WORK OF WATER RESOURCES COUNCIL

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Mr. Chairman, Ladies and Gentlemen:

Many of our economists report that today we stand on the threshhold of our Golden Age. They remind us that during the past one hundred years the average number of horsepower per worker has been increased five times over, and the average out-put per man hour increased six times over. This means, for example, that today's farmer gets twice as much work done as his much harder working predecessor of 1900, while at the same time his farm yield per acre is fifty percent more than the farm of 1900, and drudgery on the farm has been almost entirely eliminated. Other technological developments have also helped us to make more efficient use of raw materials. We now get more than six times as much delivered energy by burning a ton of coal as we did in 1900. With automation today's factory has become almost automatic, from the processing of these raw materials to the machining, and even assembly operations. These electronic devices are not only faster but they are far more accurate than the human brain. In terms of production this means, for example, that a steel strip mill which only a few years ago operated at a speed of 600 feet per minute today rolls thin guage steel at the rate of a mile a minute, producing enough for five millions cans in an eight hour day. A still newer design calls for 100 miles of steel sheet, 14 feet wide, every hour! And this, if you please is but twenty-eight years since the first strip mills began to replace the hand mill.

Conveyor belts which at the outbreak of World War II sped along at 300 feet per minute, now move at more than 1,000 feet per minute. A diesel vessel on Long Island Sound, with seven man crew, sucks up oysters through a rubber hose at the rate of 1,000 bushels per hour where not long ago an individual oysterman laboriously pulled in one single rowboat load in a whole day. In communications, newsprint machines that whirred magnificently at 900 feet per minute during the Twenties today rip along at 2,500 feet per minute. Newspaper presses can produce 1,200 standard newspapers per minute which is faster than bullets come out of a Browning machine gun and exactly twice the best speed of such presses scarcely twenty years age. An electronic printer, produced by Potter Instrument Company for use with punchcard sorting systems, prints 24,000 characters a minute, or five lines of type per second. Now R.C.A. has its phenomenal Ultrafax which unifies in one process television-radio facsimile relaying and high speed motion picture photography. This machine has demonstrated the uncanny ability of transmitting and reproducing, in less than three minutes, every page of the novel "Gone with The

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Wind," at a rate of a million words per minute!

And so it goes in our magical age of automation, this fabulous realm of silicons, transistors and the feed-back principle, which runs our factories, communicates across space at the speed of light, and works out intricate mathematical problems. To multiply 6,834,872 by 1,488,639 takes a good man with a pencil and paper five minutes, but an electronic computer at the University of Toronto in 1952 could multiply 500 pairs of such numbers in two seconds! Still that wasn't fast enough, so the Atomic Energy Commission's Argonne Laboratory brought out a machine that could multiply twelve digit numbers by other twelve digit numbers 2,000 times in one second! Last week the New York Times announced the award of an Army contract to I.B.M. for a machine which will add 30,000 ten digit numbers a second.

How has all this affected us? What is it doing to our way of life?

We live better, we have more, we work less and far more effortlessly and get more done, and we earn more to buy more things than any man who ever walked the face of the earth. There, presumably, is the basis of what we call our standard of living. It does not alone represent an economic achievement. The fact is that we not only may enjoy just about whatever we may convince ourselves we need, for less work, but that we can have it in an environment of better physical health, more advanced education facilities, and a far more fully developed cultural and spiritual atmosphere designed to encourage those seeking to express themselves and their convictions in these vital areas of human endeavor. We have better painters and sculptors, finer musicians, more penetrating research in the realm of the humanities than has yet been the good fortune of any society.

Greater output in less time means more leisure. It is a widely held belief that with this decade our work-week will shorten to four and a half days from its present five, just as it has been consistently shortened from the 72-hour work week of 1850 to today's 40-hour week. Looking beyond 1960, qualified observers forecast further decreases in the amount of daily work we must do to maintain and improve our standard of living. They describe that period as our new era of leisure, pleasure and plenty. It is no utopian dream. Most Americans already have more leisure than any of their antecedents. If one isn't convinced that Americans have more leisure and intend to make the most of it one need only look at the number of pleasure craft sold each year, -not automobiles, not television sets,- everyone seems to have at least a brace of those, but boats. Last year there were more than 25,000,000 boats on our waterways, which means that one person out of every seven in the population has a boat.

Moreover, we have more retired people (ten times more in proportion to the population than we had in 1850). Our senior citizens live longer, happier lives, free of the vicissitudes of pain and want. The

median age in our population which was nineteen years only a century ago is now thirty years. At the other end, in case you should be worrying lest we become a race of patriarchs, we have an unprecendented number of small fry coming up. In fact, about a quarter of the population today is under twelve years of age, and the boom in babies seems to be holding.

Now, purveyors of these sorts of statistics are too often prone to view the future in terms of demand for our collective good and services. Let's move over with the sociologists and get another perspective. There the picture is, frankly, not as pleasant. While Stuart Chase and other students of American mores may wonder how Americans will spend their leisure, concerned lest we become a nation of pleasure lovers rather than a society seeking more substantial satisfactions out of life, the people who study mankind in relation to his environment, the ecologists, think perhaps we may never have that problem. That unless we can hurdle two major obstacles we will never know any promised age of leisure, pleasure and plenty. Markets are people, normally. More good are sold because there are more people to buy them, a very familiar economic law of supply and demand. But if either end of that equilibrium is seriously overweighted the result is equally disastrous.

Today there are 2,655,000,000 people in our world, which is just double the number we had only one hundred years ago. With each passing day another 85,000 people are added to our population. In round numbers, this means that every ninety days we have enough people to populate another New York, another London, or another Tokyo. Modern medicine is still prolonging life, still decreasing death rates throughout the world, and because birth rates have not decreased proportionately, world populations mushrooms. The tombs of all the world's wars have been insignificant as measured against the increase in births, accelerated by these hygienic advances. And, as our friend Sam Ordway says, the insidious thing about population growth is that it is cumulative. At the present rate of growth we will have 3,600,000,000 world population by the end of this century. Proportionate to its population increase we no longer inhabit a world of 25,000 miles in circumference but one which has shrunk to one-fifth that size in the past three centuries, and is still shrinking. Its resource base, its productive mines, forests, soils and waters are only a fraction of what they were in 1650. Major population increases are occurring in those lands which are already unable to support their people adequately. It has been estimated that the production of two and one-half acres is needed to feed a human being, minimal requirement. Since we do not have that amount of food production in the world today a great many people starve to death. We are accustomed to thinking of population pressures in terms of India's teeming masses, or of China's hordes and their tragic floods and famines. But it is not alone there. The problem of overpopulation is found just about everywhere one looks,- whether it be Asia, Africa, or the Americas. Right on our doorstep,

not four jet hours from where we sit, in the West Indies, starvation is the pitiless plight of half the population of Haiti. Cannibalism is again rampant. Perhaps worse than it has ever been. And as these pressures mount, whether it be in India where a quarter of a million people roam the streets of Calcutta, never knowing where their next meal will come from, or whether it be Haiti, China or Brazil, what will happen? We are not the kind of people who could long be preoccupied with how to spend our leisure time while our neighbors starve, even if we dared. We are proud of our contributions for the relief of mankind's pain and want. We strive tirelessly for more such discoveries. But we must realize that those scientific contributions are largely at the base of the population problem. India never knew her present dilemmas before the coming of western man; when the British colonized India there were fewer than a third the inhabitants she now has.

Another tragedy of our times is the warm hearted belief that the "have" nations of the earth can support the "have not" nations. This idea enjoyed wide currency until quite recently, largely because of efforts after World War II to find homes abroad for 5,000,000 displaced Europeans. The belief was that the population pressures could be eased in Europe and that these people would find new homes in what was described as the "food long" and "labor short" nations, countries with jobs and capable of producing more food than their own people needed. In all the Free World there were believed to be five such countries. These were Australia, New Zealand, Canada, the Argentine and the United States. In reality, reflecting the fact that total world food production today is only nine percent greater than it was twenty years ago, while population increases are twelve percent greater, three of those countries on closer inspection had to be eliminated. Agriculture in both the Argentine and Australia has been the victim of very bad planning during recent years, stemming from an obsessive popular idea that each of those countries should become great industrial centers, even at the systematic destruction of their productive agriculture. As a means of realizing this, both livestock and crop production were forced down in price or shorted of labor, and their national economy hasn't yet fully recovered. Canada, for all its capacity as a producer of minerals and forest products, rests largely on a sheath of stone, poor crop soil, and most of Canada has frosts every month of the year. New Zealand is a land of some potential, but since it is about the size of Colorado it can be of little significance as a world food supplier.

Whom does that leave as food supplier for the Free World? And how would it work? In sharper focus, the problem is no longer one of finding a home for 5,000,000 displaced Europeans. In true perspective it begins to take on the somber shadow of something far more threatening. As a means of relieving population pressures in a crowded area, experience has shown that to move people from one area to another brings only temporary relief; that within two decades the pressures are again as great. History has also shown that, however noble the wish, however

commendable the design, it is almost impossible for one nation to transport food to feed another, for any period of time in any large amount. Nehru's need for grain in India in 1951 - 6,000,000 tons, - was obviously a large amount. It would have required 600 ships, of at least 500 feet in length, to carry it, with the dispatch of two such ships per day every day for an entire year. As much as another nation may wish to help, the tragic fact is that each will have to work out its own problem pretty much alone. We can, however, afford to be a little patient with Nehru if in his predicament he turns to Russia, to China, or to wherever else he can get help.

"As these pressures grow all over the world in the next decades, particularly on the continents of Africa, Asia and Latin America, the Western Democracies, themselves increasing in numbers, will be competing with each other to feed and support these super-spawning areas, to win them into their political orbits. But whether these areas accept support from the West or from Russia, or from both, the total of goods increasingly consumed and the total numbers of people born, is bound to bring about a more unfavorable ratio of population to resources than exists in the world today, says Sam Ordway. Neither will it prove beneficial to "industrialize" those so-called "backward" areas, as proposed under Point Four and some of its successors. To industrialize these areas, to attempt to raise their standard of living has so far resulted only in increasing the populations and further compounding the problem, and in the end lowering, not raising their living standard.

What is the situation here at home? We think of the great population upsurges in India, China and Africa as being problems uniquely identified with those places. Actually, the net gain is greater in the United States today, than in either India or China. Official Census Bureau estimates in 1938 were that we would have 154 million people by 1980. We have already passed that figure and the rate of gain is racing along faster than anyone dreamed. The estimates now are that we will have, at the end of this century, between two and three hundred million people, in fact we will pass the 190 million mark before 1975. To feed that 1975 population we will need 113 million more acres of crop land than we now have--which is 70 million more acres than are now envisioned in all the government's present land reclamation projects--and additionally will require that we put out present farm acreage under considerably more "forced draft" production, increases it cannot long survive. Throughout our great midwest region productivity of the soil is in a steady decline at the rate of seven-tenths of one percent per year. In fabulously fertile Iowa the decline is as high as one percent per annum. This is nothing more than the slow corrosion which in the long future will prove a weakening factor in our people and our country just as it has done in Spain, Egypt, Korea and China. "The day is still to come," says Fairfield Osborne, "when we will realize that the protection of our agricultural base is the first need of a 'national defense' program. Not military defense but the defense of values that make American life what it is. The relationship of those farm acres and our highly industrialized economy is not readily

understood. An automobile plant, a chemical plant, a steel mill, a rayon spinning mill, all seem operations quite remote from the farm. But are they? Now, I know, statistics should be recited with the same reluctance with which they are apt to be heard, yet these figures so strikingly illustrate the industry-farm relationship that your anti-statistical pain (which most of you by now must already feel acutely) should be endured for just a momemt. To manufacture a million automobiles requires:

"89,000,000 pounds of cotton, the crop yield of 558,000 acres (for upholstery, for brake linings, timing gears and safety glass);

"500,000 bushels of corn, the harvest of 11,280 acres (for rubber substitute butyl alcohol, solvents);

"2,400,000 pounds of linseed oil, the yield of 17,500 acres of flax (for paints, oil, soap, glycerine);

"2,500,000 gallons of molasses, from 12,500 acres of sugar cane (for antifreeze, shockabsorber fluids and solvents);

"3,200,000 pounds of wool from 800,000 head of sheep (for upholstery, gaskets, anti-rust, floor coverings and lubricants);

"1,500,000 square feet of leather, from 30,000 head of cattle (for upholstery, hide and glues);

"20,000 hogs to supply 1,000,000 pounds of lard (for lubricants, oleic acids, and bristles for brushes);

"350,000 pounds of mohair from 87,500 goats (for pile fabric upholstery);

"2,000,000 pounds of soybean oil from the crop of 10,000 acres (for the enamels).

Thus to meet the present annual output of six million cars there is needed the produce of 3,600,000 acres, to say nothing of the very large supply of animals involved. Agriculture supplies an increasing number of other purposes than just food."

Our compelling passion for more and more production would seem to risk pushing our economy to a point where we are no longer one of the nations producing more than we need. Heretofore, we might have taken immense satisfaction in the fact that our gross national product, the total value of what we make, increases at a rate of about three percent per annum. But three percent per annum, compounded, results in doubling every twenty-five years. 1950's gross national product of $300 billions becomes $600 billions by 1975,- or could be expected to reach

that figure provided we have not so undermined the resource base to prevent it. Only now are we waking up to the fact that for several basic minerals, minerals which we confidently believed were here in inexhaustible numbers, we must rely now on foreign sources. For example, in 1900, we produced from our mines fifteen percent more than we needed; today we have not only reversed that but now must depend on foreign sources for at least ten percent of our requirement. Just how fast are we decreasing that resource base? Well, here it is:

"The quantity of most metal and mineral fuels used by the United States since the first World War exceeds the total used throughout the entire world in all of history preceding 1914. That thought is difficult to absorb. That we Americans have used as much of the Earth's riches in forty years as all the people, the world over, have used in four thousand.

There is no need for me to tell this audience that as a Nation we are using water at an alarming rate. Demands of our industrial plant, the intensive farming of our croplands, the accustomed need for all the labor saving devices in the home, are costing us a great deal in the one resource we have not yet synthesized nor found a satisfactory substitute for. Not only is our population's aggregate demand many times greater but the per capita water consumption for each man, woman and child in that population is more than double what it was fifty years ago. Here is the balance sheet. From annual precipitation, rainfall and snow, this country receives an average of about 4300 billion gallons a day of which 3,000 billion gallons is lost, for use purposes, through evaporation. That leaves us, us collectively because it is not equally distributed, a 1,300 billion gallons daily average water supply. Of that we use 200 billion gallons daily to run our factories, our farms, our homes to float our ships, maintain the water table level, irrigate fields and drive hydroelectric power generators. Well you say, that's fine. If we get 1300 and use only 200 that's about 16 percent. What's all the worry? Moreover, you can add, much of the water used is not consumed. It can be used over and over so in reality we have a considerable reserve, don't we?

Here's where the trouble starts. First, the water is not evenly distributed either geographically or seasonally. Some regions get an abundance, others get little. Rainfall and snows are natural phenomena - in other words we have an environment that is largely man made intended to function as man directs 365 days a year, but it draws its essential raw material, water, from a source which may or may not synchronize its function with regularity. Moreover, there are other limiting factors. A great deal of this precipitation, once used, is dangerously polluted, or otherwise rendered unusable, particularly in the densely populated areas where the briefest dislocation can cause a tremendous amount of suffering and unhappiness in the lives of millions of people, as well as in their industrial and agricultural production.

Moreover, in the long pull, if today we are using 16 percent, by our present rate of growth we can expect before the turn of the century that we will be using all the precipitation we have. Should meanwhile we have to go to war, the water dilemma will be that much quicker upon us.

For a dismal fifteen minutes I have, factually, I believe, told you of all the barriers, all the obstacles, all the hazards imposed by nature and by man himself which stand between us and our promised destiny,- that happy era of leisure, pleasure and plenty. In reality, ladies and gentlemen, the future is not hopeless. Far from it, in fact. Provided that we are aware of these problems, and further provided that we will dedicate ourselves to human actions based on a constant revolution in human attitudes. We will not solve tomorrow's problems with yesterday's remedies.

Several months ago in Nevada an underground atomic explosion took place involving one kiloton equivalent of T.N.T. So powerful was this blast that it opened a vast chamber in solid rock, forcing the rock to separate, to open up, to form a cavern with glazed walls, where the tremendous heat, the latent energy of this explosion, now contains itself, waiting to be drawn off and used as power, whenever we care to do so. Next year we will detonate another such explosion, this one one megaton T.N.T. equivalent, and in a deep underground formation of oil shale, an area containing 50 million cubic feet of this oil bearing rock. What will happen? I am told that the shale will be pulverized to such a degree that by very ordinary separation methods not involving any milling, it will yield 25,000,000 barrels of oil, - the result of a single blast. If that is practicable and we and our Canadian neighbors can economically utilize the vast deposits of oil shale, our oil reserve again becomes sizeable. But even without it, Oil in its present state is know to lie in formations thus far inaccessible to conventional extraction methods. One such deposit under the Sprayberry range in West Texas, a formation ten miles long and a thousand feet thick, contains not millions but billions of barrels of oil. An atomic blast to fracture that deposit, to move it over where it will be accessible to drilling, would demonstrate another useful function of the atom, and would also demonstrate how broadly it will widen our resource base both in its own right as well as it the expansion of our useable reserve of other fuels.

Whether we ever use an atomic bomb again, whether we ever harness the enormous power of the atom to turn a single wheel, the great value of the fissioned atom's radio-isotopes, a sort of by-product, are already bringing us closer to that day of leisure, pleasure and plenty. These extraordinary agents of the atom are already at work in the fight against cancer, as a means of exploring new dimensions in the structure of metal, measuring to hitherto unobtainable degrees of accuracy, the thicknesses and weights of precision articles on the assembly lines, determining the proper kinds of fertilizers for particular plants, destroying pests, making it possible to produce really effective insecticides,

and most important of all, in light of the enormous population pressures and shortage of food in the world, explaining what takes place in photosynthesis, the plant's method of manufacturing protein, fats and carbohydrates. In that very critical area, if we can learn how these cells are formed, who knows but what we will be at last in consonance with the greates mystery of life itself, the formation of cells. These invaluable atomic by-products, these radio-isotopes, have just begun their useful journey with us. Already, in ten brief years they have revealed the answers to hitherto insoluble mysteries in chemistry, biology, agronomy, medicine, literally the whole realm of science, including geology.

While we know and can measure our surface waters we have yet to know and measure the extent and quality of our ground water. The atom, and what we have learned from it, is helping us to do that. And having helped us, by measurement of radioactive tritium discharged from these waters underground we will know exactly from where we can dependably draw these waters. We can even determine their movement, thousands of feet underground, and measure their quality.

New Mexico has an abundance of marginal waters, underground. New Mexico has a vast supply of fossil and atomic fuels. Our population pressures, our need for more productive land, will bring these factors into equilibrium, a happy and a prosperous one, provided that this generation in New Mexico where both the atom and the rocket first proved themselves takes up the challenge boldly in the spirit that man does not live to extenuate the miseries of the past nor to accept as incurable those of the present.