

**IABG. The Future.**



**Environmental and  
energy services**

**iABG**



**ENVIRON  
MENTAL**  
**SERVICES**  
**ENERGY**

# ENVIRONMENTAL SERVICES



Land recycling



Remediation



Environmental consulting



Environmental impact analyses

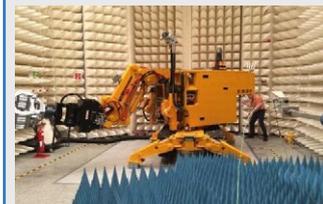


Project management

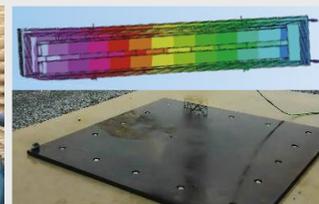
# ENERGY SERVICES



## Decommissioning, retrofitting and radiation protection



Qualification of plants and components



Testing and simulation of transport and storage containers



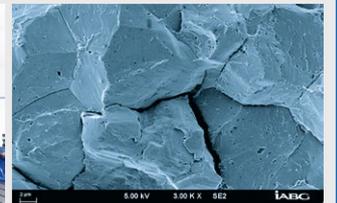
Climatic qualification



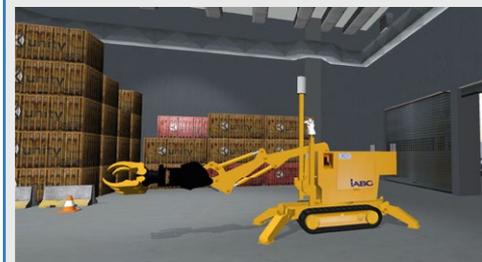
Multi-axis vibration and seismic testing



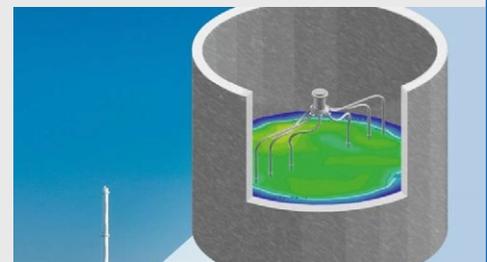
Seismic qualification via FEM



Failure analysis and materials testing



Virtual Reality



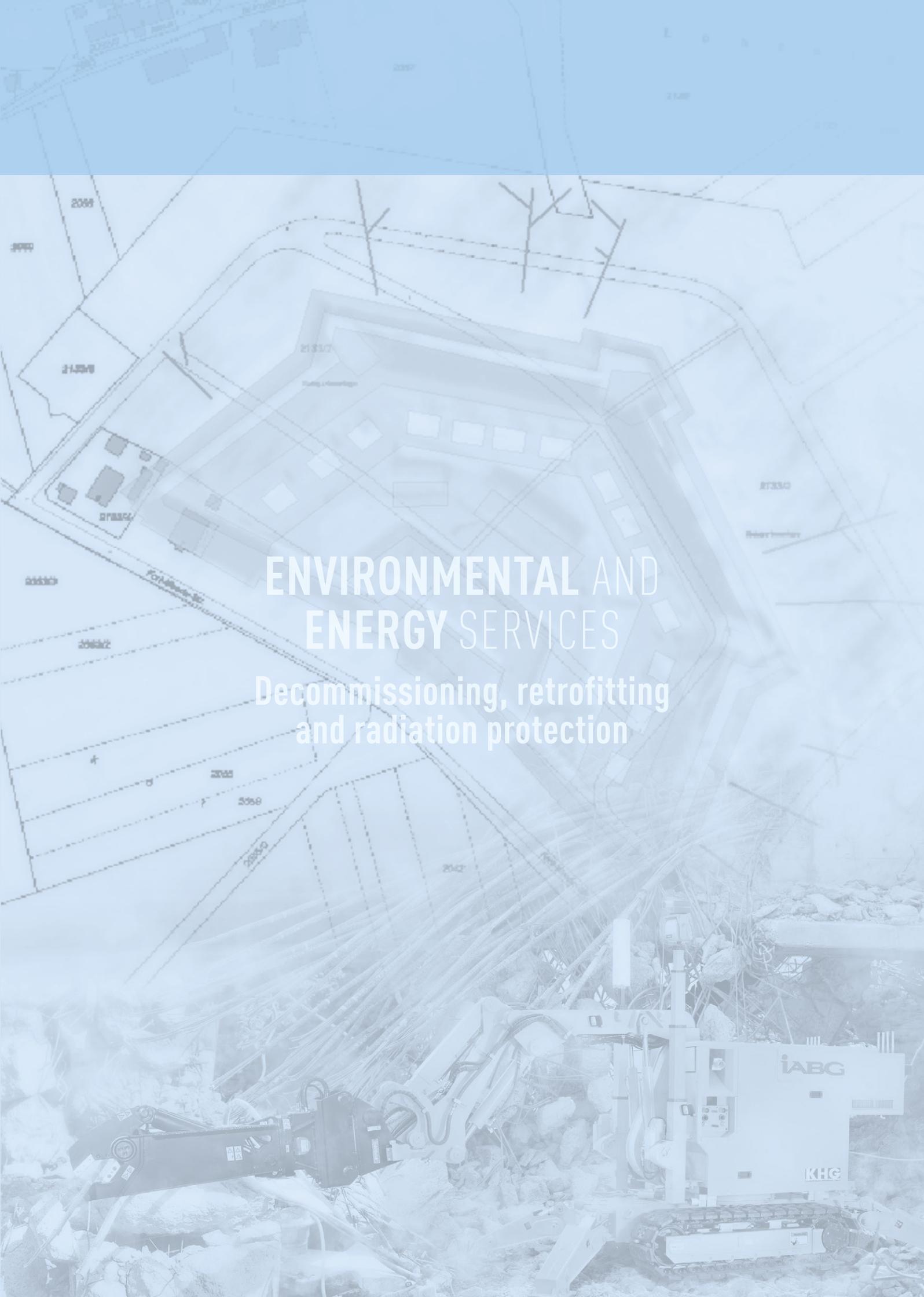
Adjustments of emission



Laser decontamination - LaPlus



Development and delivery of remote-control systems



# ENVIRONMENTAL AND ENERGY SERVICES

Decommissioning, retrofitting  
and radiation protection



## Environmental services

### We support the turnaround in German energy policy

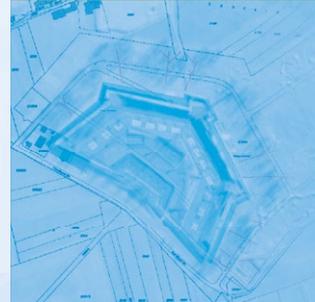
Based on our longstanding know-how, we develop sustainable and cost-oriented solutions for the exploration and assessment of waste residue for complex environmental projects. Our environmental remediation experts conceptualize and implement the revitalization of industrial brownfields and the conversion of former military and armament sites.

We support the turnaround in German energy policy by providing our technical expertise for the deconstruction of nuclear power stations and the use of regenerative energy generation plants. Our focus regarding regenerative energy thereby lies on the qualification and engineering of wind energy plants and on examining the potential applicability of regenerative energy generation plants.

### Our services

- Contaminated site remediation
- Remediation
- Environmental consulting
- Environmental impact analyses
- Project management





## Contaminated site remediation for former industrial, military, and ordnance sites

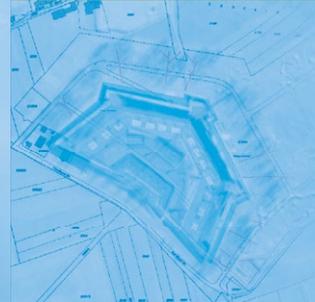
As an independent service company, we possess current expert knowledge from 30 years of experience in national and international projects. Even today, former industrial and commercial sites oftentimes pose a hazard to humans and the environment, due to decades of production and the use of a multitude of substances.

In addition to conventional pollutants, particularly military and armament sites – such as production plants, munitions institutes, weapons disposal sites, explosion sites and sites where bombs were dropped, etc. – are burdened with explosive substance compounds and chemical warfare agents and their degradation products. In any case, waste residue poses a severe obstacle for the reuse of these areas.

IABG specialists possess the required precise skills and the specialist knowledge regarding the construction of facilities, technological procedures, and the diverse chemical degradation processes of highly toxic environmental pollutants that are related to various sources of waste residue.

### Our services

- Determining the pollutant burden using load profiles
- Remedial investigations and risk assessment
- Remediation planning and technical supervision
- Implementation and management of remedial measures
- Waste disposal management
- Monitoring
- Conversion and environmental management
- Conducting expert training
- Aftercare and recultivation



## Remediation

Even today, old industrial and commercial sites are often still a danger to people and the environment due to decades of production and utilisation of all sorts of hazardous materials. In particular former military and armament sites like production factories, ammunition dumps, facilities for the disposal of explosive ordnance, shelling and bombing sites, etc. are contaminated with explosives, explosive ordnance and their degradation products in addition to the usual pollutants. In such cases, the contaminated sites are an enormous obstacle for the reutilisation of the land areas.

The IABG specialists solve even the toughest of problems. Here, specific knowledge beyond general expertise in contaminated sites is required about how the plants were constructed, about the technical procedures and about the often highly poisonous and carcinogenic materials involved in industrial and armament-related contamination.

### Our services

- Remediation planning and investigation
- Remediation of commercial and industrial sites
- Remediation of military and armament contaminated sites
- Biological remediation procedures

### Additional services

- Cost estimation
- Utilisation concepts
- Coordination with authorities/moderation
- Public relations/site marketing
- Planning and support for deconstruction
- Construction site management and monitoring
- Construction site logistics
- Property management/information systems



## Biological remediation procedures

### DROP – Decontamination and Revitalisation of Oil-Polluted Land

#### DROP

- is a biological remediation procedure for soil and ground water
- is a joint development of the companies IABG and Henkel/ognis
- is a procedure that has been developed especially for large-area contamination with biologically degradable materials like mineral oil and fuel
- can be used in-situ and ex-situ and combined easily with other procedures
- is soil conserving
- is environmentally friendly
  - no washing out of soil content or contaminants into the ground water
  - no soil excavation, no soil transport
  - exclusive use of easily biodegradable materials (mainly approved food/fodder) on the basis of natural raw materials

DROP requires very little equipment technology and can also be applied in water protection areas.

### BioREx – the new on-site procedure for decontaminating sites contaminated with explosives

- no toxicological/ecotoxicological-related metabolites
- suitable even in cases of heavy contamination
- cost-effective



## Environmental consulting

### Experience and specialized knowledge in environmental consulting

As an independent service company, we possess current expert knowledge from 30 years of experience in national and international projects. As such, we pride ourselves in environmental consulting from an engineering perspective, which is particularly valued by our regular clients of the public and private sectors alike. Our longstanding experience and our specialized knowledge are the basis on which our clients entrust us with technically demanding cases.

Our thematic focus includes consulting in plant-related water protection and incident management, flood risk management planning, the remediation and aftercare of military and armament waste residue, the conversion of civil and military properties, technical project management, the preparation of manuals and study guides in the context of research programs, securing old waste deposits or former landfills, as well as deconstruction and dismantling including land development.

Our consulting services are complemented with hands-on project management

- Consultancy services in the field of civil and military waste residue, conversion, and environmental management for ministries, administrations, and the corporate sector
- Conducting expert training
- Technical support services
- Conducting ground, groundwater and water analyses
- Site investigations for renewable energies



## Environmental impact analyses

### for technical products as part of consumer product management

The environmental impact assessment (EIA) is the central base for realising the element of environmental protection for a project or product. EIA covers the whole life cycle of a project or product. In the EIA we indicate which avoidable or unavoidable environmental impacts are to be expected and what are the options for reducing or avoiding the impacts. We point out an additional need for analysis if further undefined environmental impacts are suspected

For the EIA, the product is always broken down into modules and submodules, and these in turn are broken down again into parts. Generally, the data acquisition is done at a part number level. If this is unavailable or impractical, the smallest unit possible is taken, the so-called line replaceable unit (LRU).

For the individual environment-related project phases or environmentally hazardous components of a project, we determine the media (soil, water, air, radiation, noise) for which potentially exist environment-related risks. These parts are labelled and documented.

To conclude, we consider whether measures for protecting the environment have been taken or should be defined. With regard to the environment and media, the focus of the assessment is on

- Materials
- Operating supply items and auxiliary material, consumables
- Energy
- Emissions/immissions

and based on this, a list of hazardous materials is drawn up and a disposal concept developed for the product.

### Our services

- Product description, intended use
- Determination of relevant legal provisions
- Compliance of environmental impact assessment with legal provisions
- Listing of hazardous project and product components
- Disposal concept
- Documentation



## Project management

Professional project management is essential for the successful execution of complex procedures. In an age of growing networks, companies and authorities are often confronted with tasks which, in addition to large, long-term and thus practically independent projects, go beyond the daily business and which cannot be mastered at all or not in time with internal capacities.

The specialists from IABG, experienced project managers with a wide range of expertise, are ready to accompany our customers in particular in the project startup phase and coordinate the complete project from beginning to end as required. As experts and technical consultants, we assume the tasks of project or programme director or also the tasks of the project management office (PMO).

The know-how and routine from project management combined with the relevant expertise form the basis for successful performance of complex environmental consulting services among other things for:

- Research and development projects
- International environmental services
- Former industrial, military, and ordnance sites
- Deconstruction and land recycling
- Site damage analysis through to remediation and aftercare
- Site assessments for renewable energies
- Coordinating with authorities

**Our services** include the complete project cycle and are adapted to the client's requirements.



## Decommissioning, retrofitting and radiation protection

The focus of our services regarding the decommissioning of nuclear facilities is on the technical aspects as well as the quality assurance of mechanical and civil engineering services.

We provide support for all phases of the decommissioning process – from planning to the removal of nuclear components, including consultation on disassembly technology, approval procedures or assistance for qualified auditing.

We assist with examinations and quality assurance measures for decommissioning nuclear facilities at the highest technical level. We provide our customers with tailor-made, interdisciplinary solutions considering realistic risk scenarios, tests and controlling.

We consult in the redesigning, calibration and qualification of exhaust air monitoring systems in the case of the need for retrofitting due to new requirements or changes in the legal regulations.

Upon request we also analyse the operating conditions of your product to devise a custom test program for product qualification.

### Our services

- Planning, project support and consulting during decommissioning and removal of nuclear power plants (mechanical and civil engineering)
- Services from concept planning to preparation of contract documents
- Expert consulting on disassembly technology
- Development, definition and implementation of tests and quality assurance measures for the decommissioning of nuclear facilities
- Retrofitting and radiation protection for nuclear facilities in operation and in decommissioning.



## Qualification of plants and components

For each plant and component used in the nuclear field, proof of proper function has to be provided – for the expected operating and environmental conditions and complying with the required precision and specified properties.

From component to complete system, tests for product development and qualification can be performed manufacturer-independent on the numerous test systems:

- Climate tests
- Transport and shock test
- EMC tests
- Thermal and mechanical ageing
- Seismic tests
- Drop tests

### Our services

- Consulting in the type testing of components for nuclear technology
- Execution of practical tests
- Creation of theoretical calculations and simulations
- Support in the drafting of test documentation
- Intermediate and final acceptance of components on customer's behalf
- Test support for mock-ups
- Review of prequalification documents
- CE conformity checking

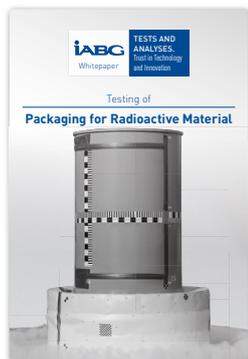




## Testing of packaging for the safe transport and storage of radioactive material

In the development and approval process of transport and storage packaging, different conditions of transport have to be demonstrated or proof of design has to be submitted as part of the approval process. We support you in preparing, executing and performing tests according to your specifications.

Years of experience and our extensive array of test infrastructure enables us to provide you with custom solutions for the complete testing and qualification process during your product development cycle. The newest addition to our test infrastructure is a drop test facility for specimens up to 65t.



Our white paper on the requirements and challenges of container inspection is available on request. Please send an email to [TA-Marketing@iabg.de](mailto:TA-Marketing@iabg.de). We will treat your information confidentially, will not publish it and will not pass it on to third parties.

### Our services

- **Preparation, execution and processing of drop tests according to customer specifications**
  - Instrumentation – assembly and handling tasks – leak testing – conditioning – 3D measurement – execution of drop tests – inspection & NDT
  - Systematic damage analysis
- **Unyielding Target for drop tests**
  - Total weight: 680 t
  - Impact plate: 6x4 m
  - Crane: 2x65t, lifting height 22 m
- **Metrology**
  - Photron high-speed cameras
  - Data acquisition systems up to 4 M-samples
  - Carl Zeiss GOM 3D metrology systems
- **Simulation**
  - Static and highly dynamic FE analysis
- **Component and material tests**
  - Transport and shock
  - Seismic
  - Climatic
  - DAkkS-accredited fatigue strength and material property testing laboratory
  - Failure analysis laboratory (VDI 3822)
  - Custom test ups for components



## Climatic qualification

During use, technical products are subject to diverse environmental influences that affect their performance and service life.

For product development it is crucial to have a good understanding of the functionality and how environmental conditions affect it.

We let the components age in a very short time in the laboratory. Our findings flow directly into the product development of our customers.

We have been testing products and components for many years in the energy sector, and in the automotive and aerospace industries.

Benefit from our competence and long-standing experience: We advise and assist you in development and acceptance testing, in assessing test items as well as documenting and interpreting test results. In close cooperation with you, we will help optimise your product line.

We test in compliance with standard specifications such as DIN EN 60068-2, MIL-STD 810, RTCA/DO-160 and ISO 16750, as well as according to the specific standards.

### Our services

- Environmental and functional tests under the influence of temperature, humidity, solar radiation and reduced air pressure (altitude)
- Ageing of parts and components



## Multi-axis vibration and seismic testing

With two technically advanced facilities for experimental vibration testing, IABG helps manufacturers and system operators avoid failures with a method of experimental verification of stress-related designs.

In order to meet the high demands for quality, the IABG is accredited in vibration testing and earthquake simulation in compliance with DIN EN ISO 17025.

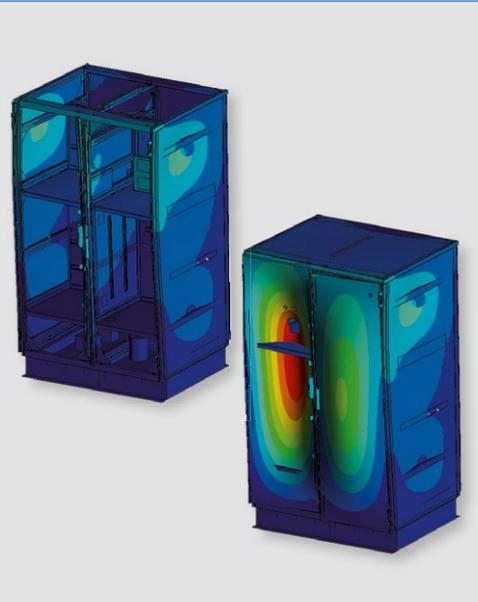
Based on our accreditation we test in compliance with common standards such as IEEE344, IEEE693, IEC 60980, IEC 61373, IEC 60068-2-6 and many more, as well as according to customer-specific standards.

For over 30 years we have been qualifying components from the following sectors:

- Nuclear power
- Wind power
- Medical technology
- Railway vehicles
- Automotive
- Aeronautics

### Our services

- Experimental vibration testing with simultaneous multi-axle excitation in all six degrees of freedom (6DOF)
- Stochastic and transient
- acceleration profiles are created based on required response spectra (RRS or PSD) according to the following specified test regulations, for example.
- Real-time profiles (e.g. El Centro, San Fernando VERTEQII) are stored in the signal library of the process computer
- HyMAS (Heavy Multi-Axis Shaker)
  - Frequency range 0.5 to 100Hz
  - Max. load 12,000kg
- LiMAS (Light Multi Axis Shaker)
  - Frequency range 0.5 to 200Hz
  - Max. load 1,000kg
  - Ambient temperature -40 to +95°C
  - Rel. humidity up to 95%



## Seismic qualification via FEM

### Calculating the strength of mechanical structures under seismic loads

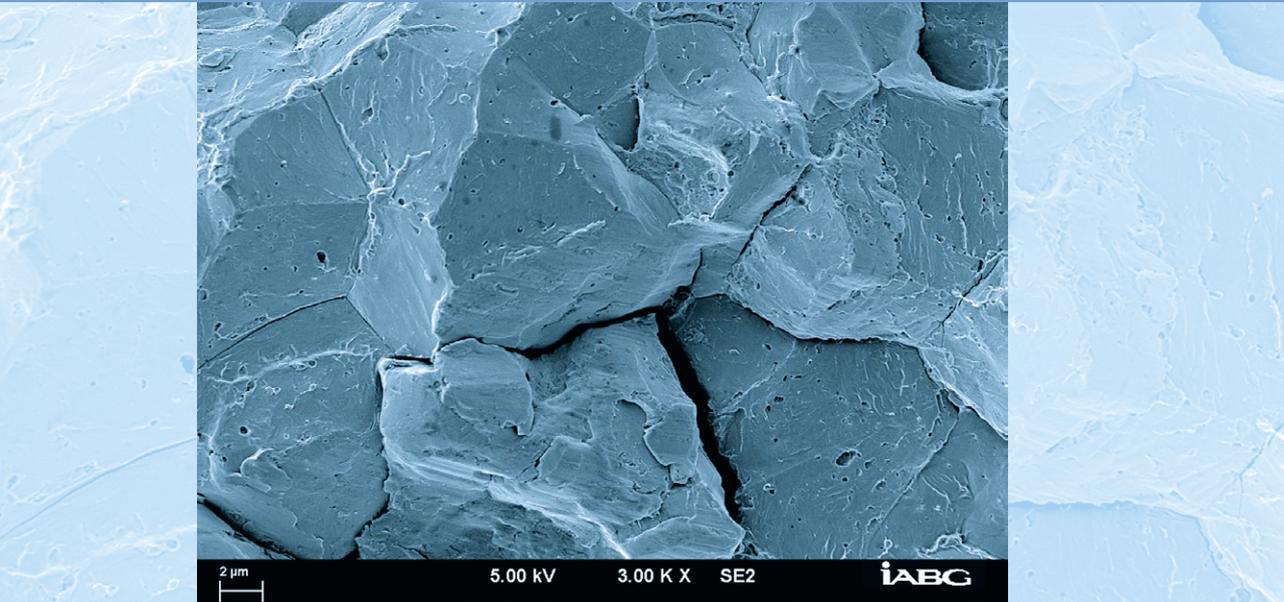
The security and serviceability of plants and assemblies in earthquake-prone areas requires proof of stability, integrity and reliability of devices and components under earthquake-specific loads.

### Benefits of calculated analyses

- Valuable input at an early stage in the design phase
- Component optimisation
- Complete strength evaluation or calculated evaluation as supplement to the acceptance test
- Cost-efficient comparison of the impact of different response spectrums
- Early strength evaluation for new products by applying updated FE model properties from previous projects

### Our services

- Consulting on and creation of seismic designs
- Derivation of seismic load assumptions from national and international standards (IEEE693-2005, KTA 2201.4, DIN EN 1998-1, IEC 980, IEEE 344-2004)
- Calculated modal, frequency response, transient and (shock) response spectrum analyses
- Alignment of FE models with test data
- Fatigue strength evaluation according to standard guidelines (e. g. FKM guideline for analytical strength assessment, VDI2230, VDI2014)
- Components and systems tests



## Systematic failure analysis

### VDI 3822-Compliant failure analyses

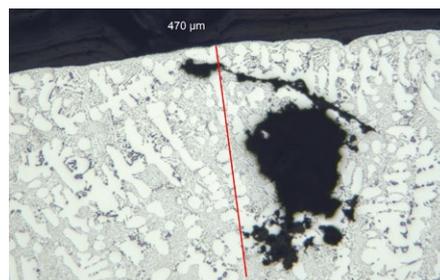
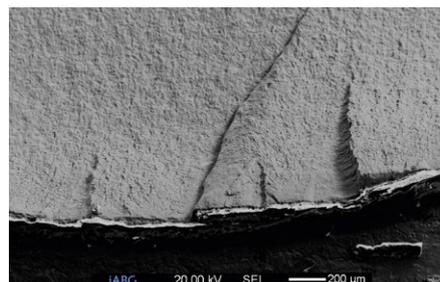
- Determination of the active damage mechanisms
- Deduction of possible damage causes
- Creation of evaluative failure reports
- Damage reconstruction through simulation tests
- Definition of remedial measures
- Consulting on failure prevention and on the design, construction and testing of components
- Component testing on-site and in the laboratory

### Cross-industry services

- Examination methods
- Macroscopy
- Light microscopy
- Hardness tests
- Scanning electron microscopy
- Chemical materials analysis
- X-ray inspection (2D/ $\mu$ CT)
- Residual stress measurements by x-ray
- On-site examinations

### Your advantages

- Short reaction times
- Immediate processing
- Failure analysis hotline: [schadensanalyse@iabg.de](mailto:schadensanalyse@iabg.de)





## Material tests

### Methods

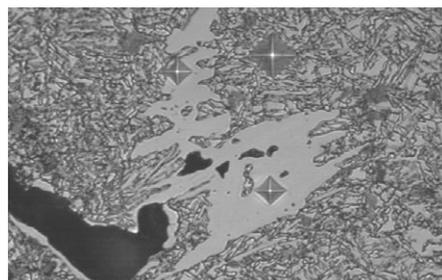
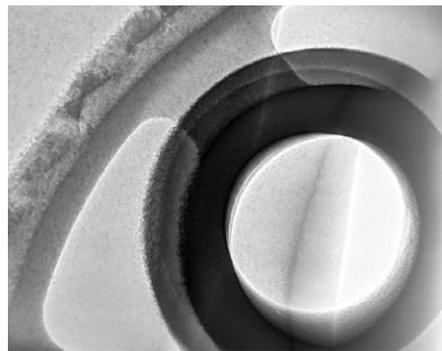
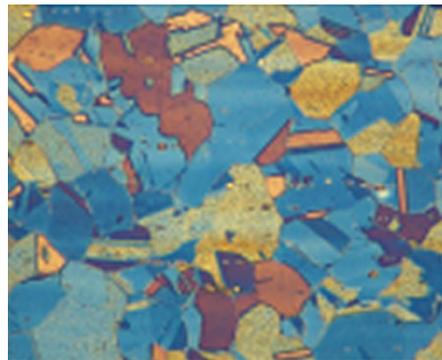
- Light microscopy
- Scanning electron microscopy
- Hardness tests
- Chemical analyses
- X-ray inspections (2D,  $\mu$ Ct)
- Fluorescent dye penetrant test
- Residual stress measurements by x-ray
- Exposure and corrosion testing

### Applications

- Examination of macrostructures and microstructures
- Determination of material strength at macrostructure and microstructure levels
- Evaluation of primary shaping and forming processes
- Evaluation of manufacturing processes
- Surface roughness measurements
- Fractography
- Non-destructive material tests
- Resistance examinations

### Method development

- Cross-sector and cross-material materials testing
- Creation of specifications
- Consulting on QA measures
- Development of incoming goods inspections
- Consulting on material selection and optimisation





## Virtual Reality

### IABG services

- Support during the design of technical components through 3D virtualisation
- Training and evaluation of personnel for new concepts and innovative systems
- Improved visualisation of planning projects
- Publications and public relations using 3D models
- Quick and efficient capturing of areas, buildings and objects using photos and subsequently generating 3D models
- Optimisation of processes by visualisation of operations planning, situation maps and scenario analyses
- Creation of semantic BIM models
- Networking of multiple users and/or AI operators
- Testing of real and/or virtual devices and machines in real and/or virtual environments
- Environment simulation (light/weather), process simulation according to the physics engine
- Quick and flexible scenario generation and analysis
- Fast integration of already existing models into the VR environment
- Visualization of integrated databases

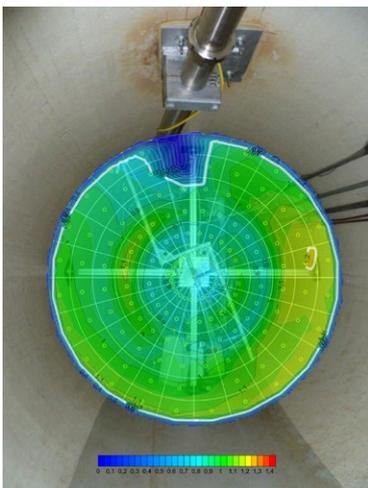




## Verification and adjustments of emission monitoring equipment

Room and exhaust air monitoring systems in nuclear facilities have to be constantly up to date with the latest science and technology standards and meet the current specified regulations.

The transition to decommissioning and the actual deconstruction phase, characterised by very unstable ventilation conditions, modify the requirements for the monitoring systems and make renewal indispensable. Variable volumetric flow rates, modified aerosol particle distribution caused by the deconstruction work or an inflexible layout of the monitoring system that cannot comply with the decommissioning concept, are just a few examples.



### Our services

- Design of an optimised emission monitoring system
- Theoretical assessment and calculation
- Implementation planning for new ducts, sampling systems and measuring devices taking into account all the conditions, parameters, standards and guidelines
- Qualification of the air sampling site and of the air sampling ducts according to DIN ISO 2889
- Qualification and calibration of the velocity and volume flowrate of exhaust air according to ISO 10780
- Assistance with reconnection and (re) commissioning activities
- Creation of technical and legal documentation for nuclear application documents



## LaPlus

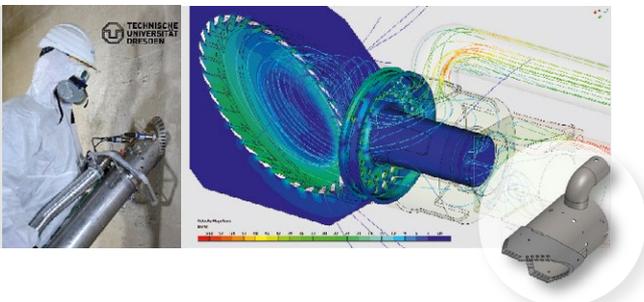
### Laser decontamination

The decontamination of painted surfaces is one of the most labour-intensive steps in the deconstruction of nuclear facilities. Large areas of metal or mineral components have to be cleared of paint and impurities to enable clearance measurements. An additional challenge here is the removal of coating systems containing PCBs, because these are potentially carcinogenic. Using laser for removal burns the coating and the PCBs react and turn into harmless products.

As part of a research project together with the TU Dresden and the TU Bergakademie Freiberg IABG developed a tool attachment for mobile use of the laser decontamination system. The aim of this research project was to transfer the findings from previous research projects from the laboratory to practical application. This was a success and was convincingly proven in trials on the premises of the reprocessing plant in Karlsruhe (WAK).

### Our services

- Turnkey: development according to customer specifications through to realisation and commissioning
- Metal and concrete: material-specific tool attachments
- Flexible component configuration: modular design enables adjustment to surface properties (corners, for example)
- Testing before manufacturing: configuration of flow characteristics using FEM simulation
- Process monitoring: online monitoring for the disintegration of PCBs
- Flexible application: mobile or remote-controlled utilization



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## Development and delivery of remote-control systems

The disaster of Fukushima Daiichi in 2011 increased worldwide awareness of the risks and problems posed by nuclear accidents and the value of a specialised in-house emergency protection system. In Germany, this service is provided by *Kerntechnische Hilfsdienst GmbH (KHG)* in Karlsruhe. KHG provides remote-controlled manipulator systems of different sizes and can perform on-site recovery tasks where dose rates (contamination levels) are extremely high. IABG developed the HMS for KHG based on a standard small-sized remote-controlled excavator, which has often been deployed for dismantling nuclear plants.

### Customer benefits

- The HMS will serve *Kerntechnische Hilfsdienst GmbH* as an additional very versatile manipulator system.
- Its modular design and the use of industry-standard components guarantee the continued availability of replacement parts during the required lifetime of 15 years and facilitate upgrades or modifications when necessary.

### HMS technical data

- Supported temperatures  $-40^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$
- Supported dose rates up to  $100\text{Gy/h}$  (cumulative dose rates of up to  $10,000\text{Gy}$ )
- Max. speed  $5\text{km/h}$
- Fording ability of basic vehicle:  $550\text{ mm}$ . Climbing ability:  $29^{\circ}$
- Applicable with various tools such as manipulator, rotary drum cutter, excavating bucket, fork lift, concrete pulveriser, hammer, scrap shears, sorting grapple and drum gripper
- Integrated emergency recovery system for the basic vehicle in the event of a technical defect
- 12 cameras and various sensors for radiological, thermal and atmospheric measurements

## Our services

### HMS features

The HMS is a remote-controlled manipulator system devised specifically for use in nuclear environments with extremely high local dose rates. Signals between the mobile control centre and the HMS are transmitted via radio or cable. The HMS can be combined with various tools including a hydraulic manipulator, and can be used for a wide range of tasks monitored and remote controlled by a cross-linked video system.

### HMS components

The HMS is based on a modular design comprising the following components:

- Basic vehicle with tools and manipulator
- Transport and control centre vehicle
- Emergency recovery system
- Manual operating unit

The entire system was developed largely using conventional, industry-standard components. A containment comprising a 65mm thick lead casing and a 10mm thick steel layer protects sensitive control unit components against ionising radiation.

### HMS communication structure

Due to the high complexity of the HMS and the security requirements for the electric/electronic systems, IABG decided to follow the guidelines of IEC 61508 and adjusted the development process and corresponding development methods accordingly. The HMS control system uses a complex communication structure which partly employs redundant signalling pathways (LAN, WLAN). Protocols enable the transmission of images and control data for tools and the manipulator as well as the application of safety-critical features.





## Smart Cities • Safe Cities

digital. secure. connected.

The world's urban population is rising constantly – in 2050, there will be 6.7 billion city dwellers according to the *United Nations World Urbanization Prospects*. The economic importance of cities is also increasing as they represent an ever-growing share of the global gross domestic product. Digitalization makes all of this possible through interconnecting the spheres of personal life and business in new and smart ways. A smart city is therefore always a networked city with advanced infrastructure, offering its citizens high quality of life while providing its private sector with a competitive advantage globally.

At the same time, security and resilience against the numerous threats rising in lockstep with urbanization – from crime and terrorism to cyberattacks and natural disasters – are fundamental. Only a safe city can be a smart city fully capable of protecting people as well as critical infrastructure.

For decades, IABG has been managing projects for urban (security) stakeholders with vendor-neutral and reliable expertise. IABG transforms the age of digitalization with its multitude of challenges for the public and private sector into an era of opportunity for *smart and safe cities*. We stand with you as an internationally experienced consultant for an intelligently networked and secure urban future. Count on us for providing the know-how needed to protect the connected city – from cyberspace and urban critical infrastructure to commanding first responders and security forces. Efficiently and cost-optimized.

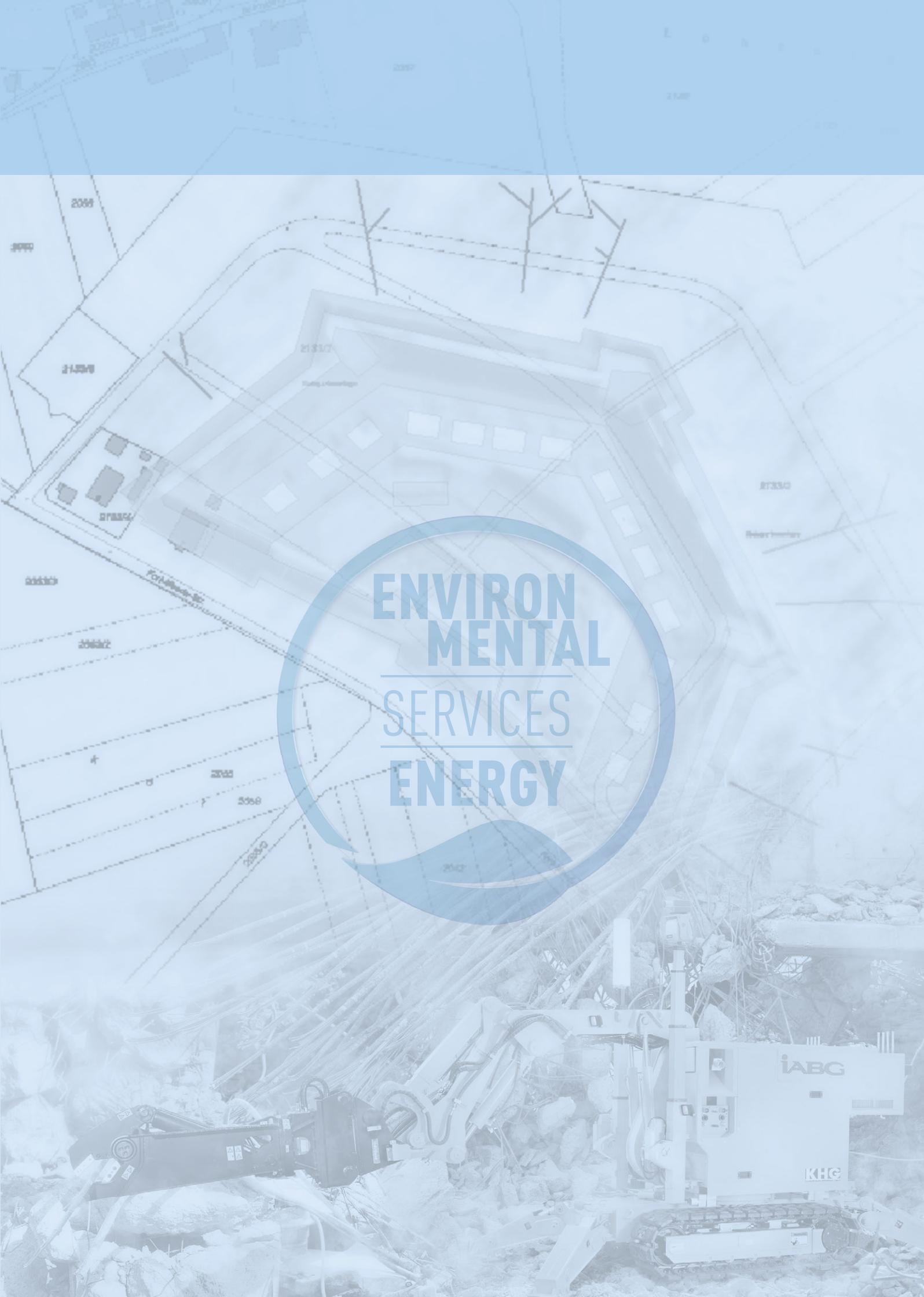
We will work with you to turn our shared vision of a smart, secure and connected city into reality, providing opportunity and high quality of life for all urban citizens.

## Our solutions

- Driving the digitalization of your processes
- Customized solutions for information security and communication technology
- Cybersecurity certification according to ISO 2700x
- Setup of Security Operations Centers (SOCs) and Security Information & Event Management (SIEM)
- End-to-end planning, consulting and training
- Tender/procurement management, analysis & business optimization of your investment decisions

## Our customers

- All levels of the *Smart & Safe City*
  - Command & Control/Management
  - Analytics and intelligent applications
  - Communications and networks
  - Sensors (CCTV cameras, drones, ...)
- Core stakeholders of the *Smart & Safe City*
  - City authorities and management
  - First responders
- Public and private sector operators of urban critical infrastructure, for example:
  - Government & administration
  - Telecommunication
  - Energy, water, gas
  - Traffic and transportation management
  - Healthcare



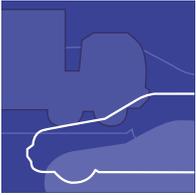
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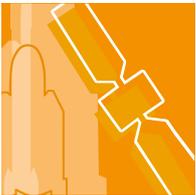
**INFOCOM**



**MOBILITY, ENERGY & ENVIRONMENT**



**AERONAUTICS**



**SPACE**



**DEFENCE & SECURITY**

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