

# THOUGHTS ON THE 20th ANNIVERSARY OF CP-1

by  
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To the members of the nuclear project in Chicago, the establishment of a nuclear chain reaction did not appear at the time to be as significant an event as it is viewed today. Theoretical work, based on nuclear constants obtained both in the United States and abroad, convinced us as early as December 1941 that the chain reaction could be established with a sufficient amount of materials of the right purity. Indeed, Fermi's "pile" was running less than 24 hours after the arrival of the necessary materials. Nor was our conviction in the possibility of a chain reaction with natural uranium based on theoretical work alone. I clearly recall one of our meetings, some time in June 1942, at which our project leader, Dr. A. H. Compton, who always had his finger on the pulse of the project, congratulated Fermi on having experimentally demonstrated the possibility of a self-sustaining reaction. This demonstration was carried out by means of another discovery of Fermi, the exponential pile, which requires much less material than the self-sustaining pile. The exponential pile is used even today for measuring the neutron multiplying properties of assemblies, and its reliability was firmly established by the end of April 1942. So also was the reliability of the theoretical work, carried out mainly by G. N. Plass and A. M. Weinberg.

As a result, the chain reaction in Stagg Field was not much of a surprise to members of the Chicago Project. It was even said, jocularly, in connection with the oft-mentioned bottle of Chianti which was broken open on 2 December, but purchased for this occasion some time in March, that it required more foresight to realize that Chianti would not be available in stores later, than to realize that it would be needed soon. Do we place, then, too much emphasis today on the last Stagg Field experiment? I do not now believe so. Perhaps imperceptibly at the time, but very clearly in retrospect, the principal aim and the whole attitude of the project changed when the line drawn by the recorder of the ionization chamber changed from convex from above to convex from below. Of the two objectives of the Chicago Project: the proof of the chain reaction, and its establishment on a large scale, the first was accomplished. Hence the energy and inventiveness of the project members could be channeled to the second objective, its many intricacies and challenges. The establishment of the chain reaction was often likened to the arrival of a navigator on a new continent. It seems to me that the similarity to the meeting of two holes, dug toward each other from opposite sides of a mountain, is more striking.



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This is also an event which everyone anticipates. It is, nevertheless, a momentous event when the last barrier is pierced and light appears ahead. It changes the objective from piercing a mountain to building a tunnel.

Did we realize on that memorable 2 December the magnitude and the character of the changes which nuclear energy was to bring to our world? Intellectually, perhaps, we did to some extent, but not truly. The atmosphere was too hectic for the new knowledge to seep into our subconscious. In addition, in at least two respects we misjudged the coming effects of the new fire. We did realize that both the economic and the political world would be affected. Economically, we thought that the main effect would be cheaper energy. This objective has, so far, eluded us. Nor is it an objective as important as we thought at the time. The principal effect was rather an indirect one: a renewed appraisal of the significance of science, the emergence of scientific inquiry

as a major factor in the economy of the world, and as a tool to improve the products of almost any enterprise. We did expect such an effect, but its extent surpasses all our expectations. Of course, many other wartime projects also contributed to the reappraisal of science.

The very general effect to have brought a recognition of the power of science overshadows even the most important specific effect of the uranium project: the stimulation of the use of radio tracers. This contributed decisively to the development of innumerable new products.

The significance of these two effects, an indirect one of overwhelming importance and a direct one which is, however, not along the main line of the endeavour of nuclear science, should not divert us from the principal manifest purpose of nuclear energy: the production of power. It is true that so far we have not been able to replace the conventional sources of power and it is true also that our objective has shifted somewhat: from competition with the old sources of power to the securing of a permanent power supply. We expect nuclear power to outlast our present sources of power to such an extent that the word "permanent" is hardly an exaggeration. This remains a worthy enterprise, deserving our best efforts, though perhaps we can afford the present, somewhat deliberate pace.

In the political field, our foresight failed us much more severely. We hoped, and indeed expected,

that the terrible nature of nuclear weapons would have such a sobering effect on the governments of all nations that they would foresake their conflicting aspirations and submit to a larger community of law and justice. This hope and objective, sincere as it was at one time, now sounds as if it came from a worn out phonograph record. We have to realize that it was based on a misunderstanding of the effect of the nature of weapons on the great issues of war and peace. These issues are governed, rather, by the conflicting desires of the governments. On the one side is their ageless desire to extend their realm; on the other, the wish to provide a happy and peaceful atmosphere to their subjects, together with the fear of the effects which a conflict may bring to their own position. Nuclear weapons have not greatly affected the balance between the risk which a conflict brings to the government and the intensities of its desire for aggrandizement and peace. At any rate, it does not appear that the existence of nuclear weapons has persuaded all governments to adopt a more understanding attitude toward one another, or toward the true aspirations of their subjects. We must clearly realize and admit that the political problems require a much deeper analysis of human motives than we have been able to furnish. We have learned, however, the necessity of such an analysis and the need to base decisions on such an analysis rather than on plausible-sounding but not closely reasoned arguments.