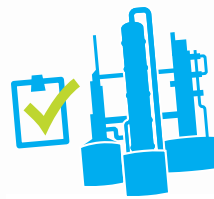




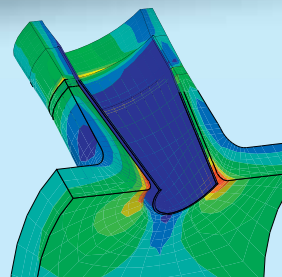
Siempelkamp

Prüf- und Gutachter-Gesellschaft

Testing – Calculation – Assessment



Worldwide –
Services for the highest
levels of safety, availability
and cost effectiveness of
systems and components



>>> www.siempelkamp-dresden.com

Siempelkamp

On the move in the service of maximum safety and availability

The firm Siempelkamp Prüf- und Gutachter-Gesellschaft mbH, or SPG for short, is a company within the globally active Siempelkamp Group. The group includes the three business divisions of Machinery and Plant, Foundry and Nuclear Technology. All over the world, we and our more than 3,000 employees help to make the corporate group and its technologies and service concepts one of the world's best.

For more than 50 years, SPG has been the specialist for testing, calculating and inspecting highly stressed systems and their

components. With our key skills of **Testing – Calculation – Assessment** we provide comprehensive services for the energy and power plant sector, as well as for the chemical and petrochemical industry. Our many years of experience, competent and qualified employees and our proven expertise help our customers to minimize their production downtimes, reduce standstill periods and improve quality.

Our services comprise:

- In-service inspections of systems and components such as piping systems, boilers, turbines etc.
- Strength calculations and service life evaluations of machines, systems and pipelines
- Material and component testing
- Online monitoring of systems and components by means of sensor application
- Factory approval/production and quality monitoring of sub-supplier
- Quality management during plant installation
- Expert report on the status of materials and corrosion
- Damage analyses / expert opinions
- Consulting on material and welding-related issues





Plant Inspection and Life Time Monitoring

For improvements in efficiency and minimizing downtimes

As an accredited inspection body, the Siempelkamp Prüf- und Gutachter-Gesellschaft assesses power plants and their components in accordance with statutory specifications and accepted guidelines. During a plant downtime, we offer our customers in the fields of energy and power plant engineering, chemicals and petrochemicals comprehensive and highly efficient services, which can also comprise the coordination of various trades. In this manner, the required plant inspections are performed quickly, reliably and in a targeted manner.

On the basis of component-specific fatigue level estimates, we make recommendations for further residual life assessment and the necessary inspection cycles of the plants and components analysed. Our expertise is based on the results of analyses which we have been performing for more than 50 years in our fatigue and creep testing laboratories. We have the necessary skills to estimate the long-term stability of the heat-resistant materials used in the plants as well as their welded joints.





Our plant inspection services comprise:

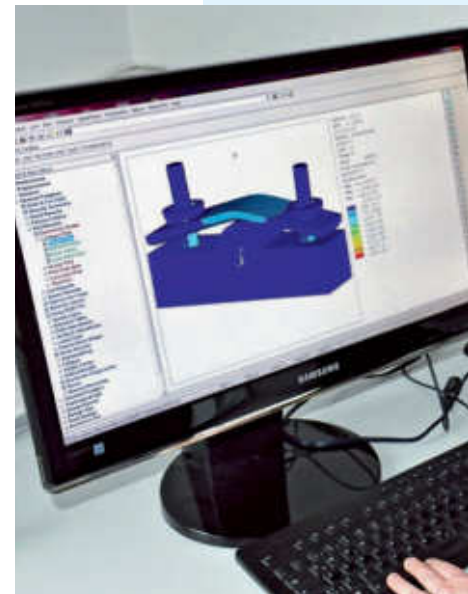
- Planning and realisation of inspection programs for life time monitoring
- Recording of the current condition and a resulting remaining service life assessment of power plant components
- Performance of non-destructive testing
- Mobile spectral analyses for a material identification test
- Portable metallography testing with subsequent microstructure assessment
- Damage investigations
- Quality assurance and manufacturing control, as well as supplier audits
- Advice on the use and optimisation of materials, as well as welding-related issues

Stress Analyses and Life Time Calculation

Reliable calculation of plant safety and availability

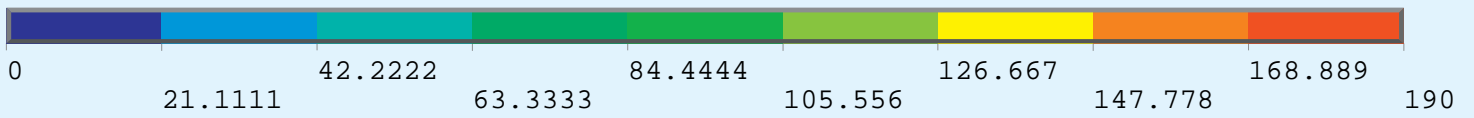
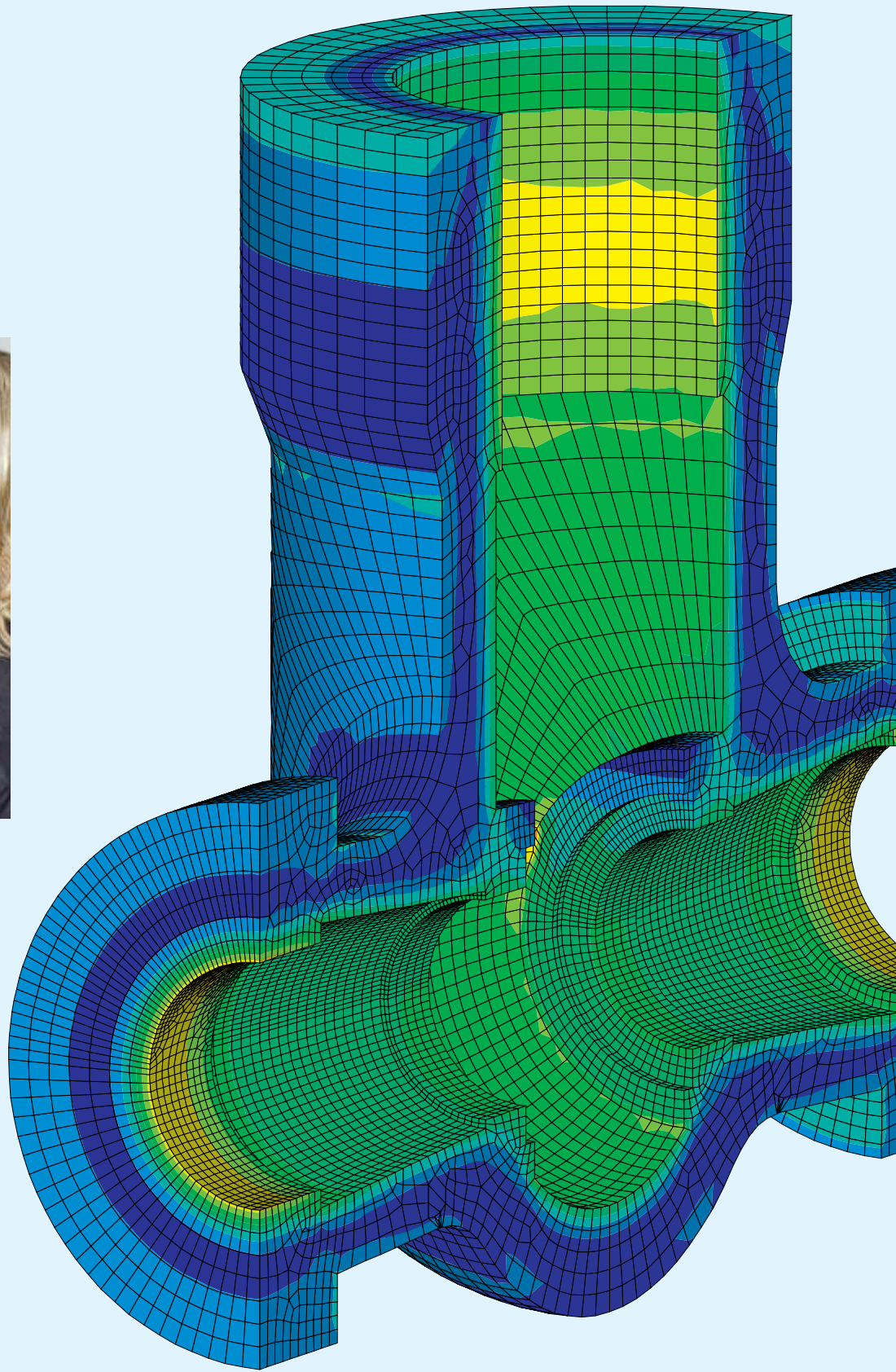
Static and dynamic stress tests as well as life time calculations make a significant contribution to the safety and availability of machines, plants and pipelines. This applies equally not only to nuclear and conventional power plants, but also to chemical and petrochemical plants. Here the standard regulations used in mechanical engineering, power plant and general plant construction apply. Formula calculations, tailor-made static and dynamic software or the finite-element programs ANSYS® and ABAQUS® are used from case to case as necessary.

For processes with high-level non-linear behaviour, such as the short-term dynamics of impact processes, also explicit FE programmes (LS-Dyna®, ABAQUS®/Explicit) are available. In the calculations, the relevant material properties are taken into account, e.g. linear-elastic, elastic-plastic or time-dependent (creep) behaviour. One possibility for verifying the calculation results is the combination with material and component tests.



Services in the Field of Stress Analyses:

- Stress and fatigue analyses
- Thermal and thermo-mechanical analyses
- Pipe system calculations and vibration analyses
- Structural analyses
- Dynamic calculations/crash simulation
- Load determination and evaluation based on measurement data
- Load-based design optimisation
- Accompanying /confirmatory experimental analyses





Material and Component Testing

Highest qualification through expertise acquired over many years and collaboration in teams of excellence

Our accredited test laboratory is equipped with state-of-the-art test machinery and measuring devices for comprehensive destructive and non-destructive material testing. The experienced team of Siempelkamp employees is certified for the processes involved in the non-destructive testing according to EN 473. Close cooperation between the SPG specialist departments of Material/Component Testing and Plant Inspection guarantees that customers in the fields of power plant engineering,

chemicals and petrochemicals are provided with the highest possible levels of expertise. The SPG team of excellence are experts in material behaviour and the damage mechanisms of heat-resistant steels, which we analyse on behalf of our customers. With our creep and fatigue testing laboratories, we can look back on a long-standing tradition and have at our disposal a capacity of 145 creep testing machines.

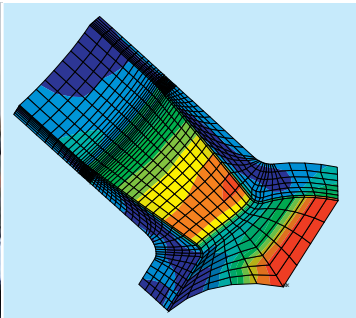
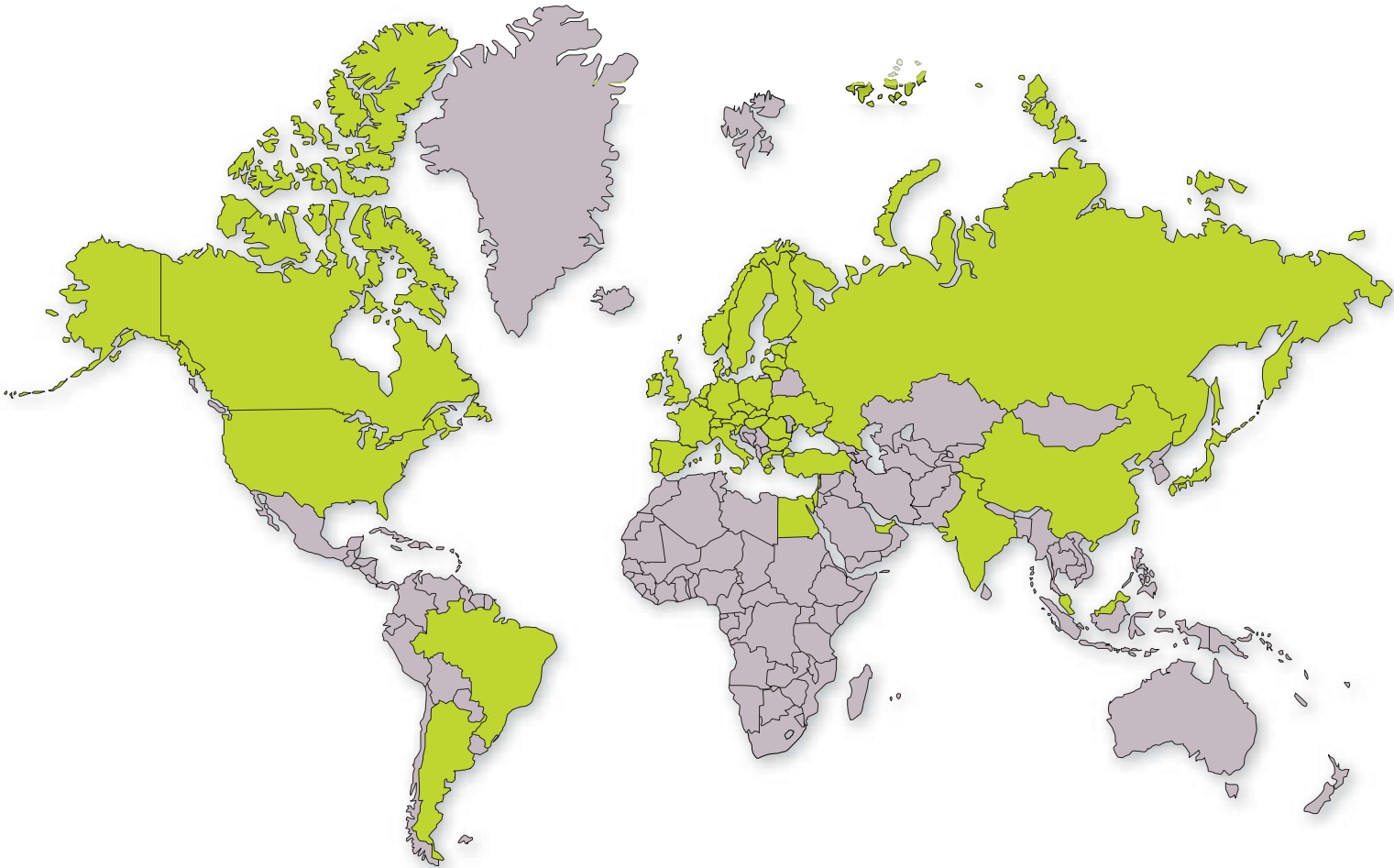


SPG Scope of Services in the Field of Material and Component Testing:

- Mechanical-technological materials testing
- Metallography and spectral analysis
- Stress-rupture test, creep and creep-crack analyses
- Non-destructive material test, including video endoscopy
- Welding procedure test and production control tests
- Residual stress measurements using hole-drilling methods
- Static and dynamic component tests, fatigue test
- Thermal mechanical internal pressure test and burst tests
- Sensor application (strain gauges for stress analysis, capacitive high-temperature strain gauges)
- Damage investigations and consulting on the use of materials

Services for Plants and Components

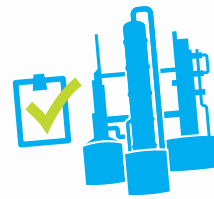
Tested, accredited and continually refined



The Siempelkamp Prüf- und Gutachter-Gesellschaft has been working for many years as a recognised inspection body for the customer and has had an accredited test laboratory for two decades. Certificates of qualification, supplier qualifications and safety certify our evidence of our secure and reliable
Testing – Calculation – Assessment:

- Accredited inspection body for in-service inspections of power plant components according to DIN EN ISO/IEC 17020:2012
- Accredited test laboratory according to DIN EN ISO/IEC 17025:2018
- Certificate of qualification for quality assurance in accordance with rule KTA 1401
- Recognised testing centre of TÜV SÜD Industrie Service GmbH
- SCC** certification (Safety Certificate Contractors)
- Qualified supplier in Connexio, the supplier information system for energy suppliers in Germany, Eastern and Central Europe

Not only the verifications and qualification of the SPG services feature our performance expectation. Our membership of and the associated collaboration and exchanges within associations and working groups are part of how we see ourselves in our service to customers. For the continued development of our expertise we take part in numerous national and European research projects.



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Memberships / Activities:

- German Society for Non-Destructive Testing (DGZfP) Association of Steam Boiler, Pressure Vessel and Piping Manufacturers (FDBR)
- Working group "Heat-resistant steels and high-temperature materials" in the association German Iron and Steel Institute (VDEh)
- Expert group "Damage investigation" (VDI)
- Working group "Creep/material power plant" (VdTÜV)
- Committee "Service monitoring for nuclear power plants" (DIN)





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Am Lagerplatz 6a
01099 Dresden
Germany

Phone: +49 (0) 351 / 824 93-20
Fax: +49 (0) 351 / 824 93-29
spg@siempelkamp.com

>>> www.siempelkamp-dresden.com