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Remarks Prepared by Lewis L. Strauss, Chairman,
United States Atomic Energy Commission,
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National Association of Science Writers,
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I come before this audience with a feeling of particular humility. In the presence of the distinguished persons who are included in this gathering, it would be more fitting and profitable that I should listen than that I should speak. For I am told that there are among you this evening perhaps more Nobel Laureates than ever before have come together under one roof and that very nearly every one of you is a medallist, past or potential. I should also walk humbly with those of you who are the writers about science.

Science-writing is a very old profession. Science probably separated from witchcraft when science-writing began. Just so long as information was passed along by word of mouth only, it was always susceptible to control by a few for their own benefit and to mystify the many. When it began to be written about, science came up out of the atmosphere of the cauldron and the alembic.

An astonishing amount of early science-writing has been preserved. Since it must clearly have had an original bulk much smaller than the aggregate of ancient religious literature, plus general belles-lettres, it is remarkable how substantial a portion of the surviving works of antiquity deal with physics, mathematics, astronomy and medicine. Perhaps those who possessed such manuscripts in ancient times set greater than ordinary store by their safe-keeping.

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Many of the great names of science writers have come down to us -- some known otherwise than as recorders of science -- Plato, Aristotle, Pliny, Seneca and Strabo, among them. But the great scientists of antiquity themselves did not hesitate to write popular expositions, and a very entertaining experience can be had by reading a collection of their articles in a book compiled some half dozen years ago by my late friend, Professor Morris Cohen, and Dr. I. E. Drabkin.

One finds there, among other stimulating content, the essay by Lucretius on the philosophical system of Epicurus, whom he so much admired. This first, or at any rate very early, theory of atoms, and their kinetics was certainly a 'quantum jump' in thinking beyond anything that had preceded it.

Even "security", that word so fretful to science and to the free exchange of ideas, is no modern innovation. Witness Bacon's elaborate encrypting of his work, Newton's allegedly purposeful distortion of a formula, Da Vinci who kept his long undeciphered notebooks in mirror-writing, and other examples that might be cited where the aim was apparently to prevent harm from ensuing as a result of the unexpert use of knowledge or wrong intent. The Sorcerer's Apprentice, that favorite fable of the laboratory assistant who learns the spell to make the mop carry water but who does not know how to stop the operation once it has begun, suggests the cataclysmic consequence where the sorcerer had not been sufficiently "security-minded" with his formula. That might be a very old piece of science-writing.

But it is with modern science-writing that I would deal tonight and, specifically, with the importance of science-writing to the program in which my colleagues and I are engaged. First off, with your permission, I should like to break a lance on the hide of that dragon labelled "atomic energy censorship." I need to do this in order to make a later point. There is a deeply grounded misconception that the Atomic Energy Commission sits guard over all its information and snaps viciously at anyone who seeks to pull the most inconsequent piece out of the pile. Nothing could bear less resemblance to the actual facts.

While weapon data are, of course, "restricted" by law, the Commission has wide latitude as to other data which

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it may declassify and release. There are a number of able people engaged in doing nothing else than reviewing and declassifying. We publish, bi-monthly, a book of abstracts of scientific papers on the whole spectrum of the physical sciences, and these papers and reports now total many thousands.

During this year, for instance, we have declassified information of very great importance in the reactor field. Some of the production processes in the case of heavy water and graphite and the reduction of uranium compounds to metal have been declassified. Most of the information on the neutron cross-section of carbon and graphite has been declassified. The spontaneous fission rate of plutonium 240, specific values for the thermal neutron cross-sections of uranium-235, uranium-238, natural uranium, and plutonium-239 have been released. Basic chemical studies involving the use of ion-exchange resins for all elements except plutonium have been released as well as basic studies of the chemical kinetics of fluoride corrosion. Information is now also being released on the production of fission products as sources of radiation for medical and industrial purposes.

Just to see what it would look like, I got reprints or photostats of the papers published by scientists whose work was supported by the Commission -- papers published only during the first six months of this year -- and this stack, almost 3 feet high, is the result. It is not quite complete at that. Despite all this, there are yet a few who say that we are handicapping science by withholding publication of certain data, and I am individually charged with "censorship by indirection" because we will not clear for publication a very few articles containing weapons data that would be of particular value to the Communists.

Now if I have succeeded in making a case for the Commission, as to what we do to provide the raw data for science-writing, I would like to proceed to the next point which is, as I have said, the importance of science-writing to the atomic energy program.

That program is a very costly one. In the last seven years we have spent \$7,987,600,000, and when our

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plants are all completed, our operating expenditures look as though they will stabilize at about \$2 billion annually. To get that money we look to the Congress, and the Congress properly listens to the electorate. If the country is well informed and if it knows of our program and approves of it, we will be allotted what it takes to operate it. If the country is uninformed or misinformed, we would feel it quickly. Obviously, therefore, we and the security of the nation need you pretty badly.

No matter how voluminous and complete our semi-annual reports may be, we know that the general public does not see them and could not be expected to do so. If they were written for popular consumption, they would be unusable as formal documents. On the other hand, our interim releases to the effect that we have awarded such and such research contracts, released such and such patents, or let a contract for a plant at so and so, -- are, at best, of very local and topical concern. About the best way that the unspecialized public gets any insight into our work is through what you publish and the use made of it by the media of radio and television.

I know from talking to some of your number who have been my long-time friends that there is a good deal of chafing for more information in order to put together the puzzle of what our program is and where it is going. This, of course, involves forecasts, and the Commission as a serious governmental body ought not to indulge in predictions. However, as a person, I suffer from no such inhibition and will venture a few predictions before I conclude. But I get the impression from these same friends that they think a number of questions in their minds as well as in ours, have been solved and simply not announced. I have assured them, and I would assure you, that you are much more current than you think. Anything that we can tell you to make your writings less speculative and more factual, it is our purpose to tell. For to repeat, you are in a very real sense our critical contact with the public.

And here we come up against a further problem. The impression prevails among the greatest part of the public that the Atomic Energy Commission is engaged exclusively in the development and manufacture of weapons. That is our paramount responsibility, certainly. The law is plain on that score. But as you of course know, we are doing a great

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deal besides. Nevertheless, as an indication, we continue to receive mail addressed to the Atomic Bomb Commission or something such. For example, I had a press conference last week. The discussion of weapons occupies less than 8% of the transcript and consists primarily of my statement that we have substantially more weapons than a year ago and that our rate of production is increasing. Yet this blanketed the news and there was much less attention devoted to other facts which were also discussed -- at considerable length -- of the peaceable program -- the President's proposal for an international atomic agency -- the project for the world conference of scientists scheduled for next year -- the negotiations with Canada and Belgium as a beginning on the President's plan. This is all part of the public attitude toward atomic energy.

The public response to non-military aspects of atomic energy has been the subject of study by Elizabeth Douvan and Stephen Withey of the University of Michigan. They have reported on the basis of a considerable number of interviews that the lay population is ill-informed about atomic energy apart from the atomic bomb. They have this to say:

"About two-thirds of the people interviewed reported having heard of atomic energy in connection with something other than the bomb, but their knowledge was fragmentary. One person in five either denied any impression that there were other uses than the bomb or did not report the vaguest concept of even general areas in which atomic energy could be used in peacetime."

"Among the two-thirds who knew of some non-military use, very few mentioned more than one application. The most frequent was power, a characteristic quite readily associated with its military use. Medical purposes were mentioned with secondary frequency. About one-half alluded to them. Minor emphasis, less than one-tenth in each case, was given to agricultural, industrial, and scientific uses of atomic energy."

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"In answer to a question regarding what atomic energy is or what it is like, about one person in fourteen was able to give an informed response. Almost half the respondents said simply that they did not know."

Rather more disturbing than these statistics, however, is that half the respondents answered negatively when asked, "Do you think that the average individual can understand enough about atomic energy to make it worth while to read things about it?"

It would certainly follow from this that the development of atomic energy and the revolutionary social and economic changes which are in train have apparently not captured the imagination or stimulated the curiosity of the population generally speaking.

The question is what can we do about this. I would not be concerned but for the fact that I feel certain it is the public's apparent preoccupation with the idea of weapons that makes us easier targets for Soviet propaganda aimed at a pact for atomic disarmament -- a kind of disarmament which would work one-sidedly, for we would observe such a pact.

The President had unequivocally said that we would never use atomic weapons except against an aggressor. None of us like the idea of using them -- not least those of us who are engaged in their production -- but these reservations, which are the result of our moral principles, can be used, and are being used, by our enemies to trap and confound us. We must see the problem in its full perspective. We are not making weapons for conquest or aggression, or to impose our system on other peoples. Our sole purpose in having them is that we may not fall easy prey to others who have no such reservations, -- and who lack them because they lack the moral springs from which they might arise. Our reservations and principles do us proud but we cannot allow them to disarm us. For if ever they did, those principles would disappear from the face of the earth.

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Before coming here this evening, I opened my file on the subject of atomic energy to review some antique material on science-writing. Back in January 1938 I was engaged in promoting an accelerator at the California Institute of Technology with the cooperation of the late Dr. Robert A. Millikan, the Chairman of its Executive Council. The device was a modest affair in cost and equally modest by present standards in its output -- 5 mev. We now deal in billions of electron volts. Millikan was enthusiastic about the possible scientific results of working with what he described as "such high potentials." My aim was to produce nuclear transformations on a fairly large scale and at small expense with the goal of making radioactive substances available for cancer therapy. It looked like it might be possible to supplement or replace radium, then priced at \$40,000 per gram. At that figure it was beyond the reach of most hospitals and only a few had so much as a gram of it.

Dr. Millikan had broader aims. He wrote me in February 1938, "The possibility of making radioactive substances artificially which would replace radium will be only one of the objectives which you and I envisage. From my point of view it is not necessarily the most promising. The direct therapeutic effect of electron beams on the treatment of cancer for instance would be well worth exploring. But the field that would be entered by going to such potentials as we can practically certainly obtain would be an exceedingly interesting and thrilling one to open up."

This bit of antique correspondence, mind you, is only 16 years old. One of the young men working with us on this enterprise was Dr. Leo Szilard. My file contains a telegram from him dated just one year later than Millikan's letter. It reads:

"Private communication just received shows that neutrons are emitted if uranium is split by very fast neutrons. Easy detection is due to time lag of 10 seconds in emission. Does not mean that our problem is solved in positive sense. Number and velocity of emitted neutrons not known, yet result has bearing on our problem. If we wished to prevent publication would have

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to act very fast through administration and even so success doubtful. Dr. Wigner in town Tuesday and Dr. Teller Wednesday."

The reference to stopping publication at first puzzled me but there also had arrived a letter in which he said, "I see in connection with this new discovery potential possibilities....leading unfortunately perhaps to atomic bombs." A far-sighted young man.

And now, as a third and last antique, a piece of science-writing of that ancient period:

".... transmutation of the elements has now been achieved for all of the ninety-two known chemical elements except two. Yet there has been no revolution in the money marts of the world as a result.

"It is highly probable that the current realization of this dream will have no more effect on the power resources of the world than has the discovery of transmutation on the world's financial exchanges.

"It takes only a quick calculation to show that even in the most favorable case it requires expenditure of about 3,000,000,000 electron volts of energy to release 200,000,000 electron volts of energy from a uranium atom.

"Thus the process is only a little over 6 per cent efficient for the most favorable case and, in reality, is much less efficient on the average."

This, clearly, was reporting on the quite conservative side. Here we stand only 15 years from the first recognition of uranium fission and, despite the intervention of a great war and our consequent complete preoccupation with weapons, we are engaged in the practical production of useful atomic power in commercial amounts. The time scale is remarkable too. Medical people tell me that it was 25 years from the time of the recognition of the antianemic

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factor in liver to the isolation and production of the pure substance.

Dr. Lawrence Hafstad, whom all of you surely know, happens to be speaking, today, in Brussels before the Congress of Industrial Chemistry. He heads the Reactor Development Division of the Atomic Energy Commission. Therefore, he expects to be asked, "How soon will you have industrial atomic electric power in the United States?" His answer is "from 5 to 15 years, depending upon the vigor of the development effort." Our time scale can fold like an accordion.

Transmutation of the elements, -- unlimited power, ability to investigate the working of living cells by tracer atoms, the secret of photosynthesis about to be uncovered, -- these and a host of other results all in 15 short years. It is not too much to expect that our children will enjoy in their homes electrical energy too cheap to meter, -- will know of great periodic regional famines in the world only as matters of history, -- will travel effortlessly over the seas and under them and through the air with a minimum of danger and at great speeds, -- and will experience a lifespan far longer than ours, as disease yields and man comes to understand what causes him to age. This is the forecast for an age of peace.

And as for war, which we dread increasingly because of its added horrors, let me conclude by quoting Sir George Thomson of Corpus Christi College, Cambridge.

"But perhaps this increasing dread of war," he said, "does really mean that our code is growing out of date and that war will join slavery as one of the things that are no longer avowed. Not, alas, that are no longer done. The only slave owners now are States and they call it by another name. I am not entirely convinced that the world will be a better place if the long accepted right and duty of a man to fight for his country, and of his country to fight for its rights, is transformed into an obligation to serve in a punishment squad directed against a nation or a class by some central committee. But if a change in the moral code does come about, atomic energy" -- and I would be more inclusive and say "science" -- "will have been one of the major causes."

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I am sure we are agreed that the ultimate survival of America is dependent on intellectual vigor and on spiritual deeprooting -- not on specific devices which are always for the moment. The atom has no ethics of its own any more than it has politics. The future of the scientists' America, and yours and mine, lies fundamentally with education -- that which is taught to the young in our schools -- that which is taught throughout life in the media of general communication by the contemporary writers. Fundamental are respect and zeal for scholarship, a lively regard for moral values, and a love of truth. And of these the last is, of course, the greatest.

It would be well that we should pledge ourselves here, you, and my associates and I, to work together, unceasingly, to that good end.