



Environmental Solutions for the Mining Sector



Environmental Solutions for the Mining Sector



1. *Veolia, the world leader in environmental services*
2. *Solutions for each stage and need of your Mining site*
3. *We bring value to your Industry: case studies*

1. Veolia Overview



The world leader in environmental services

A unique combination of service capabilities

For an optimized resource management:



WATER

Management of the complete water cycle; from raw water to drinking water and wastewater treatment.

We innovate to reduce water consumption and encourage water reuse and recycling.

96,000,000

people supplied in drinking water

59,600,000

people connected to wastewater systems

4,455

water plants managed

3,338

wastewater plants managed



WASTE

Expertise in liquid and solid waste, hazardous and non-hazardous material.

We provide waste solutions from sorting and collection to disposal and recycling.

42,800,000

people provided with waste services

31,300,000

tons of waste recovered as materials or energy

730,000

business customers

655

waste processing facilities operated



ENERGY

Management of your energy, heat, cooling, and ancillary facilities with the objective to improve systems efficiency.

52,000,000

MWh produced

2,400,000

collective housing units managed

1,802

industrial sites managed

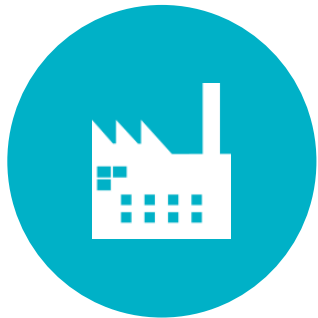
529

heating and cooling networks managed

For both municipal and industrial customers



We are a strategic partner to cities



We create value for our industrial customers

NEW YORK BUCAREST
HONG KONG LYON LONDON
KONG BUENOS AIRES
SHANGHAI SYDNEY
PRAHA ABU DHABI

40%

of our customers
are **Industries**

We are present across all continents



179,000 employees
in over **48 countries**

23,8 billion Euros
revenue in 2014



Consistent values across our operations



SUSTAINABILITY

A strong commitment to sustainability across our business with **9 corporate objectives**

Veolia Foundation

Setting the example with environmentally efficient operations and **CSR rating**

Carbon and Water footprinting for our Clients



HEALTH & SAFETY

H&S is a **priority** and a constant concern for Veolia in all its activities.

Consistent policy across the Group

Dedicated **2020 H&S targets**

Continuous **Training and Performance measurement**

H&S **values alignment** with our Employees, our Clients, and along our Supply Chain.



INNOVATION

Veolia aims to be at the **forefront of technological and business innovation** for the Environment.

Network of **900 experts** worldwide and **200 academic partnerships**

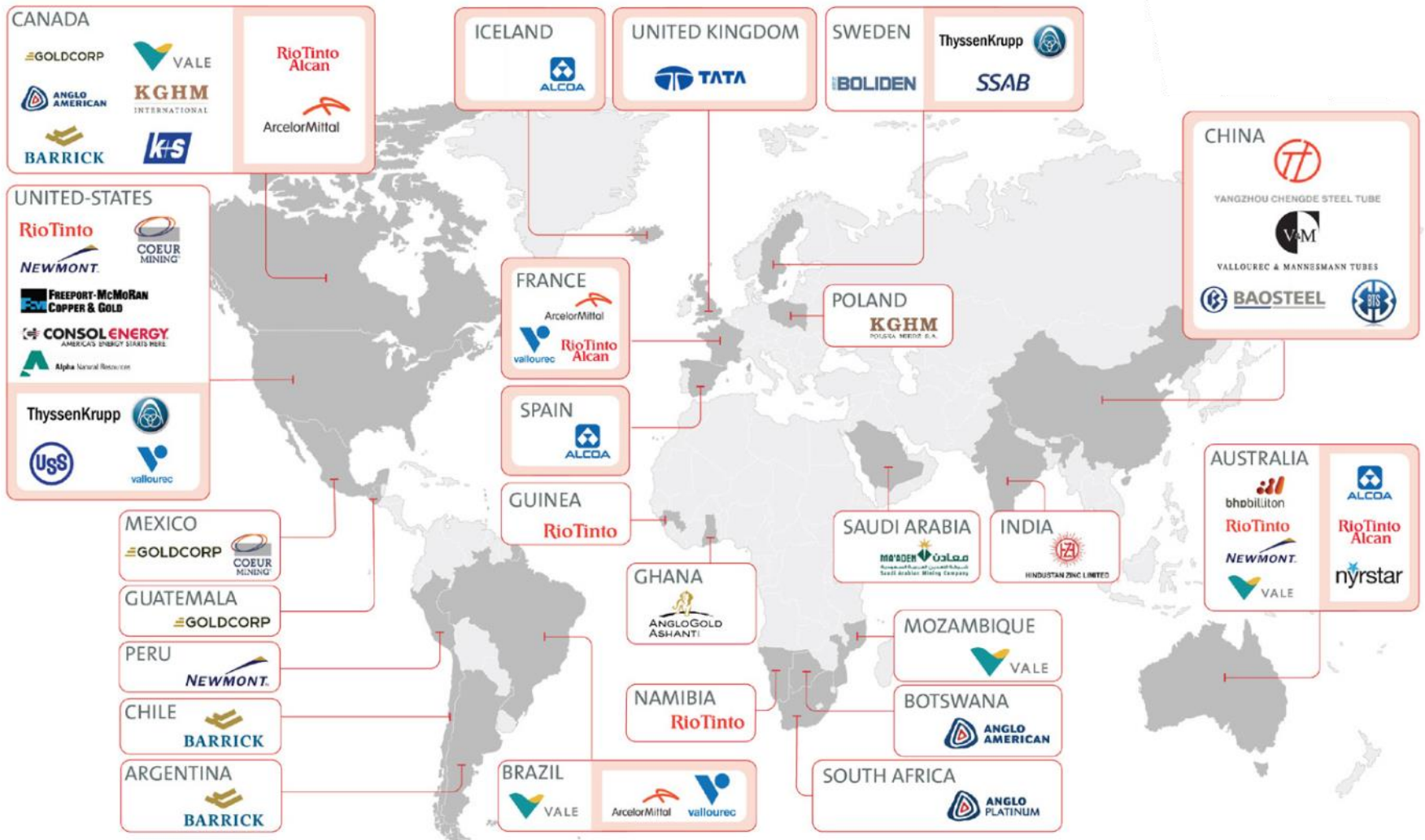
7 research centers with **over 2,000 patents**

An **Open Innovation Programme** and a prospective Institute

2. Solutions for each stage and need of your Mining site



Veolia has extensive experience with the Mining & Metals sector



We work across all types of minerals



We understand your industry

CHALLENGES FOR MINERS

Build state-of-the-art facilities and upgrade existing plants

Prolong assets life and find resources for capital improvement

Maintain safety at site at all times

Reliability of supply

Maximize site's productivity

Reduce environmental impacts, pollution loads
Comply with and anticipate environmental requirements

Empower local workforce

Build long term and win win relationships with local communities



Excellent project delivery track record and full technology portfolio in water management



Assets management systems and project finance capability



Safety as our priority
Technology innovations to improve work safety



Operations excellence with performance guarantees
Continuous improvement
Ability to service remote locations



Solutions to minimize downtime and interruptions
Yield improvement: waste and by-product recovery



Transfer of risk with compliance and quality guarantees
Unlock License to Operate: innovative environment solutions



Proven experience with indigenous workforce employment, strong commitment to training and career development



Meaningful community engagement programs

VEOLIA SOLUTIONS

We provide a complete project cycle offering



Design & Engineering of Infrastructures and/or Camp site facilities:

- Water plants
- Power island
- Waste sorting & disposal

Performance and specifications guarantees

Total Cost of Ownership optimization:
CAPEX/OPEX balance

Project planning and Management

Equipment supply, installation, and commissioning

Infrastructure construction supervision

Health & Safety

Mobile plants and containerized units for speed-to-market

Operations & Maintenance of infrastructures and utilities

Performance and price guarantees

Efficiency gains and performance measurement tools

Continuous improvement along your production adjustments:

- Innovation
- Optimization
- Upgrades etc

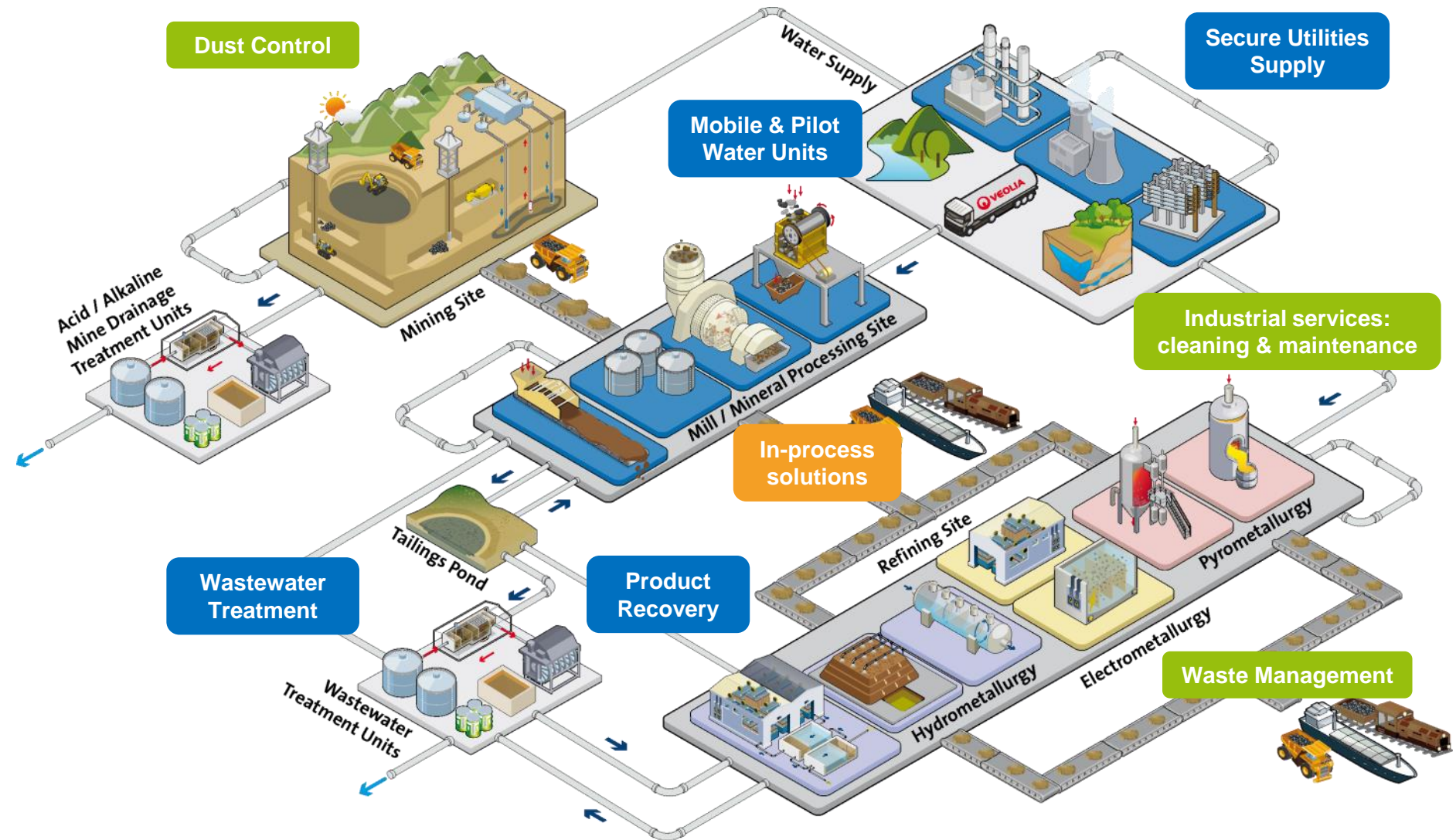
Assets decommissioning and dismantling

Management of environmental legacy after closure:

- Tailings and water issues
- Soil decontamination
- Waste and product recovery

Site ecological valorization

Along each step of the Mining value chain



3. We bring value to our Clients



Selection of case studies for Mining

Secure utilities supply



Forward planning to find the most adapted water and energy resources for your Mine site, at the right capacity and best value

Reliable, safe operations with a continuous improvement focus

Delivering critical utilities to coal mines Czech Republic



CHALLENGE

Client with 5 underground coal mines in Czech Republic, annual production over 8 million tons per year;

Outsource power, heat, cold and compressed air facilities to focus on core business;

Find a reliable and experienced service provider for these critical utilities: continuous power and ventilation are vital to underground coal mine operations.

SOLUTION

- ✓ Smooth transfer of employees and assets for a **20-years delegation** of operations. Annual capacities:
 - Heat production: 270 GWh
 - Compressed Air: 1,4 billion Nm³
 - Power distribution: 730 GWh
 - Nitrogen: 25 billion m³
- ✓ **Improved reliability** of supply with technical upgrades: new cold production facility and nitrogen supply;
- ✓ **Performance guarantees** with black out commitments
- ✓ Transparent pricing, and **energy savings** guarantee equivalent to 50,000 tons of CO₂eq. reduction per year.



Technical improvements to deliver efficiency savings



Assets financing and guaranteed pricing for long term visibility on cost.

Securing water supply with desalination

Peru



CHALLENGE

Secure Mine's license to operate in a water-scarce environment;

Identify an alternative water supply to avoid consumption of surface water needed for other uses (agriculture);

Ensure reliability and quality of supply for stable operations.

SOLUTION

- ✓ Operations & Maintenance of 4000 m³/day reverse osmosis desalination plant
- ✓ Reliable and continuous supply of clean industrial water for the Mine's refining and processing plant
- ✓ Highest environmental and safety standard



Optimize Total Cost of Ownership by balancing OPEX and CAPEX.



Alternative and reliable water supply for mine site.

Secure long term water supply to avoid mine shutdown, Morocco



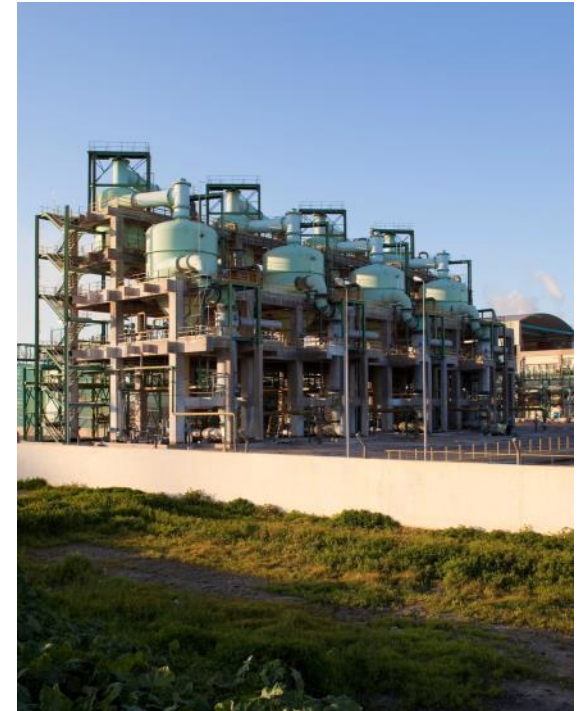
CHALLENGE

Phosphate mine from a global key player, producing over 27 million tons of phosphate per year;

Water scarce environment putting production continuity at risk;

SOLUTION

- ✓ Veolia designed and built a facility to treat and **reuse the wastewater from the neighbouring municipal plant** into the Mine's water supply system.



Mitigate risk of production disruption



Be a responsible corporate player by replacing surface water usage with a more environment-friendly solution₁₈

In-process solutions



Technologies to maximize your production's efficiency

Gold filtration optimization

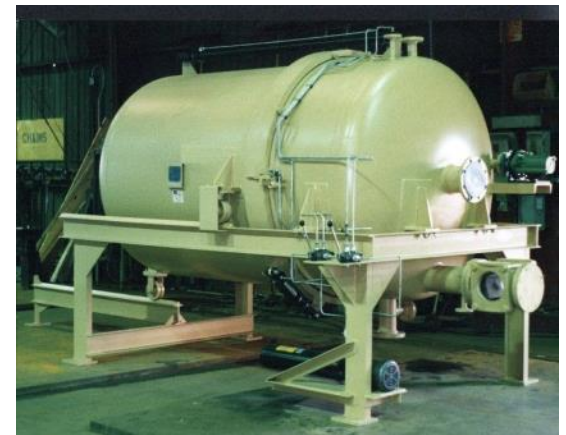
Multiple locations

CHALLENGE

Maximize efficiency of Merrill-Crowe process for gold and silver cyanide solutions filtration;

SOLUTION

- ✓ Dedicated, premium **self-cleaning pressure leaf filters** AutoJet® and FiltraMatic™
- ✓ Designed for large volumes handling and strong materials resistance
- ✓ Over 25 references.



Cost-efficient, robust equipment to support Gold plant's performance and uptime.

Boost potash extraction performance

Saskatchewan, Canada

CHALLENGE

Establishment of a new potash production site, North America's largest, with a production of 2,86 million tons when at full capacity;

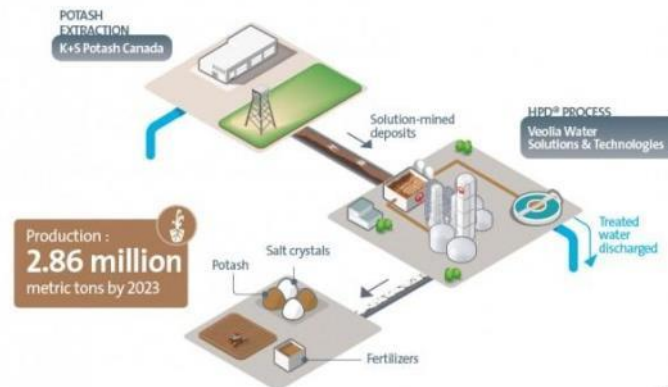
Need for a high-performance evapo-crystallization solution for the new site's core process.

SOLUTION

- ✓ Design, build and installation of **HPD® highly efficient evapo-crystallizers** for potash recovery by solution mining.



HPD® EVAPORATION AND CRYSTALLIZATION PROCESS UTILIZED FOR FERTILIZER PRODUCTION



Cost effective potash recovery in solution mining.

Ensure environmental stewardship



Guarantee compliance to your applicable environmental requirements

Reduce and safely discharge of liquid and solid waste

Identify opportunities for resources recovery and recycling

Optimization of water management

Iduapriem, Ghana



CHALLENGE

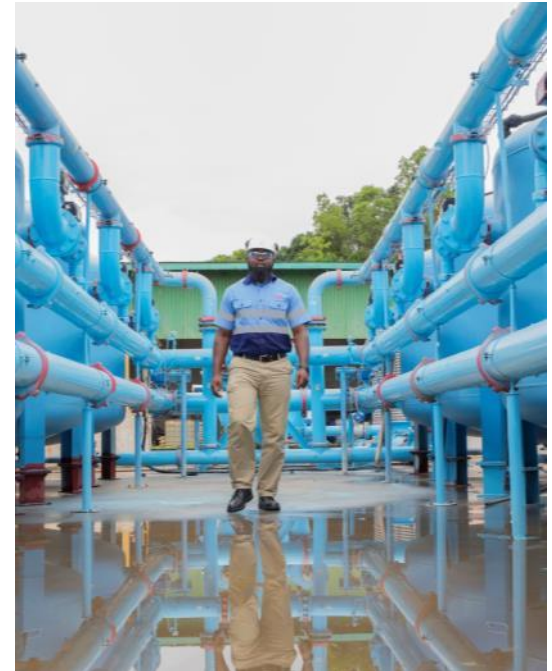
Ensure compliance of tailings wastewater treatment and discharge to Ghana EPA requirements;

Reliably operate the WWTP in a very seasonal climate, including a high rainfall season;

Cyanide removal from open pit gold mining tailings.

SOLUTION

- ✓ **Operations and Maintenance** contract for a 7,200 m³/day WWTP
- ✓ Two-stages process including physico-chemical treatments and Reverse Osmosis;
- ✓ **Transparency** and high-level expertise to ensure smooth operations and full review of plant's facilities.



Resumed WW treatment and mine operations, uninterrupted performance since then.



Operations costs reduction and improved maintenance practices.

Zero Liquid Waste Discharge Solution West Virginia, USA



CHALLENGE

Provide a cost-efficient, integrated solution for 6 coal mines contaminated water treatment;

Meet the newly issued regulation on chloride discharge.

SOLUTION

- ✓ 10-years **Design, Build and Operations** contract
- ✓ **Centralized plant** for treatment of the 6 mines effluents, with a total capacity of 18,900 m³/day and 85% chlorides removal;
- ✓ Combination of softening, filtration, reverse osmosis and evapo-crystallization technologies;
- ✓ Achieve a **zero liquid waste system**: based on site's needs, clean water is reused for boiler feed or safely discharged, while solid non-hazardous waste is put into landfill.



LICENCE
TO OPERATE

Meet local environmental requirements to maintain smooth operations



BRAND / CSR

Plant upgrade allowed to remove 9,300 tons of chloride discharge to local water streams.

Brine concentrators to mitigate tailings overflow

Northern Territories, Australia



CHALLENGE

Uranium mine located in a sensitive and high rainfall environment (national park)

Tailing ponds reaching full capacity: issues of flow management and no additional capacity granted for mine extension.

SOLUTION

- ✓ **Design, Build and Operate brine concentrators** (mechanical vapor compression type) with a 4,900 m³/day treatment capacity;
- ✓ **Seamless project delivery** with H&S track record of zero incident;
- ✓ Clean distillate safely discharged to wetlands



Full control of the mine's water balance critical to extend mine operations.



Supporting Client's environmental stewardship in a sensitive natural area.

Copper recovery from Tailings

El Teniente, Chile



CHALLENGE

Largest underground copper mine with an annual production over 420 000 tons;

High-volumes, old tailings with low copper concentration.

SOLUTION

- ✓ Design, construction and operations of a **copper recovery plant** with a annual capacity of 3 million m³ ;
- ✓ Combination of **concentration technologies** including filtration and ion exchange for cost-effective recovery;
- ✓ Recovery of a high quality, high concentration copper solution suitable for Solvent Extraction – Electrowinning (SX-EW) process of the Client.



Boost Mine's copper production, with a total recovery of 1,680 tons.



Reduce environmental liability of Tailing ponds

Industrial Cleaning Services



Comprehensive range of cleaning, maintenance, waste and mechanical offering at your service

Veolia as the partner you can rely on to ensure your production uptime and safety

Identify opportunities for resources recovery and recycling

Road sweeping, dust control at Iron Ore mine Pilbara, Western Australia



CHALLENGE

Ensure mine site, ore conveyance and port facilities dust control;

Maintaining the sites' cleanliness is paramount to safety, business continuity and neighbouring communities.

SOLUTION

- ✓ Design of **customized trucks** that can sustain harsh climatic conditions and improve water efficiency of road sweeping
- ✓ **Operations** of road sweeping service 7/7: guarantee dust control
- ✓ Use of **Veolia Hydrex™** dedicated range of dust control chemicals



Dust control essential to avoid disruption of operations.



Reuse water and reduce fresh water consumption.

Comprehensive equipment cleaning

Hunter Valley, Australia



CHALLENGE

Major coal mining and handling hub needs a comprehensive equipment cleaning solution to ensure smooth operations.

Ensuring that equipment runs properly without breakdown or clogging is a direct support of the site's productivity and safety.

SOLUTION

- ✓ 10-years framework agreement with Veolia to provide comprehensive cleaning solutions
- ✓ **Operations of wash bays** for haulage trucks
- ✓ **High pressure water jetting** of draglines, shovels, excavators and drilling equipment
- ✓ **Industrial cleaning** of coal preparation plants



Clean equipment as key factor for mine operations safety



Contain costs by minimizing equipment downtime

Integrated waste and cleaning management

BHP Billiton, multiple locations, Australia



CHALLENGE

Find a competitive and reliable service provider for the management of all types of Mining waste across multiple sites in Australia

Handling of both domestic and industrial waste (including scrap metals, plastics, tyres, light vehicles etc)

Maintenance of equipment and site's cleanliness



SOLUTION

- ✓ Daily and on-site waste operations including **collection and sorting** at over 9 Client facilities in **remote areas**; management of both **hazardous and non-hazardous** waste;
- ✓ On-site **management of landfill and recovery centres** or off-site transportation and disposal depending on site conditions.
- ✓ Comprehensive range of **cleaning services**, including high pressure water jetting and vacuum loading.



EFFICIENCY

Ability to service a large territory allows to optimize service cost



LICENCE TO OPERATE

Remote site servicing and employment opportunities for indigenous communities



BRAND / CSR

Guarantee compliance to environmental requirements and Client safety standards

Total Waste Management Mexico



CHALLENGE

Safe handling and disposal of all Mine's waste, at one of the world largest gold mines.

SOLUTION

- ✓ RIMSA, a Veolia subsidiary in Mexico, provided 3-years service under the **Integrated Project Management** scheme;
- ✓ **Total waste management on-site** with dedicated personnel, vehicles and equipment: collection, sorting, and off-site safe transport and disposal of all types of waste;
- ✓ Both **hazardous and non-hazardous** materials



Cost-effective service, reuse opportunities identified when possible



Responsible waste management in line with Client's environmental and safety requirements

Mine Closure



Customized environmental solutions to plan and minimize closure and remediation costs

Innovation and business synergies to make the most out of the site's legacy

Restore environmental capital of the site, contribute to local communities and territories

Coal Mine Tailings Management

Wheal Janes, UK



CHALLENGE

Former mine tailings contaminated water overflow control to avoid spillage into the environment



SOLUTION

- ✓ **10-years operations and maintenance** contract for tailings overflow water treatment;
- ✓ Integrated wastewater treatment solution and technology improvement allowed **treatment cost optimization**
 - 25% reduction of energy cost for WW treatment
 - 10% reduction of energy cost for pumping
- ✓ **Comprehensive monitoring and reporting** systems to follow up on water quality and operations performance



Improved cost efficiency of the service



Improved discharged water quality and risk management

Acid Mine Drainage Control

Multiple locations, Germany



CHALLENGE

Handle the environmental legacy and acid mine drainage issue of former open pit coal mines in Eastern Germany;

Restore attractiveness of a region with high tourism and economic potential.



SOLUTION

- ✓ **Operations and maintenance** of two major contaminated water treatment plants
Treatment capacity over 35 million m³ / year
- ✓ **Supervision and monitoring** (quality and overflow management) of over **20 closed mine sites** across Eastern Germany
- ✓ **Optimization of service costs** thanks to
resources pooling with Veolia municipal business
investment in data transmission
optimization of sludge dewatering and disposal costs.



Cost efficient service for closed mines.



Guarantee environmental requirements, manage risks and rehabilitate area for future activities

Specific pollutants removal

Sogerem, France



CHALLENGE

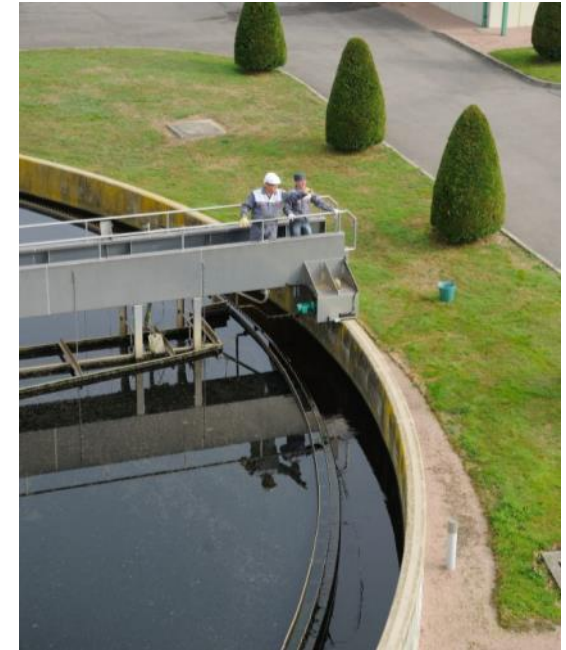
Prevent closed fluorite mine tailings and water drainage to contaminate near-by surface water (lakes)

Remove specific harmful components such as fluorine and manganese.

Provide a cost-effective solution for the 3 closed mine sites

SOLUTION

- ✓ **Operations and maintenance** of the three water treatment facilities for a total capacity 300 of m³/hour.
- ✓ Removal of **specific components** to reach client's requirement
 - Fluorine < 15 mg/L
 - Manganese < 1 mg/L



Integrated operations for the 3 plants support cost efficiency



Improved discharged water quality and risk management

Soil decontamination

Cromatos, Mexico



CHALLENGE

Decontaminate area of a former chromite ore processing site;

Removal of hexavalent chromium (Cr VI), a highly toxic and carcinogenic compound, from remaining waste and soil.

SOLUTION

- ✓ RIMSA, a Veolia subsidiary in Mexico specialized in hazardous waste handling and disposal, was selected in 2008 for demolition, decontamination and remaining waste treatment of the site;
- ✓ **Removal and decontamination of over 30,000 tons of hexavalent chromium tainted soil within a few months.**



Safe decontamination for a better environment.

Closed Mine Site Valorization

Woodlawn, Australia



CHALLENGE

Previous copper, lead and zinc open cut mine was put to Closure.

SOLUTION

- ✓ Turn-around of the closed mine site into a **bio-energy facility**
- ✓ Design and integration of municipal solid waste landfilling, compost facilities and bio-energy generation
 - 200,000 tons of waste/year
 - production of power for over 2,500 households
- ✓ Remaining nutrients and recovered heat are further re-used for on-site agricultural purposes (aquaculture and animal breeding).



Turn an environmental legacy into a source of revenues



Second life of the mine site is beneficial to both environment and the communities.

Benefits of partnering with Veolia

We build **long term partnership with our clients** aimed at unlocking the value of environmental services outsourcing:

- Focus on your core business
- Maximize plant performance
- Control your costs
- Access to a unique range of environmental capabilities
- Performance guarantees
- Transparency and visibility
- Transfer of responsibility and risks
- Continuous improvement

Resourcing the World

