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Water Chemistry Services

Here 2 Optimize
Experience based
knowledge for strong
power plant chemistry

Your performance
is **our** everyday **commitment**

Primary Side Chemistry Consulting

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Our primary side chemistry consulting for PWR ensures a reliable, safe and economic plant operation by best water chemistry regime

Customer Benefits

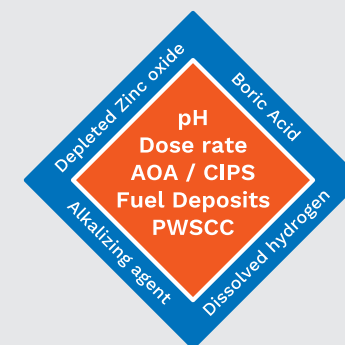
- Minimization of corrosion and avoidance of high dose rates
- Knowledge of manifold chemistry treatments and guidelines
- Close cooperation with fuel and material experts
- Tailored plant-specific studies in close cooperation with operators fitting your needs and requirements
- State-of-the-art chemistry measures applied at any PWR reactor

Consulting Services

- Enriched boric acid (EBA)
- Compatibility check and licensing support in case of modification
- Chemistry guidelines (EPRI, VGB)
- AOA / CIPS fuel risks assessments
- Elevated Lithium operation
- Depleted Zinc Oxide (DZO)
- Chemical counteractions at fuel failures
- Fuel cladding integrity
- Minimization of recontamination
- Dose rate reduction measures
- Reactor core reactivity control

Solution

Our primary side chemistry consulting for PWR ensures a reliable, safe and economic plant operation by best water chemistry regime. Plant design features and material concept, the plants' operational history, core design and fuel element materials are taken into account.



Chemistry Consulting for Boiling Water Reactor (BWR)

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State-of-the-art water chemistry ensures system integrity

Customer Benefits

- Minimization of stress corrosion cracking and avoidance of high dose rate build-up
- Improvement of plant reliability
- Knowledge of various chemistry regimes and guidelines
- Close cooperation with material and fuel experts
- Tailored plant-specific studies in close cooperation with operators fitting your needs and requirements

Consulting Services

- Normal water chemistry / Hydrogen water chemistry / Online noble chemistry
- Depleted Zinc Oxide (DZO)
- Mitigation approaches for stress corrosion cracking (SCC)
- Water chemistry consulting for component replacement and refurbishment
- Fuel-Chemistry interaction
- Passivation mode
- Evolution of chemistry guidelines (EPRI, VGB)
- Root cause analyses

Solution

Our chemistry consulting for BWR ensures a safe, reliable and economic plant operation by the best chemistry treatment. Our recommendations following an integrated approach for the plant considers operational conditions, materials concept and core design targeting minimal corrosion and dose rate build-up in out-of-core areas.



Depleted Zinc Oxide (DZO) Technology

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Affects characteristics of oxide layers and reduce corrosion and accumulation of radioactive material

Very effective technology to reduce degradation of coolant system materials and lowering shutdown dose rates.

Customer Benefits

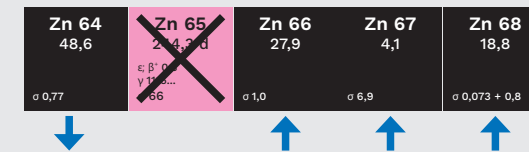
- Reduces collective dose by reduced pickup of ⁵⁸Co and ⁶⁰Co
- Reduction of dose rates by 15 % during the first fuel cycles
- Up to 40 % after a few cycles
- Experienced team
- Mitigation of stress corrosion cracking

Scope of Services

- Concept Design
 - Dosing procedure
 - Zinc injection device, analysis methods & monitoring
- — Fuel In-plant surveillance
- Feasibility Study
 - Compatibility (fuel, RCP, seals)
 - Effects on chemistry and systems
- Establishing of implementing, project and quality plan

Solution

Our experience in introducing the injection of depleted zinc compounds, which affects the concentration and characteristics of oxide layers, as an effective method to counteract the accumulation of corrosive and radioactive materials, enables nuclear power plant operators to reduce corrosion and radiation fields, resulting in reduced accumulation of radioactive materials.



Zinc on nuclide chart

Conversion to Enriched Boric Acid Operation (EBA)

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Enables the control of higher neutron fluxes

EBA is an effective approach for handling higher enriched fuel or MOX fuel. Experts help to adapt any necessary requirement.

Customer Benefits

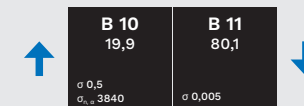
- Moderating high neutron population (introduction of MOX fuel)
- Reduced total boron concentration enabling elevated pH (300 °C) strategies
- Decreased amount of boric acid waste
- (Facilitating) dose rate reduction (ALARA)
- Reduced volume of borated water system tanks

Concept of shifting process considering

- Detailed analysis to ensure that all relevant systems are considered
- No impact on plant safety at any time of the change-over process
- Plant operation is impacted as low as possible
- No extended plant outage for refueling or for maintenance
- Minimizing costs for 10B and produced waste
- Ensure safe shutdown reactivity in safety relevant parts

Solution

Our experience in introducing Enriched Boric Acid (EBA) operation helps operators of nuclear power plants to control higher neutron fluxes. The EBA increases the capacity for reactivity control without increasing the total boron inventory in storage volumes. Furthermore it allows the application of the same or even a higher operational pH range in the primary coolant with the same or even a lower concentration of total boron and of the alkalis agent.



Bor on nuclide chart

Qualified maintenance product database

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Provides detailed information on chemical suitability for maintenance products to avoid corrosion of components

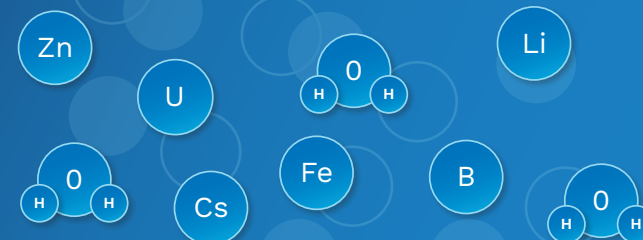
The database created assists quality assurance in nuclear power plants, for wind turbines and other technical equipment. The product information provided therein helps to avoid corrosion.

Customer Benefits

- Use of qualified products
- Material protection, Quality assurance and lower repair costs
- Exchange of knowledge and experience between users
- Avoidance of unexpected downtimes due to component failure in technical systems

Solution

Our database (Qualified Products Database, QPDB), in which only assessed maintenance products are listed, helps to effectively protect units and their components by avoiding corrosion. Through a strict qualification procedure they are analyzed for impurities. In addition, impurity contents were evaluated based on effective rules and our standards.



Secondary Side Chemistry Consulting

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State-of-the-art chemistry consulting to help maintain clean components and facilitate prevention of corrosion

Customer Benefits

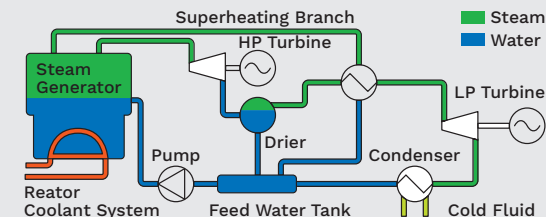
- Minimize corrosion through the best knowledge of manifold chemistry treatments and chemistry guidelines
- Access to top-level fuel expertise with dedicated teams and laboratories
- Maximize customization of plant-specific studies
- Leverage state-of-the-art chemistry measures applied at different PWR reactor types

Consulting Services

- Advanced water-steam cycle chemistry conditions (i.e. PAA, FFA, Mixed Amine Treatment)
- Oxygenated Treatment for FAC prevention
- SG Health Assessment
- SG Hide Out Return assessments with advanced codes
- Deposit analysis with focus on chemical composition and morphology
- Evolution of chemistry guidelines (EPRI, VGB)
- Compatibility assessments
- Root cause analyses
- Licensing support

Solution

Our secondary side chemistry consulting facilitates prevention of secondary side components against corrosion degradation phenomena (e.g. FAC) and maintains a clean condition inside of the steam generators. Our recommendations are based on assessments of the current specific situation (like SG cleanliness, hide-out return) and lead to the best suitable operational conditions.



Studies, Evaluation and Root Cause Analysis

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Planning of activities according to the PDCA cycle – Plan, Do, Check, Act

Focusing on effective corrective measures and prediction of impairments from implementation or modifications.

Customer Benefits

- Support and basis for approval procedure
- Justified assessment of planned modification
- Permanent solution for faults or problems
- Our international experience covers plant design of various original equipment manufacturers (OEMs)
- Close cooperation with experience nationally and internationally acknowledged experts in different areas

Range of Services

- Studies
 - Application of arc spray technique
 - Injection of depleted zinc oxide
 - Impact of an increased pH
 - Enriched boric acid in combination of usage of 100% MOX core
 - Dose rate reduction study
- Evaluation
 - Operational and shutdown chemistry
 - Elevated Li-pH operation mode
- Root Cause analysis
 - Mobilization of primarily deposits at SG

Solution

Our experienced and competent professionals evaluate impacts of (planned) modifications and identify the root causes of faults or problems. Our studies and evaluations assess the current situation as well as impacts of planned modifications and are a basis for approval procedures. Problems and faults can be effectively treated after identifying them in terms of our root cause analysis and support you in finding solutions which are more than “putting out fires”. Therefore, our professionals use all relevant available data and analyze why the event or problem occurs.

events action performing required causes identify corrective
 ess management outcomes effective
 ants performing general management
 recurrence prevention events
 eral action required performing
 effective causes process identify outcomes required manager

RCA Root Cause Analysis

Chemistry Training for Plant Staff

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From basic to fundamental knowledge

Dedicated chemistry employee training for know-how transfer and knowledge management.

Customer Benefits

- Best realization of chemistry adaptations and modifications
- Quick and correct countermeasures in cases of deviations
- Maintenance of well-trained employees
- Professional lectures and supervision
- Experienced support and commissioning

Training Services

- Commissioning
- Employee training
- Primary side chemistry (key components, key parameters)
- Secondary side chemistry (key components, key parameters)
- Water-steam cycle
- Fundamentals of SG corrosion
- Guidelines
- Chemistry supervision and support
- Employee training
- Required documentation
- Chemistry manual, work procedures
- Countermeasures

Solution

Our experts and specialists perform in-house training, imparting chemistry knowledge to your employees focusing on desired specific subjects. On the area of primary and secondary side chemistry, all required key components and parameters are covered. The training can be organized as interactive workshops, training lectures as well as training sessions. In addition, our specialists support you in commissioning and supervision of chemical treatment.



Water chemistry consulting

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Corrosion protection

Studies and evaluations on corrosion phenomena in cooling systems of nuclear power plants and customized solutions.

Customer Benefits

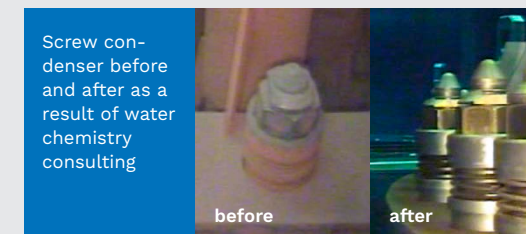
- Minimization of corrosion
- State-of-the-art chemistry measures applied at European Pressurized Reactor (EPR)
- Tailored plant-specific studies in close cooperation with operators fitting your needs and requirements
- Our international experience covers plant design of various original equipment manufacturers (OEMs)
- Close cooperation with material experts

Frequency of corrosion mechanism

- PWR
 - Erosion corrosion (43 %)
 - Corrosion of nickel alloys (18%)
 - Stress corrosion cracking (9 %)
 - Corrosion induced by microbiology (9 %)
 - Contact Corrosion (3 %)
 - Other corrosion types (18 %)
- BWR
 - Stress corrosion cracking (56 %)
 - Erosion corrosion (34 %)
 - Corrosion induced by microbiology (3 %)
 - Other corrosion types (7 %)

Solution

Our water chemistry consulting helps to prevent components against corrosion degradation phenomena. Our experienced and competent professionals assess the current situation and identify the root causes or rather the mechanism of corrosion phenomena. Our recommendations are based on assessments and lead to the best suitable operational conditions.



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Click here to visit our
solutions-portfolio

For more info please contact:
chemistry-services@framatome.com

Your performance
is **our** everyday **commitment**