVED ON A SCALE ENABLING US TO SUSTAIN OUR PRESENT STANDARD OF LIVING IS NOT CLEAR AT THIS TIME.

ONE THING IS CLEAR. THESE PROBLEMS CANNOT BE DEALT WITH EFFECTIVELY—FROM A TECHNICAL OR POLITICAL STANDPOINT—IF THOSE RESPONSIBLE ARE NOT SET FREE TO WORK ON THE PROBLEMS. WE CANNOT MAKE PROGRESS UNLESS THOSE TRULY INTERESTED IN SOLVING THESE PROBLEMS ACT RESPONSIBLY.

TOO MANY SO-CALLED TECHNICAL, MEDICAL, AND SCIENTIFIC PEOPLE HAVE BEEN ABROGATING THEIR PROFESSIONAL RESPONSIBILITY TO PRESENT FACTS ACCURATELY AND OBJECTIVELY AND IN A CONTEXT WHICH ENABLES OTHERS TO EVALUATE THEM.

TOO MANY IN THE MEDIA ARE SENSATIONALIZING THE NEWS IN AN ATTEMPT TO ATTRACT READERS, GENERATE CONTROVERSY, AND MAKE A NAME FOR THEMSELVES.

TOO MANY SELF-PROCLAIMED PUBLIC INTEREST ADVOCATES ARE PUSHING SINGLE INTEREST IDEAS IN WAYS THAT MAKE IT INCREASINGLY DIFFICULT TO PLACE THE ISSUES IN TRUE PERSPECTIVE.

TOO MANY, IN EXERCISING THEIR SO-CALLED RIGHTS, ARE EXPLOITING ENVIRONMENTAL ISSUES TO OBTAIN GRANTS FROM THE GOVERNMENT; THROUGH STUDY CONTRACTS, IMPROPER INJURY CLAIMS AND OTHER METHODS.

THESE CONFLICTING PRESSURES HAVE LEFT THE PUBLIC UNCERTAIN, DISTRUSTFUL, CONFUSED, AND IN NEED OF HELP. I CONSIDER THIS AUDIENCE CAN PROVIDE A SIGNAL SERVICE BY ANSWERING THIS CALL FOR HELP. ENVIRONMENTAL ISSUES MUST BE PUT INTO PROPER PERSPECTIVE. BALANCING RISKS AND BENEFITS MUST BECOME A STANDARD APPROACH TO EVALUATING ENVIRONMENTAL MATTERS. THE SIGNIFICANCE OF ENVIRONMENTAL DATA MUST BE EXPLAINED TO THE PUBLIC, SO IT CAN REACH ITS OWN CONCLUSIONS.

THE PRESENT CRISIS IN CONFIDENCE OVER ENERGY REQUIRES THIS APPROACH TO ENVIRONMENTAL ISSUES. THE CHINESE WORD FOR CRISIS COMBINES TWO

IDEOGRAPHS, WEI CHI (PRONOUNCED WEIGH GEE) LITERALLY, DANGEROUS OPPORTUNITY.
A TIME OF CRISIS IS ALSO A TIME OF OPPORTUNITY. WE SHOULD TAKE ADVANTAGE
OF THIS OPPORTUNITY TO ACHIEVE A PROPER PERSPECTIVE IN ENVIRONMENTAL
MATTERS.