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电解铝废料处理的最新发展

New Developments in Treatment Options for Spent Aluminum Potliner [简称为**SPL**]

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Over the last 25 years there have been re-occurring attempts to use spent aluminum potliner (SPL) in cement kilns. There are two major difficulties to overcome relativeto the use of SPL, other than the off and on again approach to the issue that the aluminum industry has had on the issue. The first of these is regulatory and perception related – SPL has cyanide. While cyanide is certainly toxic it will also clearly be destroyed in a cement kiln, and unless mixed with acid or blown as powder into the air is unlikely to present a significant safety concern to employees in a plant. Nevertheless, the combination of the perception of problems with this issue and the fact that it is the cyanide that renders this waste hazardous in the eyes of the USEPA and other regulators around the world makes this a difficult problem to overcome.Only a handful of cement plants already permitted to burn hazardous waste are in a position to deal effectively with this issue in order to use SPL as a fuel, mineralizer and alternative raw material.

在过去的25年间曾经反复多次有水泥厂企图使用电解铝废料作燃料. 除了一直以来铝金属冶炼工业遇到的问题之外，使用SPL有两个主要障碍需要克服. 第一个是与监管和概念有关的，那就是SPL含有氰化物. 氰化物果然有毒但已经清楚地知道它在水泥窑内一定可以被销毁，除非与酸混合，或者是成粉状漂浮于空气中，否则不会对员工构成顯著的安全威胁.

不过，综合了这种概念的问题和氰化物本质，SPL被美国环保当局和世界上其他的环保机构视为危险废物，使得利用SPL成为不易解决的难题. 只有为数不多的、已经获准燃烧危险废物的水泥厂，有效地应付这个问题才得以使用SPL作为燃料，或作为代替的矿物原料使用。

The other issue is not as well known but is of far more concern. SPL is highly water reactive generating ammonia, methane, hydrogen and heat on contact with as little water as can be found in humid air! There have been fires and explosions in enclosed shipping containers. The finer the material is ground, as is done prior to injecting it into a cement kiln, the greater the potential for hazardous gas release. Any cement plant using SPL, even one used to dealing with other hazardous wastes, needs to take extra precautions when handling this material.

另外一个问题虽不为人们熟悉，但却深受关注。 SPL遇到水会有强烈的反应，就算些微的水，如潮湿的空气，会产生氨、甲烷、氢气和发热. 在密封的海运集装箱内曾经发生过火灾和爆炸。这种物质越是磨得细，像注入水泥窑之前的状态，释放危险气体的可能性就越大。任何水泥厂使用SPL,就算是已经在使用危险废物，也必须在处理这些物料时特别小心。

All of that said, imagine my pleasant surprise during a recent visit to a cement plant in Australia to find that a company had developed a process to both destroy the cyanide in SPL and the reactivity, rendering the SPL non-hazardous. The plant I was visiting, as well as two others in southern Australia, are now using SPL as easily as most plants use coal or coke – no special permitting, no special handling. Trucks are pneumatically unloaded into a storage tank and from there fed to the kiln like any other solid powdered fuel. The plant gets not only the fuel value but also the mineralizing benefits of the fluoride present in SPL and the material value from the aluminum.

我最近到澳大利亚访问一家水泥厂，看到那家公司发展出一种工序，既销毁了SPL的氰化物又摧毁了它的反应性，使得SPL成为非危险品，这个发现令我惊奇不已。我访问的那家厂子和另外两家都是在澳大利亚南部，他们都使用SPL犹如其他厂子使用煤碳和焦煤那么容易，不需要许可、也没有特殊的处理. 罐车用液压方法自车上把SPL卸入储存库，如其它粉状燃料一般直接喂入水泥窑内。 厂子不单获得燃料的价值，同时也得益自SPL中获得氟化物和铝的原料价值。

The process for rendering hazardous waste SPL non-hazardous has been developed and patented by a company called Regain Services Pty Ltd (Regain). Regain has worked for years to refine and develop the process into a truly elegant solution – speaking as a chemist, of course. I cannot go into details because of the confidential nature of what I have seen but the process is certainly ready for prime time. While not mobile it is easily set up in a relatively small amount of space right at the aluminum plant generating the SPL. The process results in a blended product with a relatively consistent quality that gets tested prior to shipment to the cement plants. The process is currently operating at two aluminum plants (soon to be a third) and provides nonhazardous SPL to three cement plants.

这种工序使得危险废物SPL成为非危险品是由Regain Services Pty Ltd（简称Regain）开发并经专利注册. Regain花了多年时间的改良和发展出这个工序，我作为一个化学工程师认为那确实是个出色的办法. 由于它的机密性我不能详述，不过这个工序肯定会大行其道. 虽然不是流动的，但是却挺容易在产生SPL的铝金属冶炼厂内，于一个不大的空间里建立起来. 这个工序的结果是能调配出一种相对一致的产品质量，经过测试后才送往水泥厂。如今这工序在两家（很快由第三家）铝金属冶炼内运作，提供非危险的SPL给三家水泥厂使用。

The development of the Regain process opens up all kinds of possibilities for both further processing and other end uses. For cement plants that might be limited in their potential use of SPL because of the sodium content it would certainly be possible to leach a portion or most of the sodium fluoride from the SPL prior to use in the kiln. The aqueous based sodium fluoride solution could then be used at a different wet process plant where the mineralizing properties are not the only benefit. Sodium fluoride acts as a viscosity reducing agent in wet plant slurry tanks reducing the percent of water required in the slurry and thus reducing overall energy consumption. Without the issue of cyanide and reactivity other industries may also find treated SPL to be a valuable additive for its fluxing action and fuel savings. The brick industry is one that comes to mind

Regain工序的发展打开了所有的可能性，作进一步的加工以及其他用途. 对水泥厂来说那也许会限制了他们使用SPL的潜在用途，因为在水泥窑使用之前，SPL中的含钠量肯定可能有部分，甚至大部分的氟化钠也会被滤去. 由于水性的氟化钠溶液能用于不同的湿法水泥厂，在那里矿物性能并非是唯一的得益. 氟化钠起的作用在湿法厂子的浆料库内如粘性减却剂，减少浆料库内所需的水分比率从而减少总的能量消耗. 没有了氰化物和反应性的问题，其他工业可能也会发现，经过处理的SPL为一种宝贵的添加剂，作为助熔和节省燃料. 制砖工业是我能想象得到的其中之一。

The folks at Regain have proven that innovation is alive and well in the hazardous waste treatment and recycling industry. It will be interesting to see how the USEPA embraces this new option for treating and reusing SPL.

Regain的人员证明了在危险废物处理和废物再生工业里的创新,是既活跃又做得不错. 有趣的是待我们看美国的环保当局如何接受这种新的处理和再用SPL的选择.

【Note】 Spent Aluminum Poliner [Abv. Spent Potliner or SPL]. This is the conductive carbon used to line the pots in the electrolytic process that separates elemental aluminum from the alumina raw material. It contains a small amount of cyanide and a few heavy metals, primarily lead and chrome, as well as considerable sodium and fluoride. In US the EPA has classified SPL as hazardous waste, it can be used as fuel and mineralizer in cement kiln after properly treated.

【注】 电解铝废料的英文名为Spent Aluminum Potliner［简称SPL］是提炼铝金属用的电解槽的内衬的导电碳废料，可以用作水泥回转窑的燃料及补充矿物原料，但是因为含有小量的氰化物和些微的重金属，主要为铅和铬，还有相当多的钠和氟化物，在美国它被定为危险废物，需经过处理后才准使用。

欲作更多咨询，或者你有什么经验可以与我们分享，请联系 Mr. David Gossman, 电话 001-847-683-4188，或者发电邮dgossman@gcisloutions.com 中国的朋友们可发电邮给我公司驻中国代表— 张启明先生〈dennis.june@gcisolutions.com〉

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