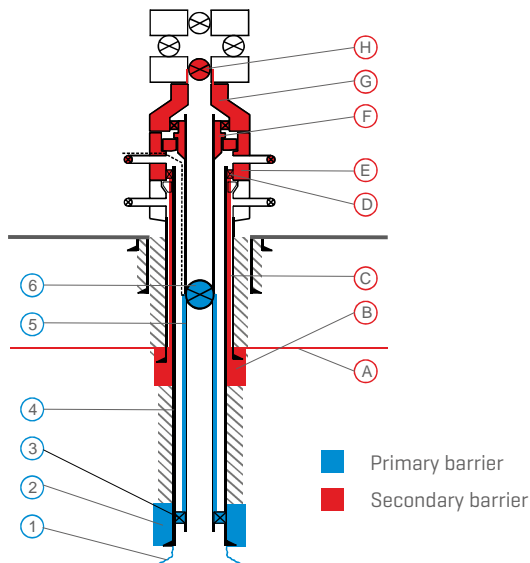


OUR SERVICES

- Integrity risk assessment for wells according to DIN EN ISO 16530-1
- Detailed assessment of well barrier elements according to BVEG TR Well Integrity, Norsok D-010, Oil & Gas UK Well Life Cycle Integrity Guidelines or other
- Due diligence assessment of existing wells
- Development of integrity management system according to DIN EN ISO 16530-2 [database management]
- Simulation and evaluation of storage scenarios with Landmark STRESSCHECK™, COMPASS™ and WELLCAT™
- Assessment of cement condition
- Assessment of tubing / casing condition
- Evaluation of the effects of corrosive [H₂S, CO₂, H₂, etc.] and abrasive media [water, particles, etc.] on materials
- Integrity tests of the production tubing [pressure tests, measurements based on acoustics or temperature] incl. evaluation
- Numerical calculations with Itasca FLAC3D™
- Analysis of possible subsidence-induced impact
- Evaluation of geological barriers
- Development of concepts for the repair of barrier systems
- Thermo-mechanical optimization of storage operation



DEEP.KBB GmbH

Convincing Competence

- Integrity analysis and evaluation of well and storage sites
- Evaluation of geological and mechanical barrier elements
- Design and implementation of a management system to monitor and ensure well and storage system integrity
- Preparation of detailed recommendations and work programs
- Cross-disciplinary services from a single source
- Application of industry-standard software
- Compliance with relevant international standards



DEEP.KBB

Office Bad Zwischenahn

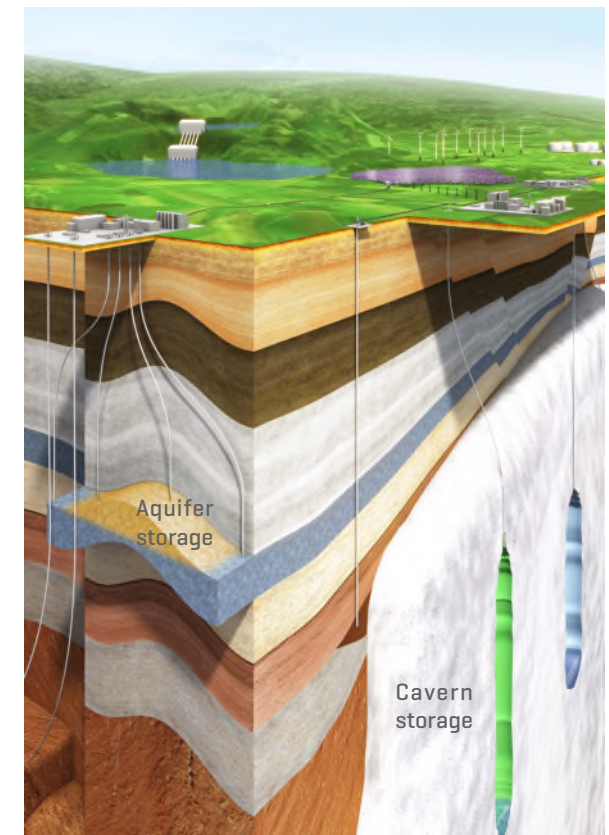
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WELL AND STORAGE INTEGRITY



INNOVATIVE ENERGY STORAGE.

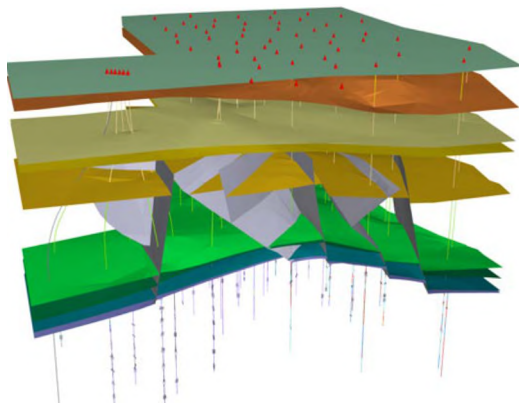
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PERMANENTLY SAFE

The long-term integrity of a production well and of an underground storage facility including its wells, is an important factor in determining operational safety and thus economic efficiency. The entire system must maintain integrity over its entire life cycle - both for the underground barriers and for the surface facilities.

Nationally and internationally, regulatory authorities, as well as standards and best practice guidelines, require operators of storage and production wells to develop and apply systems to manage well integrity [e.g. DIN EN 1918-2, ISO/TS 16530-2]. In several countries further requirements are relevant, such as BVEG Technical Rule on Well Integrity, Norsok D-010 or Oil & Gas UK Well Life Cycle Integrity Guidelines.

COMPREHENSIVE INTEGRITY ASSESSMENT



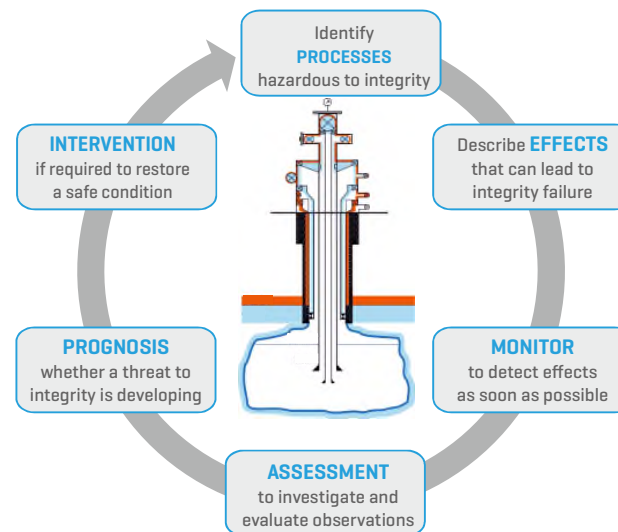
In addition to the regulatory requirements which focus on the wells, DEEP.KBB considers the integrity of the whole storage system. This approach not only includes the mechanical but also the geological barriers. In addition to implementing the requirements mentioned above, operators can utilise such management systems in order to facilitate the maintenance and operation of the storage facilities in the long term. Based on these considerations, DEEP.KBB has developed a concept for storage integrity management.

STORAGE INTEGRITY MANAGEMENT

The integrity of the overall storage system is affected by various factors and processes - many of them time-dependent and from different specialist disciplines. Some of these processes are:

- Convergence and subsidence
- Pressure and temperature changes due to operation and corresponding stress states
- Strain on pipes due to subsidence as well as pressure and temperature changes
- Aging of the cementation and corrosion/abrasion of the pipes

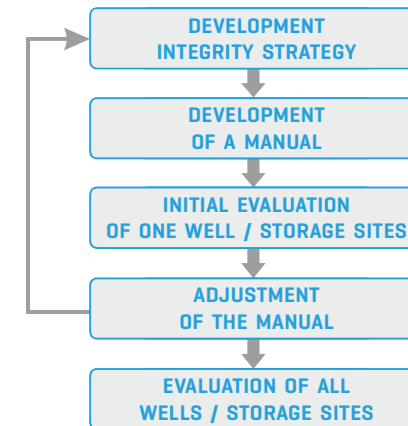
Therefore, these and other processes should be considered when managing overall storage integrity.



The method applied by DEEP.KBB takes into account the relevant processes and their integrity-relevant effects in order to develop appropriate options for monitoring these effects. The evaluation of the current situation and a forecast of the possible future development allow for the identification of required interventions. These could be costly workovers but also simple adjustments of the operating limits or changes to the monitoring techniques.

DEVELOPMENT OF A MANAGEMENT SYSTEM

The development of the management system should, at least as a first step, include a manual. This manual describes the company-specific strategy and the necessary steps to evaluate the integrity of the wells and/or the entire storage system. It also defines the procedures to permanently maintain or potentially re-establish integrity. During the initial evaluation of sample wells, the manual is assessed before the entire storage site is evaluated.



A storage integrity management system must be adapted to local conditions and other parameters of the operator and the sites to be evaluated. Essentially, the following aspects are taken into account:

- Laws, standards, company policies and scope of work
- Methods and strategies
- General procedures for evaluation of integrity
- Barrier systems and barrier elements of different well types
- Relevant well and storage data
- Consideration of [well] operating limits
- Barrier element test acceptance criteria
- Evaluation of leak paths through risk assessments
- Structure and design of an integrity report