Statement by Clarence E. Larson, Commissioner
U. S. Atomic Energy Commission
on Uranium Enrichment Services Criteria
Before the Joint Committee on Atomic Energy

March 7, 1973

Mr. Chairman and members of the Committee:

We appreciate this opportunity to testify on this very important subject of the proposed revision to the Uranium Enrichment Services Criteria. In my opening remarks I will provide an overview of the uranium enrichment enterprise - past, present and future. I hope that this will put in perspective the views of the AEC on the significance and importance of these proposed revisions. Following my remarks, Mr. Quinn will present in more detail some of the considerations that are involved in the proposed revisions to the Criteria. Mr. LeGassie will then give a more detailed explanation of the new contract provisions. In addition to our testimony here this morning, I would also refer to our January 18, 1973 letter to the Committee in which we proposed a substantial revision of the Uranium Enrichment Services Criteria that set forth the basis of arrangements under which the AEC will provide such services. The Committee was also furnished a statement of AEC plans for contracting under the revised Criteria.

In its most recent forecast of nuclear power growth, the AEC predicts that U. S. nuclear generating capacity will grow to 1,200,000 megawatts by the year 2000 -- over 80 times the present level of about 14,700 megawatts. In other words, nuclear power, now providing about 4 percent of the nation's electricity generating

capacity, will constitute 60 percent of that capacity by the end of the century. Total nuclear capacity in other non-Communist countries is forecast to be 1,460,000 MWe by the year 2,000 (presently operating free-world reactors amount in capacity to 6,900 MWe).

This vast increase in use of nuclear power must be accompanied by an equally substantial increase in enrichment capability to meet the demand for nuclear fuel even after giving consideration to the oncoming fast breeder reactors. The investments required are staggering. By the year 2000, if the combined foreign and domestic demand is to be met, as many as eleven new enrichment plants, either gaseous diffusion or centrifuge, of 8,750 MTU per year capacity may be needed. These plants are estimated to cost up to $1.5 billion per plant in current dollars for a total of $16.5 billion. However, the capital cost requirements for a centrifuge plant are less well known than for a diffusion plant. These figures assume the development of some foreign enrichment capability--about four such enrichment plants. If by the year 2000, these eleven new enrichment plants use gaseous diffusion technology they in turn will require over twenty-five 1,000 MWe power plants to supply the enormous amounts of electric power needed. This represents in current dollars an outlay of 8 to 12 billion dollars. Putting these two sums together results in a combined investment of approximately 24.5 to 28.5 billion dollars. If centrifuge technology is used rather than gaseous diffusion, the grand total of 24.5 to 28.5 billion dollars may be reduced because the power needs will be only about one-tenth of those for gaseous diffusion plants. The investments required will still be tremendous. Thus, it is only by

putting the uranium enrichment activities - both those in existence and those to come in the future - on a sound financial basis that these vast future requirements can be met.

The question of how future increments of capacity to supply uranium enrichment services will be made available to meet the needs of the world's growing nuclear power industry for nuclear fuel is of critical importance both here in the U.S. and abroad. The AEC has been reviewing this matter in great detail over an extended period. The new contractual approach which the AEC is proposing for the future to provide uranium enrichment services should be considered in the context of these longer term projections.

On July 1, 1966, the AEC submitted its initial Uranium Enrichment Services Criteria to the JCAE. In less than a decade, the U.S. has witnessed the evolution of a major, sophisticated, high-technology nuclear power industry. Comparisons of then-existing circumstances with the realities of the present day nuclear power industry are very impressive and revealing. It was only in 1962 that the first completely commercial sale of a domestic nuclear power reactor was announced. That plant was still under construction in 1966. At that time operable reactors using enriched uranium were generating 1700 MWe at home and approximately 500 MWe abroad. It was predicted that year that U.S. nuclear generating capacity would reach 95,000 MWe by 1980*.

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*AEC Press Releases S-20-66, June 7, 1966, and S-23-66, September 8, 1966.

Leasing of AEC-owned uranium was the chief mechanism for distribution of nuclear fuel. The Private Ownership Act of 1964 authorized the AEC to enrich privately owned uranium but this was not to begin until 1969. The uranium enrichment process and production costs were classified, and the concept of separative work mystified newcomers to the nuclear industry, and some of the old-timers as well. In fact, it still does.

Even those few years ago, the operational uncertainties of the infant nuclear power industry were such that considerable flexibility was needed within contractual relationships. Requirements for fuel, the assays of fuel and reactor exposure levels could not yet be defined with accuracy. The timing of fuel deliveries was not predictable. The industry itself was still wrestling with questions of the technology, capacity and economic life of a nuclear power plant.

The AEC, for its part, was charged with encouraging the development of an industry to exploit the energy of the atom. The Criteria of 1966 reflect these circumstances. In addition to accommodating the residual uncertainties of the industry, these Criteria and the elastic arrangements thereunder served several other related purposes. They assured the utilities of a continuing availability of reasonably priced enrichment services utilizing the large capacity of existing facilities

which were no longer needed to meet defense requirements. An assured fuel supply was attractive to customers and fostered early growth of the industry. The availability of enrichment services to both foreign and domestic customers on generous terms also stimulated sales of U.S. reactors abroad.

An approach to contracting that was highly favorable to the customer was both possible and desirable because of the considerable excess capacity of the AEC's enrichment facilities which had been constructed and operated to meet defense requirements.

The shift of production from military to primarily civilian needs left the plants operating at well under 50 percent of capacity. Even at this reduced level of operation considerable pre-production of enriched uranium was possible; this, in turn, has created a high degree of supply flexibility for a number of years into the future. As the Committee is aware, the Japanese utilities have taken advantage of this situation and have recently purchased about $320 million of pre-produced material.

The Criteria established in 1966 had the desired salutary effect and contributed to the growth of the nuclear power industry which today is a major commercial enterprise. At the close of 1972, there

were 29 power reactors operating in the U.S. Operating license applications for 36 more reactors were pending before the AEC, as well as construction permits for still another 35. An additional 60 reactors were known to be on order by the nation's utility companies. Of that 60, the 35 ordered within CY 1972 represent a total plant investment of $16 billion. The 29 operating reactors constituted 4 percent of the nation's electric generating capacity at the end of 1972. As I mentioned earlier, operating reactors using enriched uranium amounted in capacity to 14,700 MWe in the U.S. and 6,900 MWe abroad. Contracts for uranium enrichment services representing projected revenues of over $10 billion had been concluded. These contracts covered 86,000 MWe of reactor capacity for periods extending as far as the year 2002.

Present forecasts indicate that nuclear power will constitute 21% of domestic power capacity by 1980 and 33% by 1985. Although accurate predictions of demand for enrichment services beyond the next decade are very difficult to make, AEC projections indicate that at least six new U.S. enrichment facilities of roughly 8750 MTU/yr. (approximately the average of the existing three plants after CIP and CUP) will be needed in the 1980s if both domestic and foreign projected demands are to be met. This represents an investment in 1973 dollars of $9 billion (at $1.5 billion per plant) exclusive of the capital cost for the power supply.

It is our belief that U.S. private industry can and should assume responsibility for the additional plants needed to meet this vast increase in demand for enrichment services and, therefore, the Commission does not intend to build additional enrichment plants. In the interim, however, the Commission is making large-scale investments in the existing plants not only to realize their full potential but also to provide additional time for the industry to get into position to provide the first new capacity increment. The $672 million Cascade Improvement Program now underway will increase the separative work capacity of existing facilities by about one third without increasing operating costs or power usage. The $235 million Cascade Uprating Program scheduled to begin in FY 1974 will increase the capacity of the improved plant by 20% by enabling it to operate at higher power levels, thereby capitalizing on the increased efficiencies introduced by the CIP.

The anticipated assumption by the private sector of responsibility for providing additional enrichment capacity needed in the future has been encouraged by declassification of the economic aspects of gaseous diffusion plants. Financial statements are now issued annually and are available to private industry. In addition, the Commission has undertaken two active programs directed toward facilitating commercial participation by U.S. firms in uranium enrichment activities,

the only production step in the nuclear fuel cycle which is still a government activity. Although enrichment technology remains classified, a number of firms have been granted access to both gaseous diffusion and gas centrifuge technology; proposals from seven companies have been accepted for the conduct of private research and development efforts in the enrichment field. This is expected to lead to future investment in privately owned facilities to manufacture uranium enriching equipment and/or to provide enrichment services. In December 1972, the Commission announced a further enrichment technology access program whereby qualified firms will be able to receive AEC information to assist them in determining the feasibility of designing, constructing and operating uranium enrichment plants using AEC technology.

Several other countries are vigorously pursuing the development of enrichment technology with an eye to creating an indigenous capacity. This is a factor that the AEC must consider in its assessment and review of the enrichment area. Whether industry or government ultimately provides the needed additional enriching capacity, it is plain that such facilities will need to be operational by the early to mid-1980s if projected demands are to be met. A major AIF report has recently stressed the necessity for early action to assure timely provision of such services. This is due to long lead times necessitated by considerations of design, construction, need for power for enrichment plants, financing requirements and other factors.

The magnitude of the capital requirements for new enriching capacity, the uncertainty in projected demands over long-term periods, and the emergence of a number of sources of enrichment services necessitate new contractual commitments by the toll enrichment customer which reflect normal business practices. Such commitments are essential to an industrial undertaking of this type as well as to a government project. Under the new Criteria the revised contracting approach is designed to provide the enricher with the firm commitments needed to secure financing for a new enriching plant. Four principal differences may be seen in this new contracting approach. First, adequate advance notice of need is required through advance contracting. Second, firm commitments to buy and firm dates of delivery must be specified by the purchaser. Third, down payments for a part of the first core will be required. Fourth, termination provisions have been modified to cover a substantial portion of the investment risk to the enricher. In our opinion, these new terms do not represent unusual or unreasonable provisions. They merely represent sound business practices. If private enterprise is to provide new enriching capacity, it will only be able to do so if it can negotiate long-term, fixed-commitment contracts similar to or even more restrictive than those being proposed by the AEC. Further, since AEC is undertaking large investments now to increase enrichment capacity it is essential to convert to a firm, commercial contracting basis not only to protect these investments but also to prepare the way for subsequent private participation in enrichment activities.

The revised Criteria and firm, commercial-type contracts with fixed quantities are necessary to assure financing of the heavy investments required for the additional enrichment capability needed in the 1980s. We believe it important that the nuclear industry both here and abroad cooperate in creating the basis for expansion and construction of new enrichment facilities to ensure an uninterrupted supply of nuclear fuel. In addition, the longer-term commitments for separative work should encourage longer-range commitments for raw materials. This should provide to that segment of the nuclear industry a greater assurance of future demand on which to base exploration and expansion of production capability.

It may be appropriate at this juncture to comment on the foreign market for enrichment services. Historically. the U.S. has played a leadership role in stimulating development of nuclear power abroad. Reactors with approximately 30,000 MWe of nuclear capacity currently operating, under construction or on order in foreign countries are based on U.S. technology. The U.S. is also virtually the sole supplier of enrichment services in the free world today. We value our close relationship with the nuclear power activities of other countries and hope to maintain these ties in the future. For this reason, the U.S. has considered foreign as well as domestic needs for enrichment services in its plans to meet projected demands. Both CIP and CUP are being undertaken with the view of providing domestic and foreign customers

alike with an assured fuel source. Like our own industry, however, the foreign nuclear power industry is growing rapidly and projected demands for enrichment services are high. We trust that our foreign customers will recognize that it is also in their own best interest to help assure expansion of capacity to meet their requirements.

There may be a special problem for some users abroad whose existing Agreements for Cooperation may not provide a sufficiently large ceiling to cover all nuclear reactors for which deliveries will be required during the next eight years. In such cases, we plan to initiate appropriate amendments to these agreements at the earliest possible date. However, some special accommodation may have to be made if it is not possible to bring any such amendment into force within the available time.

In summary, I would like to emphasize three points. First, if the nuclear power industry in the U.S. and throughout the non-Communist countries is to continue to grow and prosper, an assured supply of enriched uranium is essential. Second, there needs to be a greater sharing by the enriching customer of the risks associated with the building of new enriching capacity. And finally, the new, fixed-commitment contract being proposed by AEC also provides a transition toward the type of contracts that a business operating in the private sector will need to secure financing for their new enriching capacity.