October 24, 1989

MEMORANDUM FOR: Leland C. Rouse, Chief
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety, NMSS

FROM: Peter Loysen
Advanced Fuel and Special
Projects Section
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety, NMSS

SUBJECT: FOREIGN TRAVEL TRIP REPORT

Attached are a Trip Report Abstract and a more detailed trip report covering my visit on September 29, 1989, to the Urenco gas centrifuge uranium enrichment plants in Gronau, West Germany, and Almelo, The Netherlands.

Original signed by

Peter Loysen
Advanced Fuel and Special
Facilities Section
Fuel Cycle Safety Branch
Division of Industrial and
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Enclosures:
As stated

cc: R. Bernero
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TRIP REPORT ABSTRACT
DATE OF REPORT
October 16, 1989

OFFICIAL TRAVELER:
Peter Loysen

TRAVEL TO: Gronau, West Germany
Almelo, The Netherlands

BEGINNING ON: 09/27/89

UNTIL: 10/02/89

OFFICE: NMSS
Division of Industrial
and Medical Nuclear Safety
Fuel Cycle Safety Branch

* * * * *

MEETING TITLE AND/OR AFFILIATION:

Visits to Urenco gas centrifuge uranium enrichment plants and discussions on health, safety, and environmental issues with plant management.

ORGANIZED BY:

NRC and Urenco, Inc.

ABSTRACT AND/OR SUMMARY OF MEETING RESULTS:

On September 29, 1989, R. M. Bernero, R. E. Cunningham, and I visited the Urenco gas centrifuge uranium enrichment plants located in Gronau, West Germany, and Almelo, The Netherlands. The purpose of the visits was to gain some familiarity with plants similar to the one being proposed for construction in the United States by Louisiana Energy Services, of which Urenco is a partner and supplier of the gas centrifuge technology. The plant tours and discussions with management centered on features for protection of worker and public health and safety and the environment.

We travelled first to the Urenco plant in Gronau and spent most of the morning touring the plant and discussing our observations and questions with Dr. H. Mohrhauer, Managing Director of Uranit, Dr. G. Meyer-Kretschmer, Mr. J. Pokar, and Mr. J. Smith. During the afternoon, we travelled to the Urenco plant in Almelo (about 30 miles from Gronau) and were briefed on company activities, toured the plant, viewed a slide presentation, and held further discussions during a dinner meeting, all with Mr. N. Hootsmans, Managing Director of Ultra-Centrifuge Nederland, Mr. F. Stockschläder, Dr. H. Rakhorst, and Mr. B. Dekker.

The overall impressions of the plants are that, despite some differences in age, innovations, and regulatory requirements, they are carefully thought out, designed, constructed, tested, and operated. Many of the

features important for nuclear material safety and safeguards are either inherent in the design of the centrifuge process, required for efficient operation, or built into the balance of the plant. An example of the first of these is that the centrifuges contain small amounts of uranium and operate under vacuum; thus, releases from the machines do not occur. An example of the second is that, to maintain efficient production, the machines cannot be rearranged in series to produce any meaningful quantities of high enriched uranium. An example of the last is that, in the uranium feed area, cylinders of UF6 which are heated so that pressures up to 2 atmospheres are attained, are encased in pressure vessel autoclaves tested to pressures of 15 atmospheres, and the air from the area can be scrubbed and filtered by banks of high efficiency air filters in the event of any release. An important element attributed to the success of the plants is the conservative approach to improvements. Changes are introduced only in an evolutionary manner after extensive, often years of, testing to demonstrate reliability as well as improvement. It became obvious to us why Urenco is insisting that the technology which will be transferred to Louisiana Energy Services must not be tampered with in the United States.

While the duration of the plant visits was brief, the opportunity to make the visits was useful and successful, for they provided valuable insights which will be directly related to a licensing review of the United States plant. I believe that other NRC personnel, in particular Safeguards staff, would also benefit from visiting one or more of the Urenco plants in Europe prior to receipt of a license application from Louisiana Energy Services. The Managing Directors of the Gronau and Almelo plants were receptive to such future visits.

TRIP REPORT

VISITS TO

URENCO GAS CENTRIFUGE URANIUM ENRICHMENT PLANTS

GRONAU, WEST GERMANY, AND ALMELO, THE NETHERLANDS

SEPTEMBER 29, 1989

SUMMARY

On September 29, 1989, R. M. Bernero, R. E. Cunningham, and I visited the Urenco gas centrifuge uranium enrichment plants located in Gronau, West Germany, and Almelo, The Netherlands. The purpose of the visits was to gain some familiarity with plants similar to the one being proposed for construction in the United States by Louisiana Energy Services (LES), of which Urenco is a partner and supplier of the gas centrifuge technology. The plant tours and discussions with management centered on features for protection of worker and public health and safety and the environment.

The overall impressions of the plants are that, despite some differences in age, innovations, and regulatory requirements, they are carefully thought out, designed, constructed, tested, and operated. Many of the features important for nuclear material safety and safeguards are either inherent in the design of the centrifuge process, required for efficient operation, or built into the balance of the plant. An important element attributed to the success of the plants is the conservative approach to improvements. Changes are introduced only in an evolutionary manner after extensive, often years of, testing to demonstrate reliability as well as improvement. It became obvious to us why Urenco is insisting that the technology which will be transferred to LES must not be tampered with in the United States.

While the duration of the plant visits was brief, the opportunity to make the visits was useful and successful, for they provided valuable insights which will be directly related to a licensing review of the United States plant. I believe that other NRC personnel, in particular Safeguards staff, would also benefit from visiting one or more of the Urenco plants in Europe prior to receipt of a license application from LES. The Managing Directors of the Gronau and Almelo plants were receptive to such future visits.

DISCUSSION

We travelled first to the Urenco Deutschland plant on the outskirts of Gronau, a small, rural town in the northwest lowlands of West Germany. The only entrance to the plant is by a road through two gated fences, between which a guard station is located. The remainder of the plant area is surrounded by a single fence. The initial impression of the site is that of simplicity and cleanliness, no doubt enhanced by the contemporary design of the buildings. We were introduced immediately to Dr. Hans Mohrhauer, Managing Director of Uranit (96 percent owner of Urenco Deutschland), Dr. G. Meyer-Kretschmer, Mr. J. Pokar, and Mr. Joseph Smith. Mr. Pokar is the licensing manager and

Mr. Smith was recently assigned to Urenco Deutschland from Urenco (UK) and has been designated as the project director to work on the Louisiana Energy Services project.

Before touring the plant, Urenco explained that licensing of the Gronau plant was performed under the German Atomic Law pertaining to nuclear power plants. Safeguards matters are delegated by agreement to Euratom and the IAEA. A construction permit was originally obtained, and the plant built, for an annual capacity of 400K SWUs, although in the license application it was made clear that the eventual capacity would be 1M SWUs per year. Impacts of operation were based on this eventual capacity. A first partial construction was issued at the end of 1981, and operation began in late 1985. Expansion of the plant from 400K to 1M SWUs has now begun under a new construction permit. The expansion will employ the latest model TC-12 centrifuge machines, which are the same as will be used in the LES plant. Urenco assembles the centrifuge machines and the cascades of machines onsite, but these operations are not subject to licensing, other than for security and demonstration of no catastrophic failure. They stressed the importance of an ongoing machine assembly program so as to maintain continuity of staff and high quality.

On the tour, we were first shown the heating station (autoclave hall) where cylinders of natural UF6 are heated to form a gas. Heating takes place in autoclaves, some of which are heated by steam and some by electrically heated air. Cylinder pressures are about 1.8 bar, and the autoclaves, which are unpressurized, are tested to a pressure of 12 bar for containment of any releases from cylinders. The air handling system for the autoclave hall is provided with a radiation monitoring system which can activate a scrubber system and high efficiency particulate air filters as a further precaution against releases of UF6 to the atmosphere. From the heating station, the gaseous UF6 is reduced in pressure to about 50 mbar for feeding to the water-cooled centrifuges at a few mbar in the cascade halls. Since the cascades operate under vacuum, only air inleakage can occur in the event of a piping or component penetration, and releases of UF6 would not appear to be possible. The whine of the machines in the cascade halls was irritating. We would have liked ear protection for any extended stay there. Workers installing new machines might require such protection, although at other times there is little reason for attendance in the halls. It is interesting to note that there was absolutely no perceptible vibration upon contact with any of the centrifuge machines. They are designed and constructed for an operating life of about 15 years with zero maintenance. If a machine should fail, it is simply left in place in the cascade, and the power cord to the drive motor is removed. Only two machines have failed since operations began in 1985. Plant availability was stated to be 99 percent. When questioned about the possibility of replumbing the cascades to try to produce high enriched uranium, Urenco said that there is inherent protection because the machines are designed to operate for low enrichment separation, and that to attempt serial connections would reduce the product output to the extent that it would be inconsequential.

UF6 product and tails are collected at the Gronau plant in freon-cooled desublimers which also act as pumps for the cascades. Still at sub-atmospheric pressure, the UF6 is then reheated by hot freon and piped to the container filling station where the product is solidified in air-cooled transport containers and the tails solidified in water-cooled containers. After collection, product

containers are transferred to a transfer station where, in autoclaves similar to those in the feed station, the product can be homogenized, sampled, and if necessary enrichment-blended to customers' specifications. As a safety precaution, containers of UF6 are always cooled and the material solidified before being transported. There are other facilities for storage of product and tails containers, services, decontamination, and of course a central control room from which all process activities are monitored and controlled. Diesel generators provide emergency power for instrumentation and control systems, but not for cascade operation. According to Urenco, about 20 minutes of mains outage can be tolerated, but since there are two independent sources of electrical power from the public grid, such an outage is unlikely. We observed that none of the stations, halls, or other facilities had automatic fire suppression installed. When questioned, Urenco said that there are virtually no combustible loadings in the buildings, and that there are no requirements for such suppression.

The quantity of tails containers accumulated so far is not large, but the plant has not operated for very many years. Urenco offers customers their tails back, offers to store their tails, and offers to acquire their tails. Few accept their tails back. Urenco has a commitment to discuss with the German authorities within 20 years the ultimate disposition of tails. In addition to further storage, options include further separation of U-235 values, use in breeder reactors, and conversion to uranium oxide for disposal.

We expressed our appreciation to the Urenco management for devoting so much effort to our visit. It seemed that other NRC personnel, particularly Safeguards staff, who will be reviewing the LES application could also benefit from a visit to one or more of the Urenco plants. Upon suggesting to Dr. Mohrhauer such a future visit to the Gronau plant, he was most receptive to the idea.

In the afternoon, we travelled to the Urenco Nederland plant in Almelo, The Netherlands, about 30 miles from Gronau and in a similar setting. We were immediately introduced to Mr. Norbert Hootsmans, Managing Director of Ultra-Centrifuge Nederland (UCN), which owns 96 percent of Urenco Nederland, Dr. F. Stockschläder, Mr. H. Rakhorst, and Mr. B. Dekker. Mr. Rakhorst is the coordinator of activities in the United States and Mr. Dekker is in charge of safety, safeguards, and licenses. They all briefed us on the business and management of the Urenco and UCN organizations, as well as the history of activities at Almelo and technical features of the plant.

The Almelo facility is larger than that at Gronau, serving as Urenco's central location for centrifuge research, development, and component manufacturing, and the largest separations plant in the organization. One plant has already been decommissioned, and we suggested that Urenco's report of the decommissioning be made available to LES to help support their decommissioning plans. A plant which began operating in 1974 has an availability of 95 percent after 15 years of continuous use. Current capacity at Almelo is about 1.2M SWUs per year, with expansion to 1.5M SWUs per year to be completed in 1991. The additional capacity will be with the new model TC-12 machines which are claimed to have an efficiency (based on energy consumption?) 100 times greater than that from gaseous diffusion. Concurrently, Urenco is considering replacing the desublimers with compressors, not only as a process improvement, but also to reduce the release of freon to the environment. This change would also be made in the LES plant design. Also, for new module or plant designs, including

LES', UF_6 gas pressure reduction will be made at the feed heating stations, so that there will be no pressures above atmospheric except at the heated tanks in autoclaves. Emergency diesel generators provide power to operate the entire facility, not just the instrumentation and control systems as at Gronau. This step was taken because power from the public grid is available from only one source, and an outage longer than could be tolerated was considered to be likely.

As described to us, the licensing process appeared to be much swifter and simpler in The Netherlands than in West Germany, although we did not perceive any significant differences in plant safety concepts between the facilities. Licensing of the Almelo plant is performed under laws other than those for nuclear reactor regulation, although there are four ministries involved. Nevertheless, the review process is limited to an eight-month period, including time for "public protest." If a protester is not satisfied with the authorities' consideration of his or her protest, there is the opportunity for adjudication subsequent to licensing. Unlike the Gronau plant, licensing of operators is not required.

With the exceptions of the age and size of the facility, use of another model of centrifuge machines, and the above-mentioned differences, the Almelo plant appeared to be similar to the Gronau plant in all important respects.

During an evening discussion with Mr. Dekker, I learned that two years ago he had presented, at an international conference in San Diego a paper on nuclear material safeguards at the Dutch and German Urenco plants. His description of information in the paper suggested that it would be of interest to NRC's Safeguards staff. Mr. Rakhorst has subsequently sent a copy of the paper to us, and it has been forwarded to Mr. Ting in the Domestic Safeguards and Regional Oversight Branch. The paper provides an unclassified description of how safeguards are implemented at the plants under the Euratom and IAEA regimes.

Again we expressed our thanks to the Urenco management for expending so much effort for our visit. Upon suggesting to Mr. Hootsmans that a future visit by NRC staff to one or more of the Urenco plants could be beneficial, he too was receptive to the idea.