



the
**GLOBAL
LEADER**
in pipe coating solutions.

**CUSTOM COATING &
FIELD COATING
SERVICES**



40000

DEDICATED EMPLOYEES

27

GLOBAL PLANTS

40

LEADING TECHNOLOGIES

75

YEARS OF COATING EXPERIENCE



BREDERO SHAW

A SHAWCOR COMPANY

the GLOBAL LEADER in pipe coating solutions.

To supplement its comprehensive capacity for coating pipelines, Bredero Shaw also offers Custom Coating & Field Coating Services, providing end-to-end coating capabilities to its clients.

Custom Coating in this context means the coating of bends, spools, manifolds, jumpers, Christmas trees, and other components incorporated into onshore and offshore projects.

Field Coating Services involves the coating of welded joints for onshore and offshore pipelines, as well as in-situ Custom Coating services at the client's designated location.

Bredero Shaw, a division of ShawCor Ltd., is the global leader in pipe coating solutions. With the largest team of dedicated professionals, the most extensive experience, the widest network of facilities, and proven, innovative coating technologies, Bredero Shaw is in a unique position to meet the demands of individual projects and provide best-in-class service to its clients:

- The largest number of fixed facilities in the industry, strategically located in key regions around the globe.
- Extensive international experience in plant mobilizations providing the unique capability of executing specific major pipeline projects at a client's chosen location. This capability is unparalleled in the industry.
- Over 40 leading pipe coating technologies to protect pipelines across all segments of the market.
- We have over 75 years of experience in both offshore and onshore environments.

CUSTOM LEADERSHIP



LEADING TECHNOLOGY

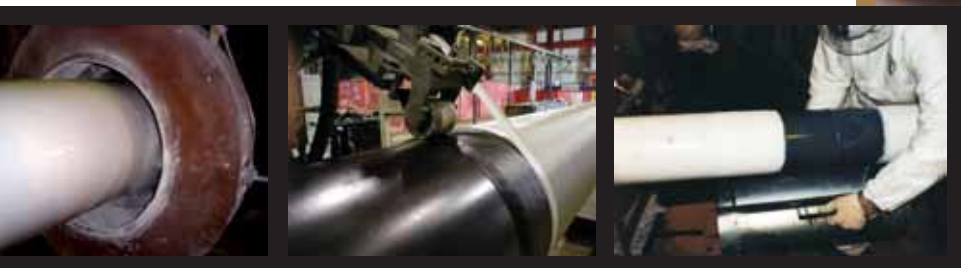
With a dedicated Research and Development team of over 50 engineers and scientists at three state-of-the-art facilities located in Canada and Norway, Bredero Shaw is focused on product improvement and new product development.

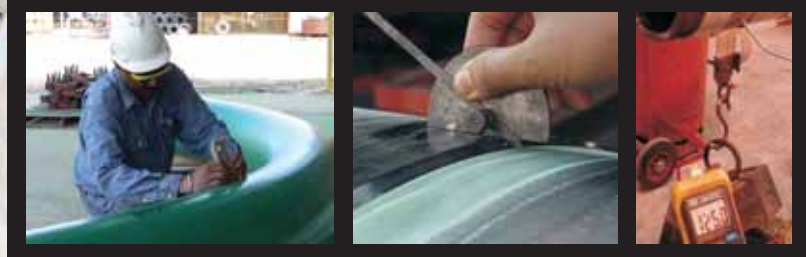
Clients are able to work with a dedicated Technology & Development group who will determine the best product for their specific application. Some examples of the T&D group's activities include:

- Determination of coating thickness for flow assurance products to meet specified U Values or cool down criteria.
- Coating type selection for specific subsea application conditions.

Bredero Shaw has developed over 100 patented technologies utilized in both coating materials and application processes, including specific Custom and Field Coating technologies such as:

- Semi-automatic application of Fusion Bonded Epoxy of individual pipes or pup pieces.
- Controlled Rotational Casting of polyurethane.
- Moulded polyurethane field joints on polypropylene coated linepipe.
- Injection-moulded PP field joints.





QUALITY ASSURANCE

Bredero Shaw is committed to complete customer satisfaction and to providing quality products and services.

The company recognizes that an emphasis on quality is essential to its success, and to the success of its clients. Bredero Shaw maintains a Quality Management System that conforms to ISO 9001:2000. The company is dedicated to the continuous improvement of the Quality Management System ensuring that all employees understand, implement and sustain the system. All plants have integrated quality control systems to ensure compliance with client specifications and industry standards.

The major principles and activities of the quality group are:

- Identification of customer requirements.
- Constant quality inspection of coating application and auditing of production systems to ensure conformance to client's specifications and compliance with applicable legal and regulatory standards.
- Innovation to prevent waste in products, processes, facilities and services.
- Adoption of a zero defects performance standard.
- Key supplier qualification and audits, and key material traceability.
- Measurement and elimination of the price of nonconformance.
- Continual improvement of quality performance.



HEALTH, SAFETY & ENVIRONMENT (HSE)

COMMITMENT TO INCIDENT AND INJURY FREE (IIF)

Bredero Shaw's vision is an Incident and Injury Free workplace, with no harm to people and no damage to the environment.

The company is committed to providing a safe and healthy workplace and ensuring that all business activities are conducted in a manner that protects employees, clients and the environment. The aims of this policy shall be achieved at all company locations by adhering to the following principles:

- Identification and evaluation of all HSE hazards or aspects and the management of their risks or impacts to acceptable levels.
- Compliance with all applicable HSE legislation.
- Prevention of accidents, injuries, and pollution.
- Intolerance of the conditions and behaviours that contribute to incidents and injuries.
- Reduction of waste and conservation of resources.
- Recording and communicating HSE performance throughout the organization.
- Continual improvement of HSE performance.

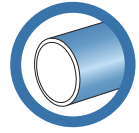
FULLY INTEGRATED MANAGEMENT SYSTEM

Bredero Shaw maintains a robust HSE Management System that is globally consistent and meets or exceeds all international standards. It can be considered best in class. The HSE Management System fully integrates the 3 aspects of HSE: engineering controls, documentation and behaviour. We believe that all three are necessary for an effective Management System.

Through these efforts Bredero Shaw has seen a significant improvement in its HSE performance. The company is committed to continuing this improvement and achieving an Incident and Injury Free workplace.



ANTI-CORROSION PRODUCT LINE



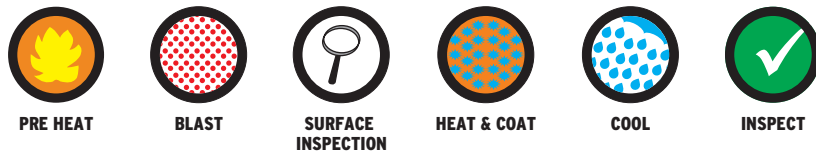
Bredero Shaw offers the widest range of anti-corrosion coatings in the industry covering all operating conditions for offshore or onshore installation. The coating selection depends on the operating conditions and specification requirements. The primary anti-corrosion coatings offered at Bredero Shaw plants for custom coating pieces are:

FBE

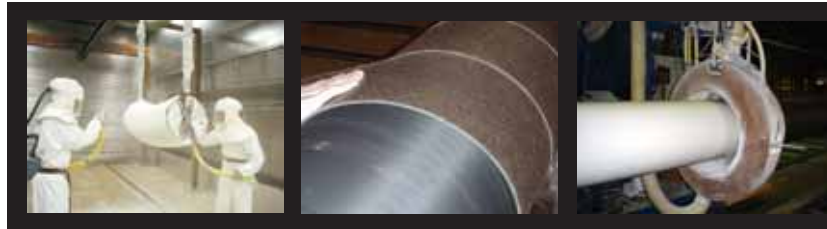
FBE (Fusion Bonded Epoxy) is a thin film coating offering good flexibility and excellent resistance to cathodic disbondment. It can be applied using a semi-automatic process for straight lengths or hand-flocked for spools & bends.

SEMI-AUTOMATIC PROCESS

This is a patented system to apply FBE to a single pipe joint.



HAND FLOCK PROCESS



3LPP

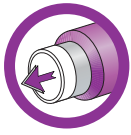
3LPP (3-Layer Polypropylene) is a system consisting of a primary layer of FBE, a mixed pass of FBE and polypropylene and an outer layer of polypropylene. 3LPP offers improved impact and abrasion resistance over polyethylene and is suitable for use up to 130°C operating temperature.

SPRAY-SPRAY PROCESS



FLAME SPRAY PROCESS





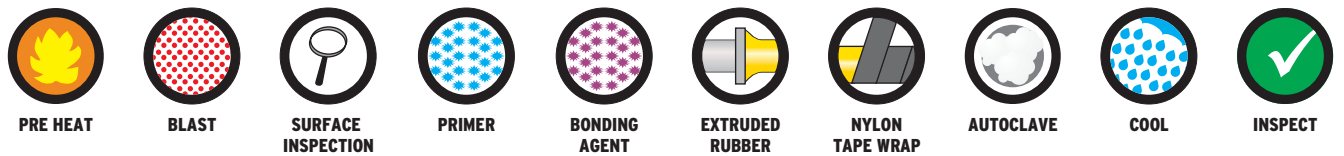
FLOW ASSURANCE PRODUCT LINE

RUBBER

Bredero Shaw offers two systems of rubber coating application; Polychloroprene for operating temperatures up to 95°C and EPDM for temperatures up to 130°C. Both systems are applied by extrusion onto straight lengths and hand wrapped to bends or fabricated spools. EPDM can be used as a thermal barrier underneath a flow assurance coating such as polyurethane. The polychloroprene system can also be adapted to an anti-fouling coating by the application of a 3mm thick outer layer of polychloroprene containing copper nickel granules.

Polychloroprene can also be internally applied to spools and used as a lining for riser clamps

STRAIGHT LENGTHS PROCESS



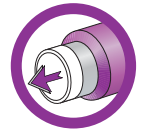
HAND APPLICATION PROCESS



INTERNAL APPLICATION PROCESS



FLOW ASSURANCE PRODUCT LINE



THERMOFLO® POLYURETHANE SYSTEMS

Bredero Shaw offers several different types of polyurethane systems:

ThermoFlo® (S)

A syntactic polyurethane containing elastomer microspheres, suitable for water depths up to 300 metres.

ThermoFlo® (D)

A syntactic polyurethane containing glass microspheres, suitable for water depths up to 2,400 metres.

ThermoFlo® Solid

A solid polyurethane suitable for deepwater applications and field weld coating.

ThermoFlo® Foam

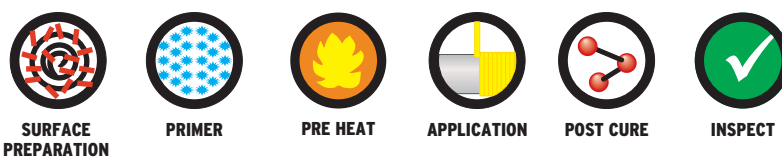
A specially formulated foamed polyurethane system with extremely fine cell structure, making it ideally suited for load-bearing applications. The system does not contain any CFC's, and as a result, has zero OPD.

ThermoFlo® Multi-Layer Coating

A three layer coating containing an inner layer of ThermoFlo® (S), a layer of ThermoFlo® Foam and an outer layer of ThermoFlo® (S), suitable for low U Value solutions in water depths up to 300 metres.

ThermoFlo® can be applied by moulding or by Controlled Rotational Casting for straight lengths of pipe.

CONTROLLED ROTATIONAL CASTING PROCESS



MOULDING PROCESS



FIELD JOINTS

Bredero Shaw has a long track record of coating welds onshore in fabrication yards and spool bases, and offshore on laybarges. We offer coating options for both anti-corrosion coatings and flow assurance coatings.

ANTI-CORROSION FIELD JOINTS

FBE

The same grade of FBE powder is applied to linepipe, custom coating pieces and field joints, providing continuous corrosion protection along the entire length of the pipeline.

The epoxy coating is applied in powder form by hand spraying onto a blast-cleaned and pre-heated weld area. Once in contact with the hot pipe, the powder melts, flows and cures, forming a coating with excellent adhesion and resistance to cathodic disbondment. Good flexibility over a wide temperature range also accommodates the strains seen during installation.

3LPP

Flame-sprayed polypropylene combines the excellent chemical resistance and corrosion protection of epoxies with the mechanical protection and excellent moisture barrier at elevated temperature of polypropylenes.

Once the weld area has been blast-cleaned, the FBE primer with an extended gel time (compared to stand alone FBE) is applied. The chemically modified polypropylene powder is then spray-applied over the FBE within the FBE gel time, forming a strong chemical bond between the layers.

Heat Shrink Sleeves

Heat shrink sleeves from Canusa-CPS have a thick radiation cross-linked polyolefin backing that is coated with a specially formulated high temperature sealant. During installation the sealant melts and flows, filling all surface irregularities and bonding to the substrate protecting the joint from mechanical damage and corrosion.

Rubber

Bredero Shaw recommends the use of rubber field joints using the same material as the parent coating. The joints are blast-cleaned and primed before the pre-heated rubber is hand applied. The newly coated joint is then wrapped in an insulating blanket and cured using electrical heat tapes.



ThermoFlo® Solid

This material is a 2-part, fast reacting polyether-based polyurethane. It is tough, shows good hydrolysis resistance and forms excellent bonds to both the parent coating and steel.

A mould is wrapped around the cleaned, preheated and primed field joint area, creating an annulus between the mould and pipe. The polyurethane is injected into the annulus and allowed to cure before the mould is removed and the coating trimmed.

FIELD JOINTS

FLOW ASSURANCE FIELD JOINTS

ThermoFlo® Solid

ThermoFlo® Solid can also be used as a field joint material on insulated line pipe using the same application techniques as on anti-corrosion coated lines. The thermal conductivity of the solid polyurethane is 0.195 W/mK.

ThermoFlo® Solid with PU Foam half-shell

This system is used for ThermoFlo® parent coating systems with a low U-Value. The PU Foam half-shells are fixed in position on spacers, then the mould is fitted and the half shells are encapsulated with ThermoFlo® Solid, giving a lower U-Value field joint than the ThermoFlo® Solid system described above.

Thermotite®

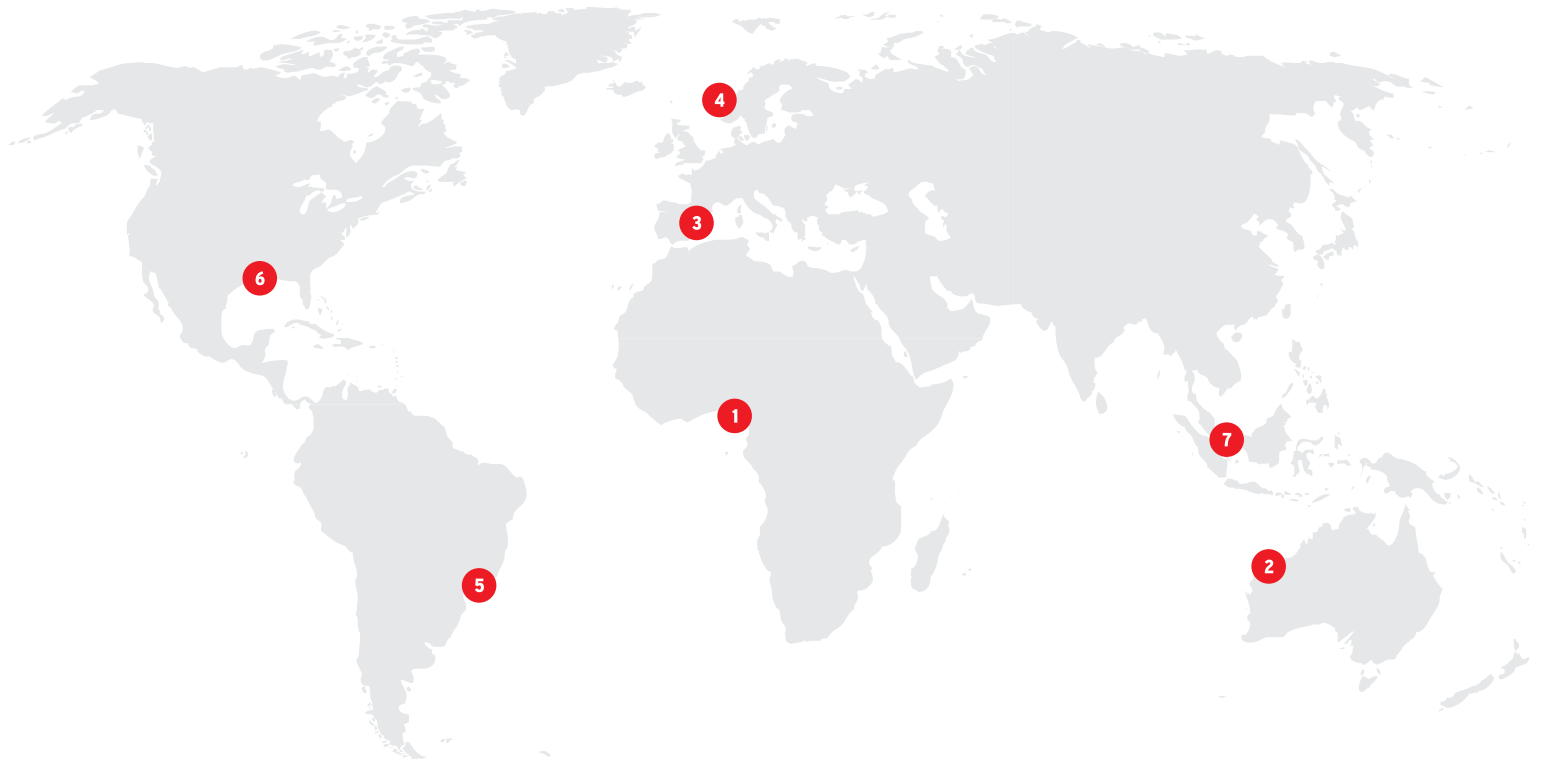
To provide continuous end-to-end pipeline coatings, equivalent grades of polypropylene can be used for the extrusion of line pipe and injection moulding of field joints.

FBE is applied to a cleaned and heated field joint area before a layer of adhesive followed by the injection of a UV stabilized polypropylene.



FIELD COATING SERVICES AT YOUR LOCATION

Supported by our 27 plants distributed globally, Bredero Shaw can mobilize to your fabrication site and apply most of our range of anti-corrosion and flow assurance coatings.



- 1 SHELL BONGA FIELD**
Bredero Shaw mobilized resources to Nigeria and applied 75 mm of ThermoFlo® (D) to 5 off FLETS.
- 2 ECHO YODEL DEVELOPMENT**
While on site coating field welds at Dampier, Australia , Bredero Shaw applied 25 mm ThermoFlo® Solid to spools.
- 3 SHELL BONGA FIELD**
Bredero Shaw mobilized to Tarragona, Spain and applied 90 mm ThermoFlo® (D) to the manifold pipework and valves on 5 manifolds destined for the Shell Bonga field off Nigeria.
- 4 GULLFAKS PROJECT**
Heat-up bundles were coated in Norway. Bredero Shaw applied 50 mm ThermoFlo® solid high temperature Polyurethane to 20" bundle pipework including encapsulating 2 x 4" heat-up lines.

- 5 BIJU PURA SALEM PROJECT**
Manifold and Dog Houses were coated in Brazil with ThermoFlo® (D).
- 6 SHELL MANATEE PROJECT**
ThermoFlo® (D) half-shells were moulded in the USA. Additional workscope included field joints, manifold, straights and bends.
- 7 PECIKO PROJECT**
Pipes were coated with ThermoFlo® Solid in Batam, Indonesia.



TECHNICAL SUMMARY

	Rubber			
	FBE	3LPP	Polychloroprene	EPDM
MAXIMUM OPERATING TEMPERATURE	85°C (185°F)	130°C (266°F)	95°C (203°F)	130°C (266°F)
MAXIMUM WATER DEPTH	unlimited	unlimited	unlimited	unlimited
MAXIMUM THICKNESS	1 mm (0.04")	2.5 mm (0.1")	25 mm (1")	25 mm (1")
K-VALUE	0.3 W/mK (0.173 BTU/ft.hr.°F)	0.22 W/mK (0.127 BTU/ft.hr.°F)	0.35 W/mK (0.200 BTU/ft.hr.°F)	0.35 W/mK (0.200 BTU/ft.hr.°F)
DENSITY	1450 kg/m ³ (90 pcf)	900 kg/m ³ (56 pcf)	1340 kg/m ³ (84 pcf)	1120 kg/m ³ (70 pcf)
OHTC (U VALUE)	–	–	15 W/m ² K (2.6 BTU/ft. ² hr.°F)	15 W/m ² K (2.6 BTU/ft. ² hr.°F)

Values shown are typical and may vary from plant to plant. Consult Bredero Shaw for special requirements.

	ThermoFlo® Product Line			
	Solid Polyurethane	Syntactic Polyurethane	Glass Syntactic Polyurethane	Polyurethane Foam
MAXIMUM OPERATING TEMPERATURE	125°C (257°F)	125°C (257°F)	115°C (240°F)	100°C (212°F)
MAXIMUM WATER DEPTH	unlimited	300 m (984 ft.)	2400 m (7875 ft.)	150 m (492 ft.)
MAXIMUM THICKNESS	200 mm (8")	200 mm (8")	200 mm (8")	150 mm (6")
K-VALUE	0.195 W/mK (0.113 BTU/ft.hr.°F)	0.12 W/mK (0.070 BTU/ft.hr.°F)	0.165 W/mK (0.095 BTU/ft.hr.°F)	0.06 W/mK (0.035 BTU/ft.hr.°F)
DENSITY	1150 kg/m ³ (72 pcf)	700 kg/m ³ (44 pcf)	860 kg/m ³ (54 pcf)	360 kg/m ³ (22 pcf)
OHTC (U VALUE)	2 W/m ² K (0.35 BTU/ft. ² hr.°F)	1 W/m ² K (0.18 BTU/ft. ² hr.°F)	1.5 W/m ² K (0.26 BTU/ft. ² hr.°F)	< 1.0 W/m ² K (< 1.8 BTU/ft. ² hr.°F)

Values shown are typical and may vary from plant to plant. Consult Bredero Shaw for special requirements.

Anti-Corrosion Field Joint	Compatibility	Typical Applications
FBE	FBE	Linepipe & Spools
FLAME SPRAY PP	3LPP	Linepipe & Spools
HEAT SHRINK SLEEVES	FBE, 3LPP, 3LPE	Linepipe & Spools
RUBBER	Rubber	Risers & Spools
THERMOFLO® SOLID	Rubber, 3LPP	Linepipe & Spools
Flow Assurance Field Joint	Compatibility	Typical Applications
THERMOFLO® SOLID	ThermoFlo® Solid S&D, Thermotite® S&D	Linepipe & Spools
THERMOFLO® SOLID WITH PU HALF SHELL	ThermoFlo® S&D	Linepipe & Spools
THERMOTITE®	Thermotite® S&D	Linepipe & Spools

PLANTS

NORTH AMERICA

1. 34th Street, Edmonton, Alberta
2. 21st Street, Edmonton, Alberta
3. Camrose I, Camrose, Alberta
4. Camrose II, Camrose, Alberta
5. Regina, Saskatchewan
6. Portland, Oregon
7. Adelanto, California
8. Fontana, California
9. Vineyard, Utah
10. Beaumont, Texas
11. Pearland, Texas *

LATIN AMERICA

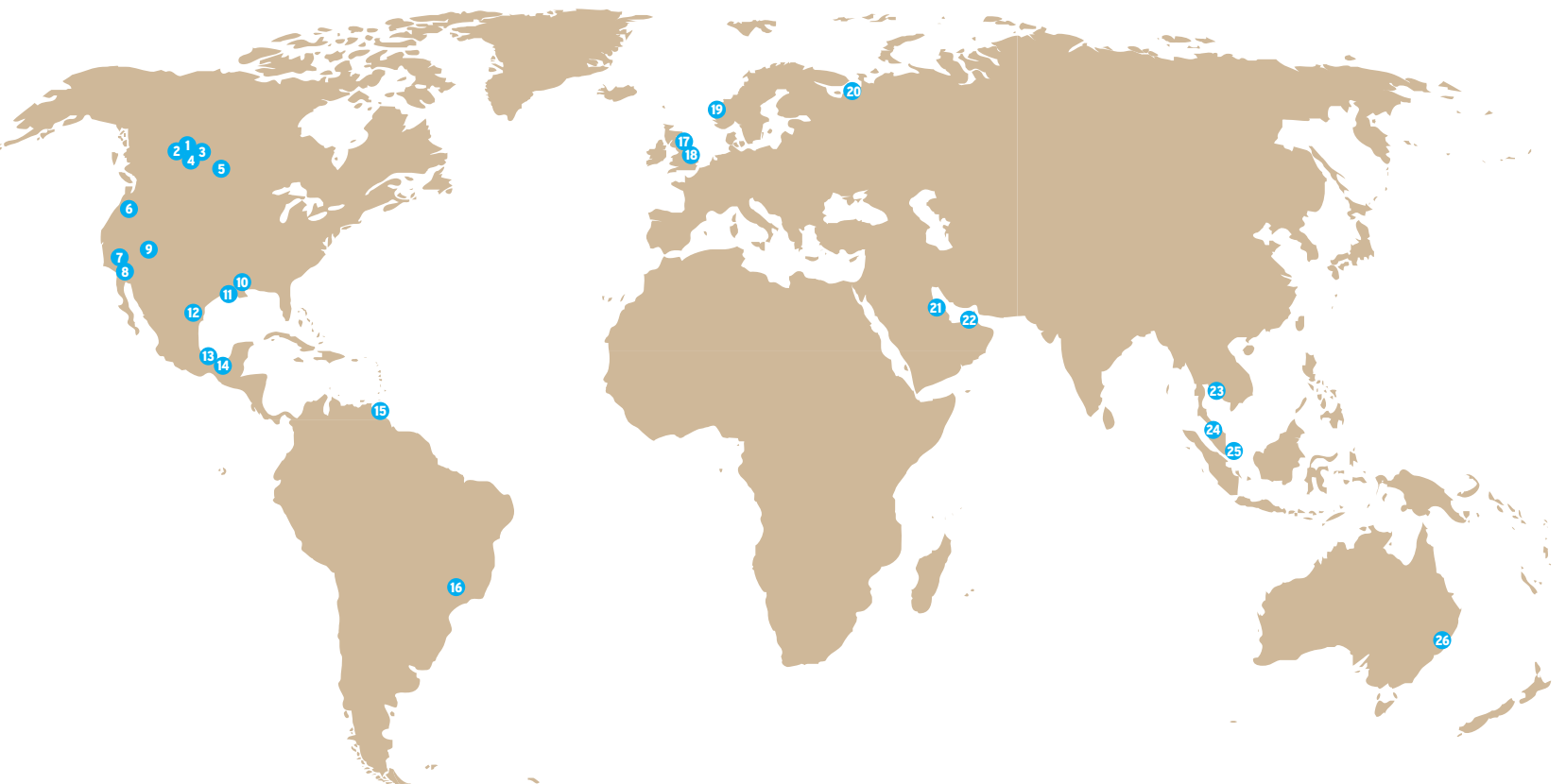
12. Monterrey, Mexico
13. Veracruz, Mexico *
14. Coatzacoalcos, Mexico
15. La Brea, Trinidad
16. Belo Horizonte, Brazil *

EUROPE, MIDDLE EAST, AFRICA & RUSSIA

17. Ellon, Scotland *
18. Leith, Scotland
19. Orkanger, Norway *
20. Arkhangelsk, Russia
21. Jubail, Saudi Arabia *
22. Ras Al Khaimah, UAE *

ASIA PACIFIC

23. Rayong, Thailand
24. Kuantan, Malaysia *
25. Kabil, Batam Island, Indonesia
26. Kembla Grange, Australia



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