

## Mr Hans-Uwe Siebert, Senior Vice President, Fuel Manufacturing Business Unit, AREVA NP AREVA Secures Fuel Assembly Manufacturing of the Future

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### Introduction

In a general context of increasing demand for nuclear energy supply, fuel assembly security of supply and reliability appear more than ever as key points for all players in the nuclear fuel activities.

The Fuel Manufacturing Business Unit of AREVA NP Fuel Sector comprises the fuel manufacturing activities of AREVA NP, Inc in the USA, FBFC in France, FBFC International in Belgium and ANF (Advanced Nuclear Fuels GmbH) in Germany. The global capacity of the Fuel Manufacturing Business Unit represents roughly 3000 tU/year (two thirds in Europe and one third in USA). This manufacturing capacity represents one third of the worldwide installed fuel manufacturing capacity for LWRs and almost half the annual needs for these reactors.

Thanks to its worldwide integrated and customer-oriented organization and to its up to date industrial tool, the AREVA NP Fuel Sector ensures flexibility and strong procurement security for the supply of fuel assemblies to its customers.

### A worldwide integrated fuel manufacturing organization globally managed

Primary synergies within the Fuel Manufacturing Business Unit resulted in installing a common Business Unit management and common processes to strengthen the integration between manufacturing organizations. The main common processes have been identified and described and Business Unit responsibilities have been introduced. After each merging step, an integration program has been launched and implemented.

Today, the Fuel Manufacturing Business Unit is organized into complementary operational lines: US Fuel Manufacturing Line, European Fuel Manufacturing Line and a worldwide Component Manufacturing Line. All aspects of worldwide supplies and technology are managed through two Global Functions. This Fuel Manufacturing Business Unit organization is consistent with the ones of the other Business Units of the Fuel Sector of AREVA NP. Fuel Design and Sales Business Unit is organized in three Customer Centers (US, Europe and Asia) and transversal services like Products and Technology or Market Strategy. Zirconium activities are organized in three lines (Upstream Line, Tube Line, Flat Products Line) and transversal units like Technology and Sales.

Within the Fuel Manufacturing Business Unit, different activities and resources are managed on a global resource basis. As an example, a common transport container fleet has been fully licensed in accordance with IAEA regulations ST-1, for each type of transport, i.e. fuel assembly, powder and pellets. It means a higher security of supply for the customers, cost optimization through container development and utilization planning optimization.

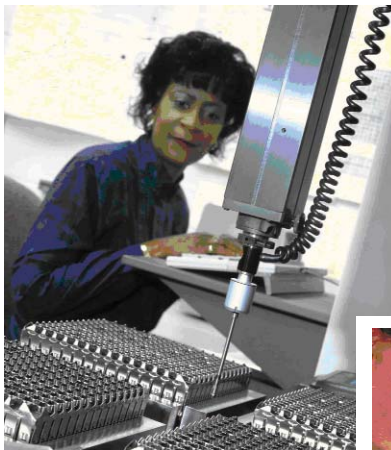
R&D activities are also managed on a global basis. Examples are numerous and include automated pellet inspection (diameter/length laser measurement, surface/dishing imaging system) or active/passive rod scanner software. In so large a Fuel Manufacturing Business Unit, the pooling of technical know-how, with a centralized technology responsibility, increases the competencies in each of the manufacturing plants, improves the quality and avoids redundant efforts.

The development of a Fuel Manufacturing Business Unit Supply Chain Function has brought many advantages resulting from global planning and inventory management, strategic purchasing planning, Business Unit list of approved vendors, common sub-supplier evaluations and fuel delivery project management. It means an increase in supply security through global planning, better supplier reliability and optimized single/multi-sourcing decisions; it also results in a structural decrease of planning and purchasing costs.

The global implementation of best practices, as well as process and technology standardization, results in quality and cost improvement. The utilization of common resources of the Fuel Manufacturing Business Unit also increases the global optimization and the security of supply. Moreover, the development of cross-qualification programs for different products, presented hereafter, increases the security of supply for our customers.

## A worldwide fuel manufacturing tool allowing flexibility

The Lynchburg fuel manufacturing facility (USA), on the East Coast, produces fuel assemblies for pressurized water reactors (PWRs). The plant is licensed for fuel assembly production of up to 5.0 wt%  $^{235}\text{U}$ . The plant does not operate a conversion and pelletizing facility. Fuel assembly components like spacer grids, tie plates and small components are produced in a specific, dedicated shop. Burnable poison rod assemblies, in-core detectors, axial power shaping rods, specialty components and B4C pellets are also produced in this plant.



The Romans plant (France) produces  $\text{UO}_2$  powder, pellets, fuel rods and fuel assemblies for PWRs. The plant is licensed to process uranium up to 5.0 wt%  $^{235}\text{U}$ . In a separate shop, lower and upper tie plates are produced for PWR fuel assemblies.

The Richland fuel manufacturing plant (USA), located on the West Coast, produces  $\text{UO}_2$  powder and pellets and is specialized on fuel rod and fuel assembly manufacturing for BWR. The plant is licensed for processing of uranium up to 5.0 wt%  $^{235}\text{U}$ . Richland also operates a specific machine shop for tie plate and small component production.



The Pierrelatte plant (France) produces spacer grids for PWR fuel assemblies which are supplied to AREVA NP's European fuel manufacturing plants. Another workshop in the Pierrelatte plant is dedicated to the manufacturing of RCCAs.

The Lingen plant (Germany) produces  $\text{UO}_2$  powder, pellets, fuel rods and fuel assemblies for both PWRs and BWRs. Lingen is a 5.0 wt%  $^{235}\text{U}$ -licensed plant.



(Germany). Dessel is a 5.0 wt%  $^{235}\text{U}$ -licensed fuel manufacturing plant. A separate building is dedicated to MOX fuel assemblies based on fuel rods received from Melox (France). The plant licensed maximum Pu-content is 12 wt% for fuel rods and 10 wt% average for fuel assemblies.

The Karlstein plant (Germany) produces components for fuel assemblies: spacer grids, upper and lower tie plates for PWR and BWR fuel assemblies as well as water channels for BWRs.



## Preparing the future with regular upgrading of the industrial tool

Looking forward to a global nuclear renaissance, we have to be ready in due time to face new and increased demand. In such a context, the Fuel Sector of AREVA NP regularly invests in the upgrading and optimization of its manufacturing industrial tool. By so doing, the Fuel Sector of AREVA NP evidences its long-term commitment in the nuclear fuel industry.

An investment of about 100 million euros over the 2004-2008 period will concern the manufacturing plant of Romans (France). It will lead to the complete renewal of its production capability, while meeting the more stringent requirements in terms of safety, radiation protection and environment.

It will result in improvements in different aspects : personnel radiation exposure less than one quarter of the regulatory limits, reinforcement of the earthquake resistance of the buildings, improvement of their segmentation and fire protection, automation of the safety functions, reduction of solid waste and of both liquid and atmospheric releases.

In parallel to this renewal initiative, the governmental authorization was revised in March 2006 to raise the authorized capacity to 1800 tU for the Conversion Line and 1400 tU for the Pelletizing/Assembling Line (formerly 1200 and 820 tU respectively). The situation is the same for the Lingen fuel plant with an increased authorized assembly line capacity from 500 to 650 tU.

Among others, these significant investments reinforce the long-term security of supply which the AREVA NP Fuel Sector offers to its customers.

As a key player in the nuclear industry and a long-term reliable supplier, the Fuel Manufacturing Business Unit has set high priority on security and environment, fulfilling AREVA's commitment to sustainable development. Extensive efforts have been made in this domain. In particular, requirements relative to the environment are included in the working instructions and employees follow training courses in the framework of general training at each working station.

All manufacturing sites are ISO 14001 certified. Dessel, Karlstein and Lingen sites achieved OHSAS 18001 certification.

## A best practice program also contributes to the upgrading of the industrial tool

In order to optimize the workload in the manufacturing plants, but also to gain even greater security of product supply, the Fuel Manufacturing Business Unit is performing a general best practice program.

This program covers all the fuel and component manufacturing plants and encompasses a broad scope, including the promotion of best practice sharing. It puts global competencies at the disposal of the individual plants.

Best practice in fuel rod manufacturing - from loading to welding - has been identified and has been implemented in the fuel rod manufacturing line for BWR fuel in Richland (USA) and in the PWR fuel rod manufacturing line in Lynchburg (USA).

Skeleton welding, powder transport and preparation, spacer welding, upper tie plate manufacturing processes are among the technologies for which a best practice analysis has also been conducted resulting in best practice choices which are implemented step by step.

## A cross-qualification program reinforces our flexibility

2003 was the year of the first cross-qualification activities for fuel assembly fabrication in a manufacturing plant of AREVA NP. The first objective was to provide our customers with a greater flexibility and security of product supply, while guaranteeing the same level of product quality. It also contributed to the optimization of the work load distribution in the different manufacturing plants.

A first reload of 17x17 HTP fuel assemblies under design responsibility of AREVA NP GmbH (Germany) and fabricated previously exclusively in the Lingen fuel plant was manufactured in Romans and delivered to a 900 MWe nuclear power plant. This project, launched in 2002, only one year after the merger between Framatome and Siemens nuclear activities, closely involved different Units within the Fuel Sector in a specific project team with contributors from the manufacturing plants, and from the Fuel Europe Customer Center located in Erlangen and in Lyon.

Furthermore, in the framework of the general cross-qualification program of the Fuel Manufacturing Business Unit, a second cross-qualification was performed in 2004 in the opposite direction with the first fabrication of AFA 3G fuel assemblies in the Lingen fuel manufacturing plant in place of Romans and Dessel plants.

Since 2005, all fuel assemblies for the 17x17 900 MWe reactors can equally be manufactured in both Romans and Lingen plants.

In 2005, the cross qualification process already started in the German and French plants of the Fuel Manufacturing Business Unit has been extended to the American plants with the qualification of the fabrication of gadolinium pellets in the Richland plant in addition to the Dessel plant.

In the year 2006, the qualification of fuel assembly manufacturing for 17x17 14 feet reactors is in progress in Lingen. From 2007, both HTP and AFA 3G fuel assembly 17x17 designs will be manufactured in either Romans or Lingen.

Cross-qualification of components, in particular spacer grids, is in progress with the manufacturing of AFA 3G spacers in Karlstein and HTP/HMP spacers in Pierrelatte.

In 2004, the Zirconium Business Unit of AREVA NP also started the process of cross-qualification, with the fabrication of AFA 3G cladding tubes made of Zr4 in Duisburg in addition to Paimboeuf.

Finally, the cross operation program will be implemented not only to the current AREVA NP products for the PWR reactors as AFA 3G and HTP designs, but also to the upgraded AGORA products which will be first introduced from 2007 in PWR nuclear power plants.

Through cross-qualification of large volumes of 17x17 PWR designs improved security of supply is also generated for BWR customers and customers of other than 17x17 PWR designs in Europe in addition to the already existing backups as large PWR volume cross-qualifications provide additional flexibility in plants with designs of smaller volumes in case of a corresponding need.

On top of the direct advantages provided for our customers, the first operations of cross-qualification were the primary step towards the standardization of the technical file, and marked an improvement in the knowledge of the different product designs and manufacturing processes within the scope of the worldwide integration of the different sites of AREVA NP Fuel worldwide.

## **An upgraded and optimized industrial tool to the benefits of AREVA's customers**

The industrial tool and integrated organization of the AREVA NP Fuel Sector ensure a strong procurement security for the supply of fuel assemblies to its customers. This results from complementary key points. One of them is the high level of integration of the fuel assembly manufacturing tool distributed on several plants in Europe and in the United States. It is the same for the integrated Zirconium activities between France and Germany, and their smooth connection with the Fuel Manufacturing Business Unit. Another key aspect results from the regular investments AREVA NP performs in the upgrading and optimization of its manufacturing industrial tool.

As a unique integrated fuel assembly manufacturer, setting high priority on security and environment and fully committed to sustainable development, AREVA has established itself as a long-term reliable supplier, so contributing to a globally increased long-term security of supply for all players in the nuclear fuel industry.