




High-performance tube and pipe
for critical nuclear power applications

Advancing a
safe and sustainable
nuclear industry



“Advanced materials are our speciality. Technical challenges are our driving force. That’s why the nuclear power industry and Alleima are a perfect match.”

Tom Eriksson,
Vice President Research & Innovation, Alleima

Delivering peace of mind since 1964

Today, with dedicated nuclear tube and pipe mills in the USA and Europe, we are the world’s only independent, fully integrated producer – meaning we are not aligned with a consortium or state-owned company. Our focus is on steam generator tubing (SGT) and fuel cladding tubing as well as a range of Class 1-3 ASME and RCC-M certified tube, pipe, strip and other products. Over the years, we’ve supplied more than 25,000 tonnes of tube and pipe, including 65,000,000 meters of nuclear fuel cladding tubes and 400 tube bundles for steam generators (approx. 2,600,000 tubes) in more than 20 countries.

Advancing tomorrow’s solutions

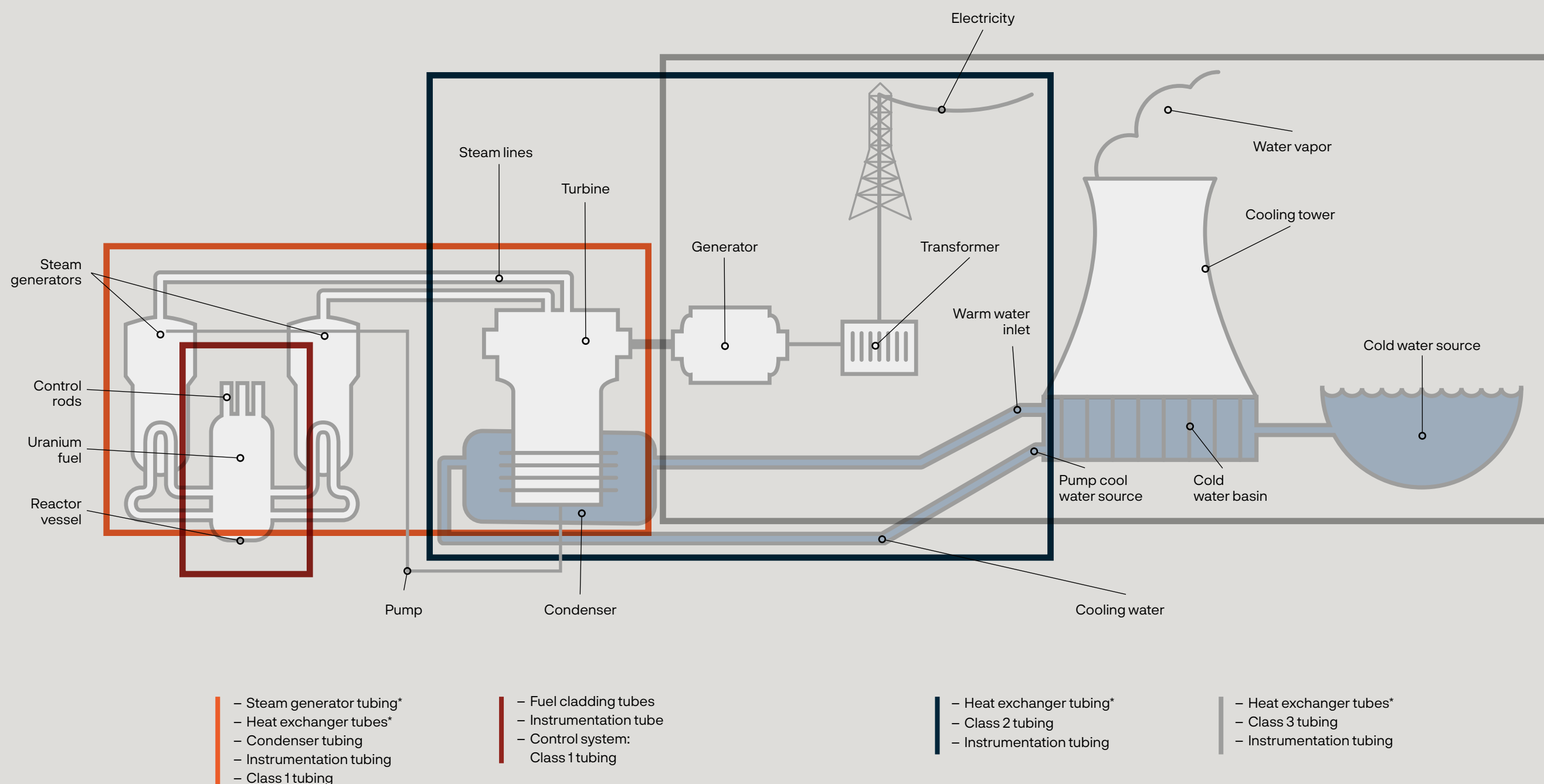
Since our founding in 1862, we’ve placed a top priority on developing tomorrow’s materials solutions. In fact, our company grew out of an innovation for using the Bessemer method to produce steel on an industrial scale. This sparked a long history of firsts and a culture of R&D that is burning bright today. We currently have more than 900 active alloy recipes and other intellectual property rights with a steady stream of R&D activities. We partner some of the world’s most demanding OEMs in Asia, Europe and the USA.

Quality and sustainability focus

For us, quality is a top priority to ensure safety in all operations and processes. We have a rigorous quality-assurance program and meet all key ASME and RCC-M requirements. From the high-quality melt to the final pilgering or drawing and testing, we keep a close eye on every produced tube. All of our tubes are carefully documented and 100% traceable. Sustainability is also at the core of our commercial strategy and we are committed to the Science-Based Targets initiative and UN Sustainability Goals, among others.

Alleima products in a nuclear power plant

Alleima offers an extensive range of products for nuclear applications, from steam generator tubes and nuclear fuel cladding tubes to a diverse variety of tube and pipe grades. Our advanced stainless steels, nickel-based alloys and zirconium grades have been integral to pressurized and boiling water reactors for more than 50 years. We also provide a wide range of seamless tube and pipe for primary, secondary and auxiliary system applications in nuclear power plants.



Whether you are retrofitting a boiling water or pressurized water reactor (BWR or PWR) or designing a new turnkey plant equipped with several pressurized water reactors (PWRs), we're ready to support you. Since 1964, we've worked with most reactor types and have now delivered tube bundles to more than 400 steam generators in over 20 countries. We encourage you to put our experience to work and bring us your toughest challenges.

Precision manufacturing of steam generator tubing

To support the stringent demands of our global customers, we operate one of the world's largest and most advanced nuclear tube lines in Sandviken, Sweden. The mill is roughly 340 meters long, and covers 12,000 square meters, or the equivalent of two soccer pitches. Our main focus is on premium stainless steel and high nickel alloy steam generator tubing that is engineered to meet the world's toughest industry requirements.

Signal-to-noise ratio of 15:1 or better
The tubes produced at our mill in in Sandviken meet the most stringent Eddy Current multifrequency demands and have a signal-to-noise ratio of 15:1 or better. This ensures the absence of any surface or sub-surface flaws.

Alloy 690 and Alloy 800
Thanks to our fully integrated manufacturing setup, we can maintain very tight quality control – from melt to final tube. Production is focused on steam generator tubing in outer diameters of 10 – 25.4 mm (0.3937 – 1.000"). The main materials are Alloy 690 (Sanicro® 69, UNS: N06690) and Alloy 800 (Sanicro® 30, UNS: N08800), all produced in accordance with ASME and RCC-M standards.



One of the world's largest dedicated mills for manufacturing steam generator tubes in Sandviken, Sweden.

More than 400 tube bundles (approx. 2,600,000 tubes) supplied to nuclear steam generators in 20 countries.

Alloy 800 (Sanicro® 30, UNS: N08800)	Alloy 600 (Sanicro® 70, UNS: N06625)	Alloy 690 (Sanicro® 69, UNS: N06690)
First delivery 1968	First delivery 1972	First delivery 1987
Delivery of > 150 tube bundles	Delivery of 75 tube bundles	Delivery of >150 tube bundles

Whatever type of plutonium, uranium or other fuel you are using, our aim is to ensure you get a sustained, concentrated, highly efficient fission reaction. To this end, our zirconium alloy nuclear fuel cladding tubes is optimized for most fuel designs and most technical specifications. Since 1964, we've provided more than 65,000,000 meters of nuclear fuel tubes for more than 100 reactor units worldwide.

Whatever your fuel type, we've got you covered

Alleima manufactures zirconium alloy nuclear fuel tubes in a completely integrated process. This end-to-end process enables us to control and optimize a wide range of critical process parameters to safeguard the extremely high quality and material property demands.

The result is safe and trouble-free performance during the targeted life time of the nuclear fuel elements, of which the cladding tubes are the most critical component.

- We manufacture tubes for the following reactor types:
- PWR/VVER
 - BWR
 - CANDU
 - AGR
 - LMFBR

Since 1964, we've supplied more than 65,000,000 meters of nuclear fuel cladding tubes to more than 100 reactor units worldwide.

Boiling Water Reactors (BWR)	
Fuel designs	8 x 8, 9 x 9 and 10 x 10
Grades	Zircaloy-2, Zircaloy-2 variants and new developments
	Zircaloy-2 plus an inner surface liner of alloyed or pure zirconium
Size range:	OD 9 – 25 mm (0.354 – 0.984")
Pressurized Water Reactors (PWR)	
Fuel designs	15 x 15, 16 x 16, 17 x 17, 18 x 18 and VVER
Grades	Zircaloy-4
	New zirconium-based alloys
Size range	OD 8 – 15 mm (0.315 – 0.590")
Heavy Water Reactors (HWR, CANDU)	
Grades	Zircaloy-4
Size range	OD 12 – 16 mm (0.472 – 0.630")

In addition to our focus on SGT and fuel rods, we offer an extensive program of tube and pipe for the primary, secondary and auxiliary systems of nuclear power plants. Our program covers a wide range of high alloy austenitic seamless stainless steel and nickel-based alloys for Class 1-3 ASME and RCC-M tube and precision strip steel.

Take advantage of our extensive nuclear program and expertise

Alleima's nuclear tube sizes range up to 260 mm in outer diameter (OD) and are supplied in seamless condition. All tubes are produced in accordance with ASME and RCC-M standards.

Application examples:

- Piping systems for primary, secondary and auxiliary equipment
- Control rod guide tubes
- Heat exchanger tube (Straight or U-bent)
- Feeders for light water primary reactor cooling systems

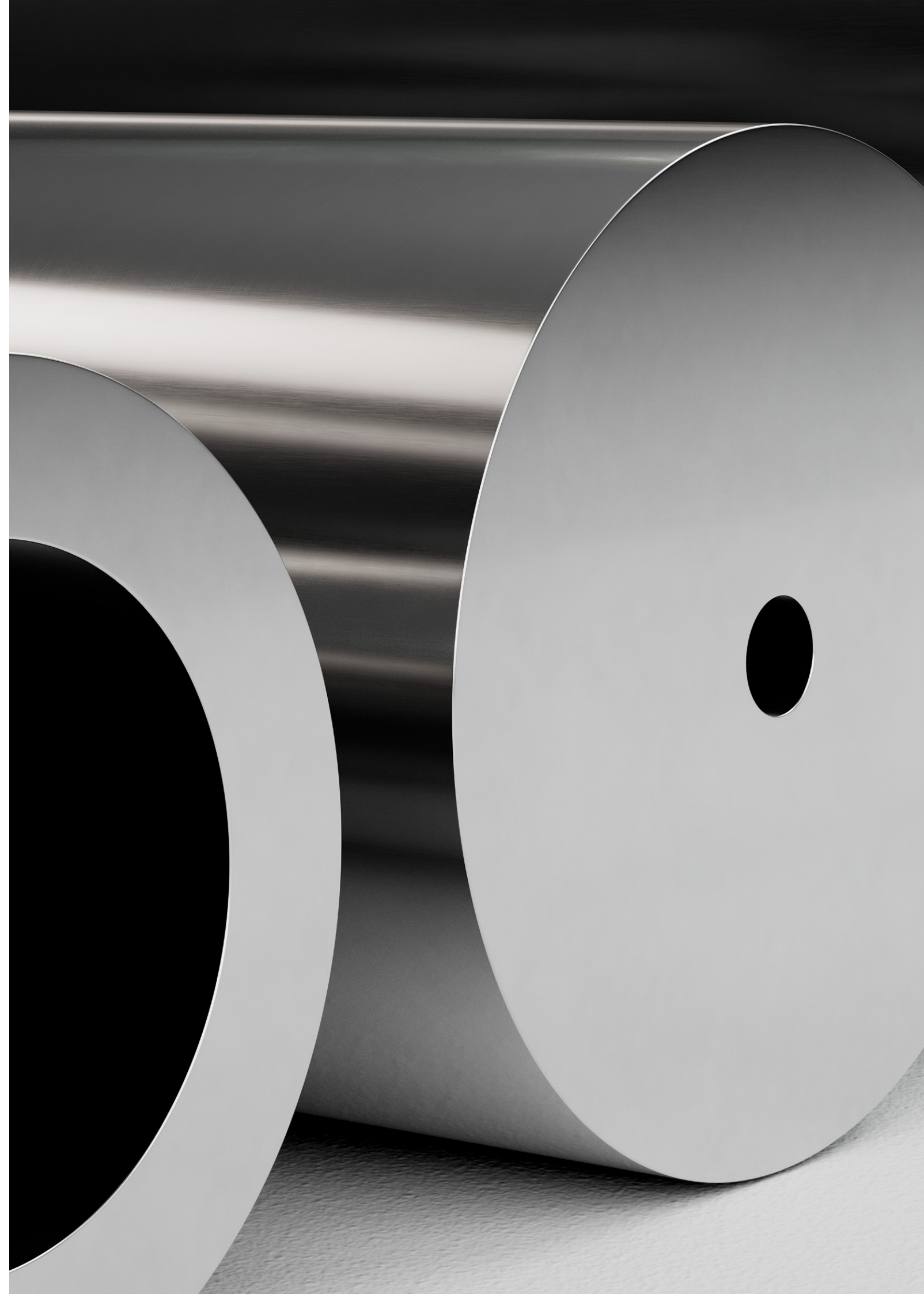
High-quality strip steel

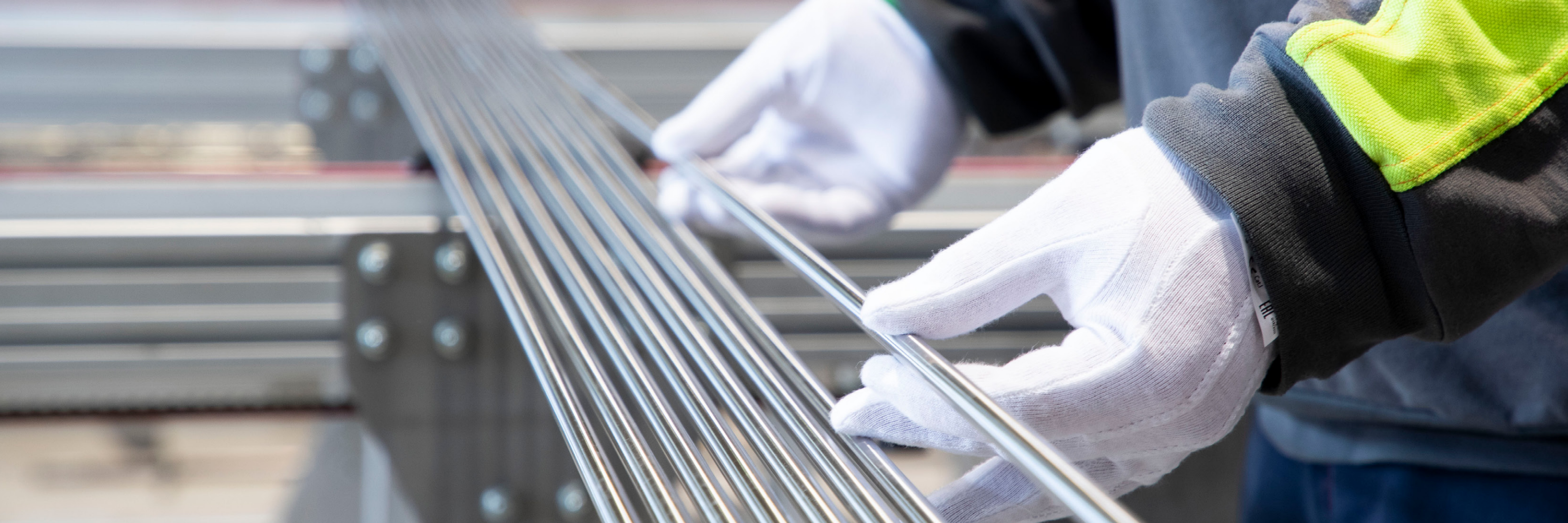
Alleima is one of the world's leading manufacturers of precision strip steel. In nuclear power plant applications, our strip is typically found in positioning grids, hold-down springs and debris filters. The nickel-based alloy Sanicro® 75X, for example, is particularly well suited to nuclear power applications due to its extremely low cobalt content (less than 0.05%).

Nuclear tube and pipe program

Tube and pipe for piping systems:
 Grades: ASTM 304L, 316L, 321 or according to customer specifications, e.g. with low cobalt content.
 Size range: Outer diameter, 13 – 260 mm.
 Standards: ASTM A312, RCC-M3304.

Thick-wall tubes for control rod assemblies:
 Grades: ASTM 304L, 316L, 321 and RCC-M Specific Grades or according to customer specifications, e.g. with low cobalt content.
 Size range: Sizes up to 270 mm (10.630").





Advancing Small Modular Reactors and Generation IV Technology

High-performance nuclear power tubing – engineered to withstand extreme heat, pressure and corrosion.

Currently, we are teaming up with both established and new industry players to support the emerging market for small modular reactors (SMRs) and new designs for Generation IV reactors. This includes developing seamless tubing to handle a wide range of coolants – from water and lead to sodium, molten salt and helium.

SMR applications	SMR benefits	Tube grades	Key tube benefits
<ul style="list-style-type: none">– On-grid sites– Off-grid sites– Marine	<ul style="list-style-type: none">– Compact design– Lower capital costs– High efficiency– Versatility away from large grids	<ul style="list-style-type: none">– Sanicro® 69 (NO6690/Alloy 690)– Sanicro® 30 (N08800/Alloy 800)– Zirconium– Other materials	<ul style="list-style-type: none">– Dedicated local mills (US, EU)– Integrated production– Full traceability from melt to final tube– Tight tolerances– Ease of welding, bending– U-bent formats

Consistent quality – the key to trouble-free performance

When it comes to testing, all of our nuclear-certified mills undergo a battery of stringent tests and fulfill tough quality parameters. Our quality assurance system is implemented throughout the organization and certified to a number of quality management standards, such as ASME NCA 3800, ISO 9001, RCCM, and ISO/TS 16949. All our production units are also certified to ISO 14001, a widely accepted international standard for environmental management.

Environment, health and safety
Environmental awareness, health and safety are integral parts of our business and are at the forefront of all activities within our operation. We hold ISO 14001 and OHSAS 18001 approvals. We are also committed to the UN Sustainability Goals and the Science-Based Targets initiative.

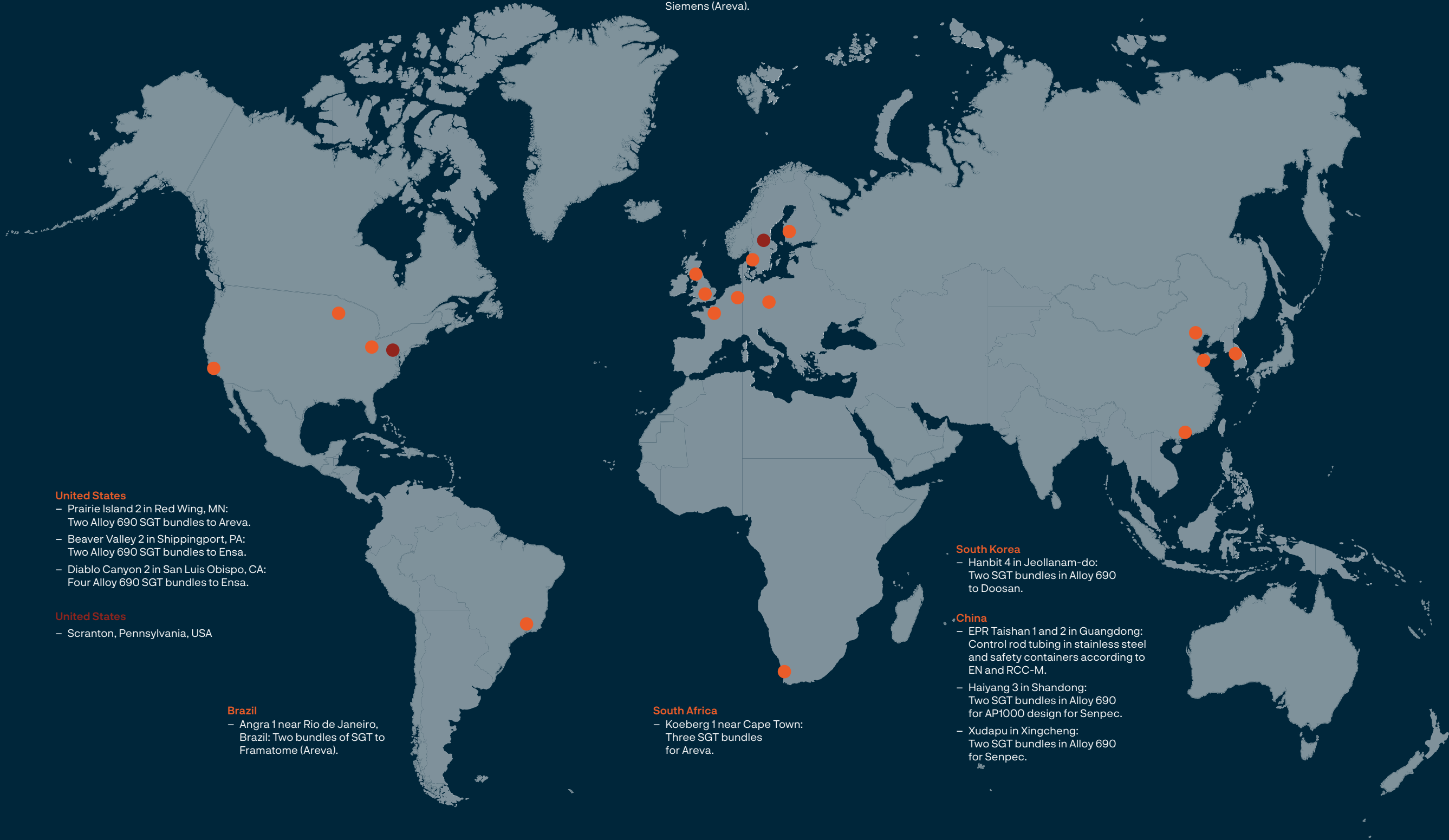
From melt to final tube
Our quality control process starts from the melt stage with a material content analysis and continues through each stage of production, including extrusion, pilgering, and inspection, testing and marking – and all documentation.

- Examples of testing**
- Tensile test
 - Corrosion test
 - Ferrite determination
 - Hardness test
 - Surface roughness
 - Microstructure and grain size
 - Flattening test
 - Flaring test
 - Ring expansion test
 - Eddy current test from outer and inner side of the tubes
 - PMI test
 - Chemical composition
 - Ultrasonic testing for flaws and dimensions

Global presence, local commitment

Selected references of nuclear power tube deliveries to more than 100 plants in 20 countries.

- Power plant project examples
- Nuclear tube manufacturing plant



United States

- Prairie Island 2 in Red Wing, MN: Two Alloy 690 SGT bundles to Areva.
- Beaver Valley 2 in Shippingport, PA: Two Alloy 690 SGT bundles to Ensa.
- Diablo Canyon 2 in San Luis Obispo, CA: Four Alloy 690 SGT bundles to Ensa.

United States

- Scranton, Pennsylvania, USA

Brazil

- Angra 1 near Rio de Janeiro, Brazil: Two bundles of SGT to Framatome (Areva).

UK*

- Sizewell B in Sizewell, Suffolk: Four Alloy 690 bundles for Westinghouse.
- Thorp / EVAP D in Sellafield: Piping meeting the stringent standards of the UK waste reprocessing industry.

* When we finish Manufacturing/Deliveries, or “Ongoing Contract to deliver” we will have delivered more than 1,200 tons of RCC-M Pipes for Project EPR HPC, Hinkley Point.

Sweden

- Ringhals 3 south of Gothenburg: Three SGT bundles of Alloy 690 to Siemens (Areva).

Finland

- Olkiluoto 3 in Eurajoiki: Four SGT bundles of alloy 690 SGT for Areva.

France

- >50 French nuclear power plants: Stainless Control Rod tubing, RCC-M piping applications and other special applications, such as measuring speed, temperature and pressure, since start of French nuclear program.

We have delivered more then 700 tons of RCC-M Pipes for Flamanville FA3 EPR.

Belgium

- Tihange 2 in Huy: Three SGT bundles of Alloy 690 for Mitsubishi.

Slovenia

- Krsko in Eastern Slovenia: Two SGT bundles of Alloy 690 for Siemens (Areva).

Europe

- Sandviken, Sweden

South Korea

- Hanbit 4 in Jeollanam-do: Two SGT bundles in Alloy 690 to Doosan.

China

- EPR Taishan 1 and 2 in Guangdong: Control rod tubing in stainless steel and safety containers according to EN and RCC-M.
- Haiyang 3 in Shandong: Two SGT bundles in Alloy 690 for AP1000 design for Senpec.
- Xudapu in Xingcheng: Two SGT bundles in Alloy 690 for Senpec.

South Africa

- Koeberg 1 near Cape Town: Three SGT bundles for Areva.

About Alleima

Alleima is a leading manufacturer of high value-added products in advanced stainless steels and special alloys as well as products for industrial heating. Based on long-term customer partnerships, we advance processes and applications in the most demanding industries. With more than 900 active alloy recipes, our offering comprises products for several customer segments, mainly seamless stainless tubes, electric heating technology and resistance materials, ultra-fine wire, and precious metals for use in medical devices and electronic appliances, as well as precision strip steel and strip-based products. Our fully integrated value chain, from R&D to end-product, ensures industry-leading technology, quality, sustainability, and circularity. Alleima, with headquarters in Sandviken, Sweden, has more than 5,500 employees and customers in approximately 90 countries.