NUCLEAR CIVIL ENGINEERING STRUCTURES
MONITORING AND MAINTENANCE

BEFORE & DURING CONSTRUCTION
To reliabilize the construction and prepare the future

Engineering
Instrumentation
Measurement, data acquisition and analysis
Works control and supervision

PRE-COMMISSIONING TESTS
To validate the structure

Containment test
First visual control
Preventive maintenance
Initialization

DURING OPERATING & DECONSTRUCTION
To follow-up structure ageing, optimize maintenance, guarantee their conformity during all their life and extend their life time.

Inspection, control, assessment
On site technical assistance
Instrumentation, measurement and maintenance
Periodical containment test
DESIGN & MAINTENANCE PROGRAM

- Drawing-up and writing of civil maintenance policy;
- Writing of base documents: minutes, blank report of expertise, schema...
- Database creation and implementation dedicated to civil engineering works ageing follow-up;
- Implementation of tools for inspection;
- Conception, qualification and validation of instrumentation systems dedicated to the structure monitoring during all its life, and its ageing.

MONITORING

STRUCTURAL INSTRUMENTATION

- Structural Health Monitoring Systems (SHMS) installation;
- Sensors selection, delivery, test and installation;
- Data acquisition and analysis with comparison.

GEOMETRIC SURVEYING

Geometric measurement on civil engineering works and equipments.

- High accuracy geometric surveys: levelling, planimetry, 3D, robotized survey;
- 3D Lidar Survey with high density of accuracy, for the analysis of structures global geometry and deflections;
- Photogrametry, orthophotography;
- Geometric measurement during particular phases: containment tests operations, stream generator revamping;
- Initial and periodical measurements for preventive maintenance.

VIBRATION ASSESSMENT

- Migrant bodies detection in pipes.
- Seismic monitoring.
- Chimneys control.
- Machines control (turbo-alternator...)
- Sensible tappings assessment to fatigue.

VISUAL INSPECTION: CLOSE INSPECTION

- Periodical inspections with visual or televisional control;
- Exhaustive survey and defects map;
- Information database;
- Damage evolution monitoring.
- Control of equipments and structures integrity in relation to environmental impact (tightness, gaseous and liquor effluents, isolation), structural impact, fire control, security, facilities safety...
VISUAL INSPECTIONS: REMOTE INSPECTION

- Televisual inspection, the SITM system, for pipelines and inaccessible area.
- Remote inspection with the SCANSITES tool

NON DESTRUCTIVE TEST & SPECIFIC CONTROL

- Geophysical radar;
- Infrared thermography;
- Coating adherence test (direct tensioning equipment);
- Coring and specific tests.

ENGINEERING - DIAGNOSIS - ASSESSMENT

- Detailed analysis of defects surveyed and their evolution:
  - Impact determination (noxiousness);
  - Organization into a hierarchy and prioritization of treatments.
- Treatment suggestions after the designation of causes and sources;
- Technical & economical studies;
- Design verification
- Contracting documents writing.
- Choose of products and specific methods to use in nuclear field
- Maintenance program update:
  - Feedback integration
  - Modification of the control purpose or the periodicity
- Structural data analysis.

SYSTEMS MAINTENANCE

- Structural instrumentation maintenance:
  - Revamping
  - Operational maintenance
- Vibration assessment maintenance:
  - Seismic system
  - Migrant objects
- System maintenance:
  - Metrologic control of various components of measuring chains
  - Systems functional control
  - Measuring channel global control
  - Reconditioning of inefficient components

TECHNICAL ASSISTANCE

- Supervising of works, respect of procedures and validated plans (carrying out order).
- Site safety supervising: risk analysis, visits on site...
- Works quality monitoring: traceability, product card, audit.
- Supplier quality monitoring: qualification, certification...
- Works organization and planning: site progress supervising
SITES 100 engineers and technicians in nuclear sector are authorized to work in environment subjected to ionizing radiation. 
26 years of experience feedback in nuclear environment across the world. 
180 multidisciplinary experts.
A permanent Research & Development to propose the best innovative solution for structure monitoring.
An independence for a perfect objectivity: no link with any constructor, tool manufacturer, repair contractor...

MAIN REFERENCES

REACTOR BUILDING:
- Structural Health Monitoring engineering, supply and settings on EPR FLA3 (France), RZH (Cadarache, France).
- Topographic engineering assistance on site (control and measurement) during RZH construction.
- Containment test on all the 56 French reactors, on Dacy Bay 1 & 2, Ling Ao unit 1 to 4 (China), on Koeberg 1 & 2 (South Africa)
- Steel liner global expertise (acoustic measurement, visual inspection, 3D auscultation...) in the 900 MW French NPP.
- Metrology measurement to steam generator revamping: high accuracy topometry (Bugey, France).

COOLING TOWERS:
- Remote inspection (SCANSITES system) and geometric survey (LIDAR) on all French NPP fleet for more than 20 years.
- Close visual inspection for all internal civil structures on Cruas, Civaux, Cholet, Belleville, Cattenom (France).

ALL CIVIL STRUCTURES OF NUCLEAR & CONVENTIONAL ISLAND, NON-CONVENTIONAL BUILDINGS:
SITES provides global expertise, first and periodical control for all kind of civil structures and equipment of NPP (roof, substructures, facing, wall, slab, retention, sump, pool, channel, dike, gallery...).
SITES is one of the main actor of EDF civil engineering preventive maintenance program since the 90's.

CHIMNEYS
- Dynamic assessment for all DVN French NPP chimneys (dynamical behaviour recording and analysing).

CONCRETE AND STEEL PIPES
- Design, supply and setting of a global concrete pipe ageing monitoring on 1300MW French NPP (SEC system in gallery).
- Preventive inspection, control and measurement of SEC, CRF and CFI pipes on Paluel, Penly, Flamanville since 2003.

COATINGS
- Periodical control of the coating liner in 1300 MW French NPP (acoustic detection, and visual inspection).
- Inspection of all the reactor coating (LOCA risk / preventive maintenance) in all EDF RX buildings.
- Expertise of Corrosion mitigation coating.

SAFETY SYSTEM
SITES performed maintenance of many safety system on all French NPP fleet for more than 20 years as seismic system, migrating object detection primary system.

TURBO- ALTERNATOR AND OTHER ROTATIVE MACHINES
- Global vibration assessment.

PASSIVE EQUIPMENT IN FIRE PROTECTION
- Dedicated maintenance data system design and first implementation.
- Global inspection and survey of all equipment involved in fire protection (openings, doors, joints, screen fire...) on many French NPP as Gravelines, Paluel, Flamanville, St.Alban, Belleville...

MAIN CLIENTS:
EDF (Nuclear, thermal, hydraulic electricity), ANDRA, AREVA, COGEMA, CEA, EURODIF, CGNPP (China Guangdong Nuclear Power Group), ENDESA, ELECTRABEL (Belgium), VSL, Bouygues Construction, IBERDROLA, ENEL, FRAMATOME, ATOFINA, EXXON, TOTAL...
SITES is PFC association partner (Partenariat France Chine Electricité: France - China Electricity Partnership).

CERTIFICATES:
- SITES has a quality organization complying with ISO 9001-2000, accepted by EDF (French Electricity Company) in CAS1 ASR, since 1991.
- SITES is certified CEFRI E (N° 321 E – For ionizing radiations exposure) since 1999.
- SITES is certificated by EDF – UTO (nuclear sector) in:
  - « Electricity & Command Control » (systems of acquisition, treatment and data transfer for the process management).
  - « Controls, Analysis, Measurements & Testing » (vibratory control, stress analysis, diagnosis, structures and civil engineering works inspection and dimensional measurements).
  - « Intellectual Performances and Technical Assistance » (expertise, technology, consulting, mandating, activities accomplishment supervision and control).
- SITES has a MICROSOFT authorization in « conception and deployment of solutions based on net IP» since 2003.