

# SANJEL CEMENTING

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### *i*Base

Sanjel's *i*Base is an innovative mixture of engineered cement that combines with a selection of customized additives to yield integrated, high-performance, high-value cement products. *i*Base is processed using an improved industrial process that intergrinds a cementitious material with cement powder. Sanjel has developed specific additives for use with the *i*Base mixture to maximize its performance and provide versatility for simplifying cementing operations. The end result is a broad range of high performance cement blends offering both economic and environmental value. *i*Base blends provide many real-world advantages over typical well cements. Enhanced setting properties decrease the number of top-off jobs required, reducing rig time and cement costs. Higher reactivity allows for lower density options that increase slurry yield, reducing overall cement costs and the amount of bulk cement handling. Reduced need for additives such as anti-shrinking or expansion agents, free water agents, thixotropic-inducing products, and various gas migration additives, provides significant cost savings. With variable systems, one bulk mix can be used in remote locations for surface, production, and various plug operations. Sanjel's *i*Base blends have proven highly successful in lowering the cementing costs for several large-scale projects. Currently only available in Canada.

### Pozmix-Bentonite Cements

Pozmix cements are a specific type of cement that utilize pozzolans as a cement extender. Pozzolans can be very effective cement extenders as they can contribute to compressive strength through some chemical reactions. Pozzolans react with the calcium hydroxide, generated from cement hydration, in the presence of water to form cementitious compounds. This is unlike other common cement extenders like foam or spheres. Flyash is the most common type of pozzolan used in the industry. These systems can also include the addition of bentonite for further cement extension.

### Thermal Cements

High temperature oil and gas wells can pose some challenges with cement design. In cases where the wellbore temperature is expected to exceed 110°C (230°F), thermal cement must be incorporated, as conventional cements will undergo a phenomenon referred to as strength retrogression. At these temperatures, the crystalline phases morph into higher density phases, resulting in a significant decrease in the cement sheath's strength and a sharp increase in the permeability. It is the permeability that is often the root cause for well failure because of the loss in zonal isolation. Thermal cements for these applications are typically stabilized with silica flour at a concentration of 30 to 40% based on the weight of cement. Silica flour has been used to thermally stabilize Portland cement for the past 50 years. It is the silica flour that is added that influences the chemistry at the high temperatures, thus achieving a competent cement sheath.

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## PROTEUS™ Cements

Sanjel's PROTEUS™ is a thermally stable, mechanically flexible, and operationally versatile cement blend for use in Steam Assisted Gravity Drainage (SAGD) and other oilsands projects. PROTEUS™ is capable of withstanding temperatures up to 360°C (680°F) without experiencing strength retrogression, making it ideal for any high-temperature application. Additionally, the blend is designed to be mechanically flexible, providing wellbore integrity through extreme heating and cooling cycles and pressure fluctuations. PROTEUS™ is versatile enough that it may be used as a surface cement, production cement, plug cement, or lost circulation cement simply by altering the additive packages. PROTEUS™ has a lower density than traditional thermally-stable cements, resulting in lower circulating pressures and less risk of inducing lost circulation during cementing. Currently only available in Canada.

## PROLITE Cements

Field proven, the PROLITE series of light weight cement blends provide enhanced mechanical properties at a reduced overall cost through the use of Sanjel's new patented additive, SanLite. Based on naturally occurring amorphous aluminum silicate materials, SanLite does not require extensive processing steps resulting in lower cost and significantly less carbon dioxide (CO<sub>2</sub>) emissions. Currently only available in Canada.

## Glacial Mix

Glacial Mix is a highly specialized blend designed for use in areas like permafrost zones. Glacial mix is designed to prevent damage to the permafrost as would happen with a highly accelerated traditional slurry. Glacial Mix is also suitable for conductor barrels due to its ability to gain compressive strength at low temperatures. Ideally the Glacial Mix is formulated for wells with bottom hole static temperatures between -5 to 10°C (23 to 50°F). Unlike traditional cement blends where water would freeze due to temperatures being below freezing, the Glacial Mix slurry has additives that allow the cement to hydrate and gain compressive strength similar to traditional cement blends.

## Expandomix and Expandomix LWL

Expandomix is Sanjel's exclusive thixotropic cement blend used for casing cementing, lost circulation plugs, and some types of remedial cement squeeze applications. Expandomix LWL is a low water loss blend used in production casing where wells have the potential for more severe gas migration, or where free water and fluid loss control are required. The Expandomix system may be densified resulting in more aggressive, earlier gel strength development. Upon setting, bulk expansion of the cement will seal the annulus inhibiting gas migration.

## Expandomix HT

Expandomix HT is Sanjel's premium-bonding cement for high temperature applications. Formation of microannuli is less likely to occur due to the crystalline expansion of the cement when it sets. This effectively improves the formation-casing bond and creates the zonal isolation required for stimulation jobs.

## Invert Preflush

Sanjel's Invert Preflush is the first part of a two-part invert well treatment. The purpose of this system is to minimize cement contamination with the drilling fluid, leaving the annulus water-wet and improving the cement bond. Invert Preflush is made with the base oil of the invert mud that is usually found on location. Specific additives are added to make Invert Preflush including a mutual solvent, a surfactant to begin turning the hole from oil-wet to water-wet, and a hydrocarbon gellant to increase viscosity for displacement efficiency or to carry weighting agents.

## Invert Spacer

Invert Spacer is the second part of Sanjel's two-part invert removal system. Invert Spacer is water-based and contains chemicals for modifying viscosity, water-wetting the hole, and controlling clay swelling. Invert Spacer is used as an intermediary between Sanjel's Invert Preflush and the cement being pumped into the well. Its purpose is to separate the cement from any hydrocarbon-based mud and leave the well water-wet prior to cementing. A water-wet annulus will ensure a good cement bond to the casing and the formation.

## Kwik Kick

Kwik Kick is optimized for shallow plug applications where directional drilling is desirable. This blend is designed to set up fast and become harder than the formation allowing for ease of directional well drilling. The blend can also be used to bypass troubled zones. The blend is recommended for operating temperatures between 15 to 25°C (59 to 77°F) and depths from surface to 600 m (1968 ft). The powerful retarding additives such as QSR-2 and CR-2 must be prehydrated before being introduced into the cement to ensure full effectiveness.

## LCS 1600

LCS 1600 is a premium, low density lost circulation slurry. It is a sphere-based blend with strong thixotropic properties to successfully cure lost circulation issues. LCS 1600 is generally utilized for placement across naturally fractured, vugular, and highly permeable formations up to a BHCT of 80°C (176°F).

## LCS 1820

Sanjel's LCS 1820 blend is an excellent choice for wells with formations that pose a significant lost circulation problem. Its ability to rapidly achieve high gel strength and compressive strength reduces the wait on cement time, thus effectively diminishing any lost circulation issues. LCS 1820 is ideal for use as plug in formations that are vuggy and cavernous.

## Mudflush

Mudflush is a water-based preflush or spacer used to create a superior bonding environment for cement. It contains two main components: SAPP and WS-30. SAPP is a mud thinner and dispersant with strong cleaning tendencies. WS-30 is a mutual solvent and surfactant-wetting agent that disperses mud filtrate and water-wets previously oil-wet formations and pipe for effective bonding to all surfaces.

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## RAS II

RAS II is a Right Angle Set cement that is primarily used in lost circulation plug applications. If partial losses are observed, RAS II is an excellent plug cement as it significantly reduces wait on cement times. RAS II is also an ideal lead slurry when performing a pancake squeeze for surface jobs, or as a cement cap for foam cementing operations. With the introduction of Sanjel's QSR-2, cement thickening times can be customized from 10 minutes to 3 hours depending on wellbore and slurry temperatures. RAS II may also be used as a water inflow shut-off blend when inflow rates are low.

## SanSeal HT

SanSeal HT is a silica-stabilized microfine cement for use in wells where the temperature is above 70°C (158°F). Unlike conventional Portland cements, typical microfine cements may suffer from strength retrogression at temperatures above 70°C (158°F). SanSeal HT contains a finely ground silica source, not only to ensure thermal stability, but also to maintain a controlled microfine particle distribution that ensures good penetration into small flow channels.

## SanSeal

SanSeal is a microblend cement which is ideal for surface casing vent flow and gas migration repairs. Production casing corrosion, leaking casing collars, or any similar problem can also be repaired utilizing this blend. SanSeal is successful due to the controlled particle size distribution that aids in controlling viscosity and flow properties, enabling the slurry to penetrate into very small channels in the formation.

## Scavenger Slurry

Scavenger slurries are prepared by mixing a cement slurry at a lighter density by increasing the water to cement ratio. Scavenger Slurry is typically mixed 200 to 300 kg/m<sup>3</sup> (1.67 to 2.50 ppg) heavier than the equivalent mud density. Scavenger Slurry is an excellent mud removal tool as it can be pumped in turbulent flow, and the cement particles provide the scouring material needed to help clean the wellbore. Scavenger Slurry is recommended for use in combination with other Sanjel preflush and spacers to help prevent slurry contamination with the drilling mud.

## SSi

SSi stands for Sanjel Surface Innovation and is a specially engineered cement system designed primarily for use on surface casing jobs. The blend provides a strong economic benefit, as the cost per cubic metre is less than traditional 0-1-0 'G' surface cements. SSi has a density of 1750 kg/m<sup>3</sup> (14.61 ppg) but is on par with traditional surface cements pumped at 1900 kg/m<sup>3</sup> (15.86 ppg) when comparing drill-out or wait on cement time. Currently only available in Canada.

## SurfLite

SurfLite is an economical, low-density surface blend. It is often used in surface casing jobs that are deeper than the norm, where traditional surface cements may be too heavy for the unconsolidated formations near surface. Unlike conventional surface blends mixed at 1900 kg/m<sup>3</sup> (15.86 ppg), SurfLite has a lower hydrostatic pressure that is perfect for areas susceptible to losses. A thixotropic additive in SurfLite reduces losses after placement is completed as well as gas migration potential.

## ThixLite HT

ThixLite HT is applied primarily as a lead cement for wells over 1500 m (4921 ft) deep. ThixLite HT is designed to have low density and low viscosity while keeping the important slurry properties such as fluid loss and free water under control. Though ThixLite HT is lightweight and usually has a long thickening time, the compressive strength development is good and does not increase wait on cement times. ThixLite HT is typically a lead cement, but it can also be used as a full production cement and as a remedial cement for circulation squeezes.

## Visweep

Sanjel's Visweep is a premium viscous water-based spacer and mud displacement system. It serves to separate the drilling mud and cement, preventing contamination. The inherent viscosity ensures the removal of filter cake and cuttings, promoting good cement bonding and the prevention of channeling.

## Whipstock Plug Cement

Whipstock Plug Cements are used when deviating from vertical in the wellbore. The high density blend gains more compressive strength than standard density plug cements. This strength is necessary to successfully kickoff the plug in the wellbore into the desired formation to begin the directional drilling process. Plug length, as well as a carefully designed preflush and spacer program, are necessary to avoid contamination and ensure a successful job. In invert wells, 3.0% potassium chloride (KCl) is added to inhibit clay swelling and movement of water from the cement to the formation, which improves the bond between the formation and the plug. KCl also improves the early compressive strength of the plug reducing rig time. This blend may be batch mixed in the field and is also typically used with an accelerator or retarder to achieve the desired thickening time.

## Wellblock-T

Wellblock-T is a temporary polymer gel plug. It may be used to temporarily block producing or highly permeable zones during typical well operations. Wellblock-T can be used to protect retrievable tools during workover applications. During some remedial cement jobs or well stimulation exercises, Wellblock-T has also been used as a backstop or diverting agent. The polymer is mixed with water on the surface, causing the water to gel during placement downhole. Gel time can be controlled by the pH of the mix water to accelerate or retard the set. Gelling is temperature-dependent so water and well temperatures should be part of the mix design. Breakers can be used to break the gel in hours or days, although the gel will break without any breakers after 5 to 7 days, depending on temperature.

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## Wellseal

Wellseal is a reactive preflush designed to effectively improve the ability of cement to bond to a formation. Areas where cement bond is a concern or bond improvements are required are ideal candidates for this treatment. Wellseal is extremely effective in porous zones. Specifically, its minimal initial viscosity allows it to penetrate deep into the porous zones where it reacts with formation waters and mud filtrate to form a stiff gel, thereby preventing cement leak-off. When pumped ahead of cement, Wellseal also prevents fallback and lost circulation. It should be noted that Wellseal is designed for use with water-based muds and that the system should be mixed for 30 minutes prior to treatment to ensure optimal reactivity.

## Wellseal-G

Wellseal-G is a two component, polymerized rubber plug that is ideal for the blocking of thief zones, the plugging of leaking casing, or the permanent plugging of a perforated interval or open hole. It is an effective 'backstop' for cement during remediation procedures and can also be used as a lost circulation treatment option. Wellseal-G is effective in that it is able to penetrate the troubling formation in its initial liquid form. Both time and temperature then allow this system to develop a gelatinous consistency, quickly viscosifying and plugging off pore throats and lost circulation areas, and providing stability to the wellbore. Wellseal-G is also an excellent option when dealing with large caverns as it provides an economical and effective fill, allowing cement to be used in the near wellbore. After the placement of Wellseal-G, it is typically recommended that operations be shut down for 1 hour to ensure complete gelation of the system, after which time squeeze procedures may be initiated.

## Control Set C Cement

Control Set C utilizes ASTM Type III cement for good early compressive strength in shallow wells. Although this type of cement is not specifically designed for wellbore usage, in the right application it substantially saves WOC times. Due to the aggressive nature of Control Set C, it is only suitable for low temperatures. Control Set C offers a density range from 1318 kg/m<sup>3</sup> to 1617 kg/m<sup>3</sup> (11.0 lbs/gal to 13.5 lbs/gal) low fluid, and thixotropic properties reduce fallback and protect against gas migration.

## Sanlead/Santail

Sanlead and Santail are light weight, high performance blends. SanLead is usually run at 1498 kg/m<sup>3</sup> (12.5 lbs/gal) while SanTail is usually run at 1617 kg/m<sup>3</sup> (13.5 lbs/gal). These blends are designed to offer 0% free water and very low fluid loss which is optimal for horizontal wellbores. The Sanlead and Santail blends are run from 60°C to 127°C (140°F to 260°F). The expansion properties of these blends create good cement bonding and protects against gas migration. These blends are salt tolerant and contain SanLite which is a natural occurring chemical additive. This makes SanLead/SanTail more eco-friendly blends as they do not require the emission of CO<sub>2</sub> in the atmosphere during the manufacturing process.

## Thixmix Cement

Thixmix is versatile casing cement used most often as a tail blend. An economical blend of thixotropic properties and good compressive strength provide insurance against lost circulation and gas migration. Thixmix is run at 1737 kg/m<sup>3</sup> (14.5 lbs/gal) and has a short transition time. Thixmix is run at temperatures up to 66°C (150°F).

## Williston Basin Lead

Williston Basin Lead was developed specifically as a lead slurry for the Williston Basin. WBL was designed to be a lightweight lead slurry used to cement across the salt formations found in the basin. WBL can be optimized for specific well conditions to help combat lost circulation and prevent salt zone wash out.