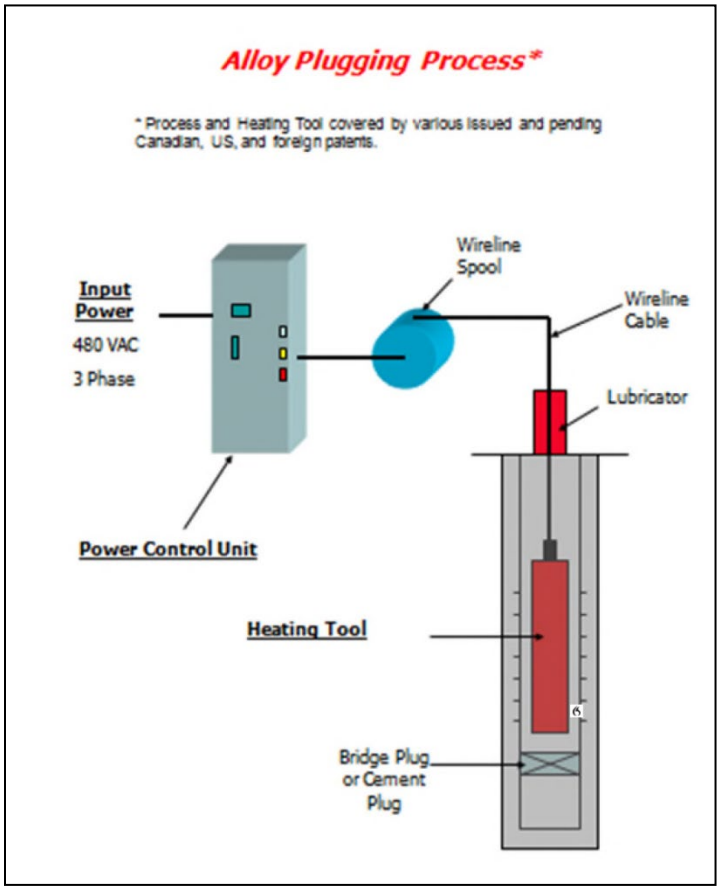
Reducing Greenhouse Gas Emissions Using Bismuth Alloy Injection

The traditional method of sealing GHG leakage from the annulus of wells in Alberta and elsewhere involves "squeezing" cement through casing perforations into the well annulus. The procedure is expensive and unreliable partly because of the fundamental properties of cement. Seal Well's bismuth alloy squeezing procedure is both less expensive per individual squeeze and potentially much more reliable, thus avoiding costly repeat of procedures.

Seal Well's bismuth alloy has fundamental physical properties that make its use ideal for this purpose. It melts at a relatively low 138°C temperature so that it can be readily molded in place within a well. It expands by about 1% when it solidifies, and, if set against a competent impermeable formation, it forms a bubble-tight seal. It has a service life in well environments, including CO_2 and H_2S, of thousands of years.



The first step in Seal Well's procedure is to select an impermeable formation within the well above the suspected source of the leaking GHG as the site for the repair. The well casing is then either perforated or slotted to access the well annulus and wellbore wall. A bridge plug is set in the casing immediately below the perforations or slots, and an electrical heating tool carrying solid bismuth alloy is lowered on an electrical cable to rest upon the bridge plug. Electrical power is introduced at surface by Seal Well to energize the heater, melt the alloy, and heat the annulus and wellbore wall. The temperature at the repair site is indicated by the real time temperature logging electronics included in the heating tool. When the target temperature is reached, modest pressure is applied to "squeeze" the molten alloy into the annulus and wellbore wall. The alloy solidifies instantaneously when it contacts formation at a temperature below its melting point. The heating tool is then lifted from the well.

Seal Well Inc. proposes to repair annular GHG leaks on a series of 20 Alberta wells to demonstrate the efficacy of its proprietary technology for doing so by melting *in situ* and "squeezing" a bismuth-based metal alloy through slots or perforations shot in the well casing and annular cement to the wellbore wall. The project is "shovel ready" and will remediate wells affected by methane leakage through Surface Casing Vent Flow (SCVF). Commercialization of the technology with one crew remediating 30 wells per year for 20 years will reduce GHG emissions by about 400,000 tons.

In addition to the elimination of GHG emissions from the demonstration wells, a study will be conducted to compare a recently introduced casing slotting tool with high density perforating to determine the more effective and economical method for accessing the well casing annulus.

Another study will be conducted to determine as completely as possible the physical competence of shale formations within the demonstration wells that are available as low permeability caprocks against which the alloy annular plugs can be set.