



水泥资源回收在中国 Cement Resource Recovery in China

一个可持续性发展的选择

A Sustainable Development Option

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前 言

Preamble:

当今世界所面临的环境与营商之间的矛盾、已达到空前未有的程度

At no time in history has the world faced environmental and business concerns of today's magnitude.

一方面是为了保护那些不能挽回的天然燃料、另一方面大批量的工业废物对健康及安全[的威胁]、形成了逼切的生态环境问题。由于国际上的竞争、如何降低成本和增加盈利、在营商方面颇受关注。正由于那些问题、纪元科技集团有限公司乐意提供水泥资源回收的科技[来解决问题]。

The preservation of irreplaceable fossil fuels, overwhelming volumes of industrial waste and health and safety concerns are in the forefront of ecological issues. Cost competitiveness and profitability due to international competition are concerns for the business side. It is precisely these issues that ERAtech Group LLC would like to address with its proven cement resource recovery technologies.

What is the solution? 有什么解决方法?

在处理危险废物方面、需要有不断的创新的思维和改良的科技、既要对环境合理又要合乎经济的原则。中国应可避免再次投资于昂贵的、有争议性的危险废物旋转焚化炉、因为可

以利用水泥窑来焚烧、从有机废物里提炼出来的再生燃料。正确地利用再生燃料的科技、会有下面的得益：

Innovative ideas and new technologies are continually needed to manage hazardous wastes in an environmentally sound and cost-effective manner. China may be able to forego the need to further invest in costly, and sometimes controversial, hazardous waste rotary kiln incinerators, because of the capability of burning recycled fuels made from organic hazardous wastes in cement kilns. Properly implemented recycled fuels technology will yield the following benefits:

- 从可燃的废物里能回收得到颇高的能源价值。
- Energy recovery from combustible wastes with a high energy value,
- 节省天然的燃料。
- Conservation of fossil fuels
- 减少二氧化碳的排放。
- Reduced CO₂ emissions
- 减低水泥的生产成本。
- Reduction in cement production costs
- 销毁危险废物[的方法]对环境合理。
- Environmentally sound destruction of hazardous wastes

自从 1970 年代后期、液体的石油与石化废物曾经是再生的液体燃料的主流。在处理固体及泥泞状的石油和石化废物时、曾经遭遇到极大的困难。不过、由于极力想避免把那些废物埋在地下的缘故、驱使人们来发展可以处理那些固体的和泥泞状废物的科技、而且可以把它当作燃料。

Liquid petroleum and petrochemical wastes has been a part of this recycled liquid fuel stream from its inception in the late 1970's. Solid and sludgy petroleum and petrochemical wastes have presented greater handling difficulties. Nevertheless, the desirability of not landfilling many of these wastes has resulted in the motivation to develop solid and sludge handling processing technologies to allow their use as fuel also.

质量控制的科技、包括在产生废物的场所和水泥厂子里设立化验室、也是发展那种科技的重要部份。资源回收的经济效益、加上对环境会有重要的、积极的影响、可使中国有个改进废物处理基础设施的重大机会、增强可持续性发展。

Quality control technologies, including laboratories at both the cement kiln and the generating/processing location, have also been a critical part of these developments. The cost effectiveness of the resource recovery option coupled with the significant, positive environmental impacts provides a significant opportunity to China for waste infrastructure improvement in a way that maximises sustainable development.

把两种似乎不同的科技的结合起来；废物管理与生产水泥、对两种工业都会有深远的影响：

The integration of two seemingly diverse technologies, management of wastes and production of cement, is having a profound effect on both industries:

反复地研究得出的警告是：如果不提升一个国家的废物处理能力、会有严重的后果。如今、在那些推行这项科技的国家里、许多种类的废物的需求已有增强、作为补充燃料。

Study after study has warned of severe consequences of not providing for a nation's capability for waste management. Yet today, many types of wastes are in significant demand for use as supplemental fuel, in those countries that have promoted this technology.

水泥的生产厂子能权衡不同的收入来源、以他们的设施为处理废物[方面]提供服务。通常、每种新的收入会帮助厂子减轻燃料和原料的成本、在这个既有的、成熟的市场里不断的努力、籍以保持竞争性。

Cement manufacturing plants can evaluate different sources of new revenue for their facilities by providing waste management services. Usually, each new source of revenue also helps lower plant fuel or raw material costs in the never-ending effort to remain competitive in a well-established and mature market.

采用已经证实有效的处理科技、在以往的数十年里、水泥业已经有控制地使用了大量废物作为另类原料和燃料。在发达国家里的水泥业已经成为废物管理规划里的重要支柱。不同种类的废料适用于水泥窑、不止是石油和石化废物、也包括橡胶轮胎、塑料、溶剂、发电厂的煤灰、高炉的渣滓与铸造用的砂等都在其中。许多这类废物、都是大批量地产生、如果不用水泥窑处理[的话]就得经焚烧厂和土壤推填。

Using proven process technology, the cement industry has made controlled use of large quantities of wastes as alternative raw materials and fuels for decades. In developed countries the cement industry has become an integral actor in waste management schemes. The variety of materials that are suitable for use in cement kilns not only includes Petroleum and Petrochemical wastes but also such wastes as tires, plastics, solvents, coal ash from power plants, blast furnace slag, and foundry sand, among many others. Many of these wastes, which are usually generated in large quantities, would require disposal through incineration or landfill if not recovered in cement kilns.

让我们探讨几个要点、对在中国推行水泥回收很重要、而且为什么它是各省、市政府支持他们发展废物管理基础的一个优越的双赢选择。

Let us touch on a few points that are important to promote the subject of cement resource recovery in China and why it represents an excellent win-win option for the provincial

governments in support of their efforts to develop improved waste management infrastructures.

以下在经商各方面会影响在中国推行水泥资源回收[的方案]:

The following aspects of the business will impact cement resource recovery in China:

- 水泥的生产工艺与化学过程.
- Cement Manufacturing Process and Chemistry
- 废物市场方面[的概况].
- Aspects of the Waste Market
- 监管的环境.
- The Regulatory Environment
- 水泥资源回收的主导地位.
- Cement Resource Recovery Stewardship
- 推荐法规来管理废物燃料.
- Recommendations for Regulations for the management of waste fuels
- 公关与风险的传达.
- Public Relations and Risk Communications

我们先由废物市场方面开始、然后涉及监管的环境、与如何它会影响废物市场、及其在中国推行另类燃料的可行性与可持续性。

We start with aspects of the waste market and then cover regulatory environment and how it affects the waste market and the viability and sustainability of alternative fuels programs in China.

检阅水泥的生产工艺与化学过程

Review of the Cement Manufacturing Process and Chemistry

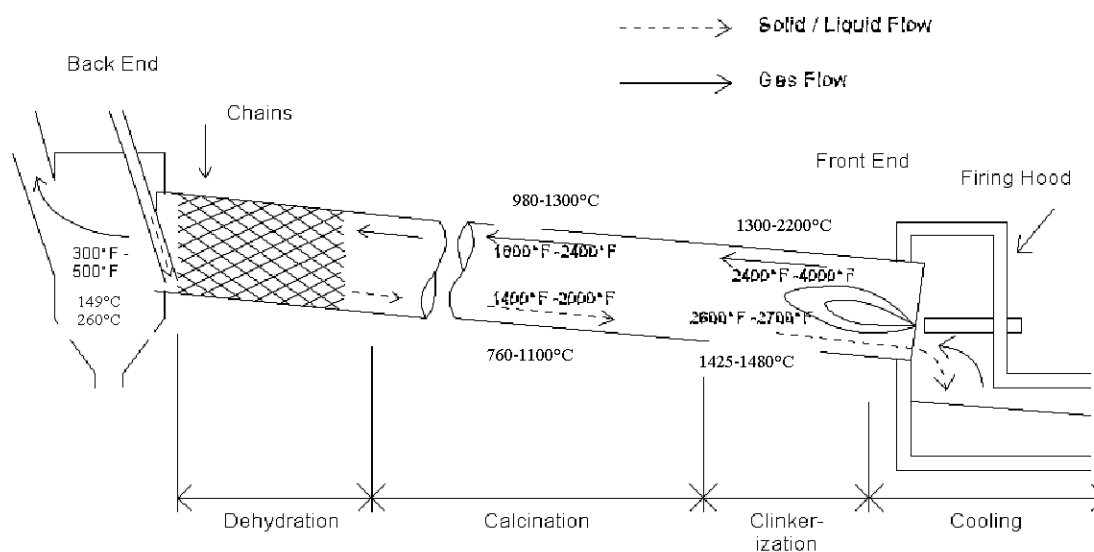
废物管理工业大致上都明白利用大型旋转窑生产水泥的工艺过程、因为在美国与欧洲的水泥厂如今已使用大量的废物燃料。不过重新检阅一次水泥的生产及其化学过程是有必要的、因为它的重要特点与焚烧的技术有很大的分别。

The process of using large rotary kilns for manufacturing cement is generally understood by the waste management industry because of the large quantity of waste fuels currently used in many cement plants in the U.S and Europe. Nevertheless, a review of the cement manufacturing process and chemistry is warranted, since critical characteristics are significantly different from incinerator technology.

第一图为一个笔直的旋转水泥窑的基本图解。原料(通称“生料”)、如石灰、页岩石、砂子及其他灰料等、以一定的比率(混合后)、在干的或湿的状态下、输入水泥窑的后部(较高的那端)。这些原料随着水泥窑的旋转慢慢的流向水泥窑的前部(较低的那端)。开始时这些

原料会放出水汽(脱水)、排放二氧化碳(灼热)。最后、在水泥窑最热的那端(较低的那端)、产生了最终的化学反应之后由水泥窑里跌落入冷却槽里、渐渐冷却。

Figure 1 is a schematic of a basic straight rotary cement kiln. Raw materials such as limestone, shale, clay, sand, fly ash, etc. are fed, either wet or dry, in specific proportions into the back end of the kiln. This material travels toward the front end of the kiln as the kiln turns. Initially, these raw materials give off water vapor (dehydration) and then give off CO_2 (calcination). Finally, in the hottest end of the kiln, the final chemical reactions occur and the material falls out of the kiln into a cooler where it is quenched.



Schematic Flow Diagram of a Straight Rotary Cement Kiln

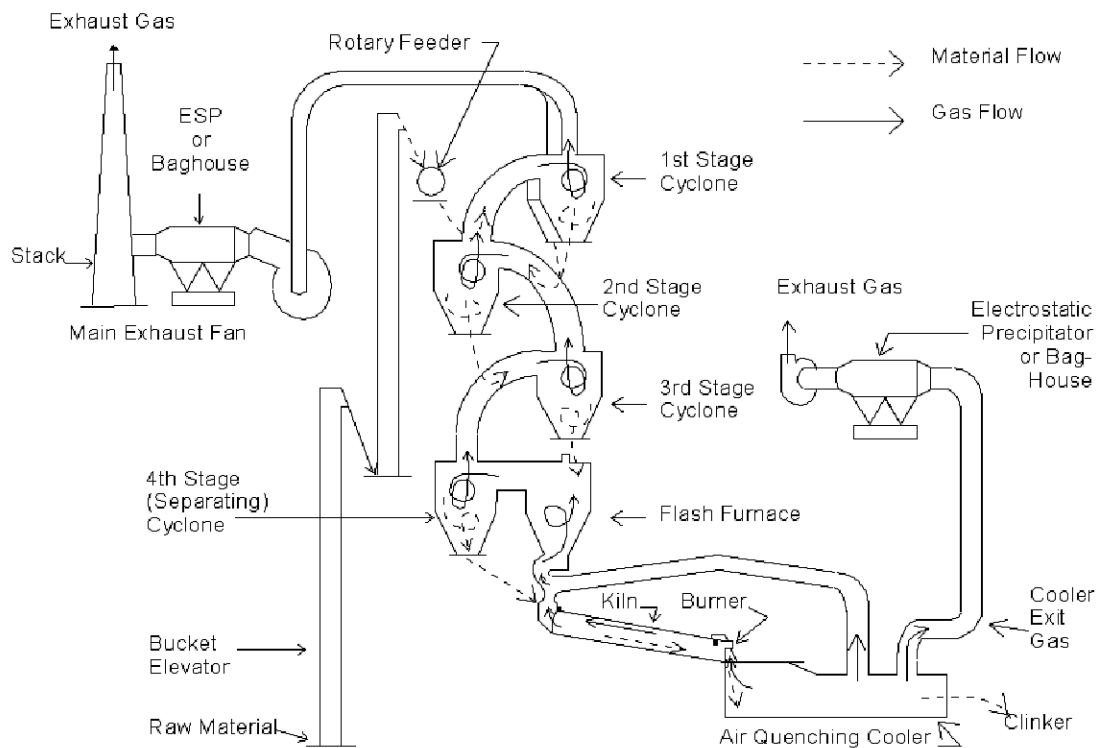
Figure 1

第二图是个比较复杂的、一种置有预热器的水泥窑。在这系统里、脱水的步骤是在预热器的内部进行的、那样做的换热效果比起笔直水泥窑里的有链部份更好。有时也会配置一套快速高炉或灼热器。快速高炉，也被称为灼热器、可使大部份的灼热反应在原料进入水泥窑之前进行、而且可使70%的燃料用于快速高炉里、而不是在水泥窑最热的那端。在这两种水泥窑的设计里、气体与原料是对流的、并且这个工艺过程的排气温度一般都是相当之低、在150至300度摄氏之间。

Figure 2 is a schematic of the more complex preheater type of cement kiln. In

this system, the dehydration step occurs in the preheater cyclones, which offer much better heat exchange efficiencies than the chain section of a straight kiln. A flash furnace or precalciner may also be present. A flash furnace, or precalciner as it is also called, allows a good portion of the calcination reaction to occur prior to material entering the kiln and also allows up to 70% of the fuel to be used in the flash furnace rather than at the hot end of the kiln. In both designs, the gas and material flow is counter current and exit gas temperatures from the process are generally quite low, 150C to 300C.

Figure 2



Schematic Flow Diagram of a Rotary Cement Kiln and Suspension Preheater with Flash Furnace

危险废物焚化炉

The Hazardous Waste Incinerator

第三图是个旋转窑焚化炉的粗略流程图。这个工艺的特色、与水泥窑有重大的区别、而且会影响排气、现说明如下。

Figure 3 provides a very generalized schematic flow diagram of a rotary kiln incinerator. Features of this process, which are critically different from cement kilns and can impact emissions, are noted below.

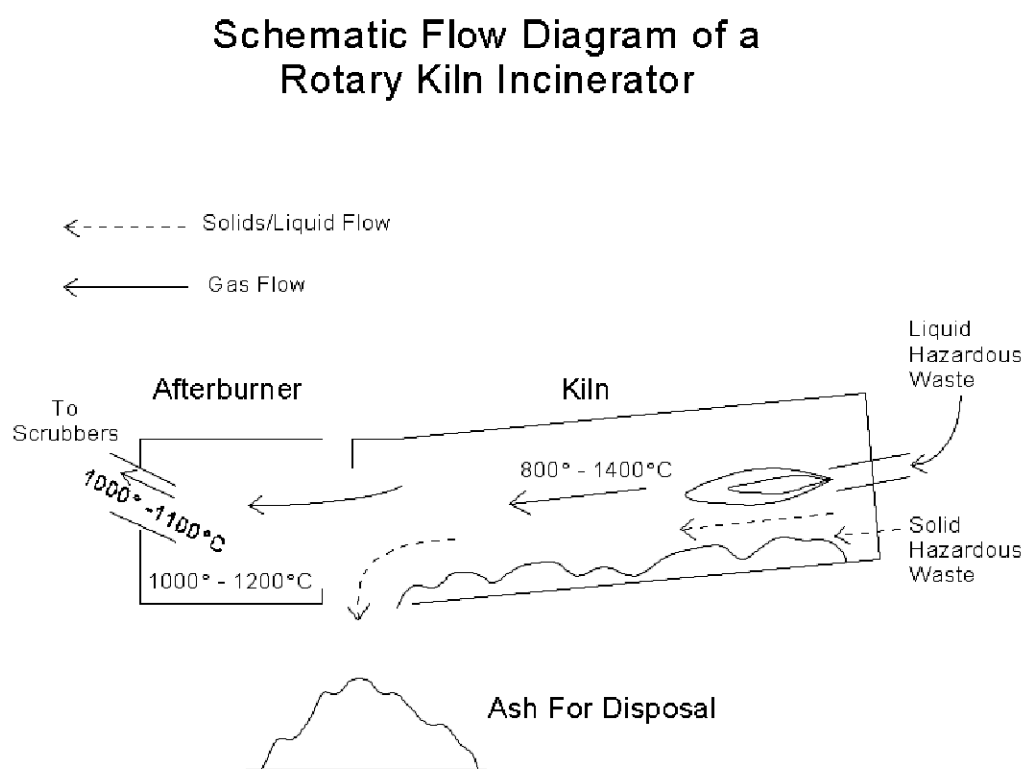


Figure 3

在焚化炉里除了直接因灼热(即氧化)[引起的化学作用]之外、没有其它的化学反应。因此、由焚化炉排放的气体犹如在水泥窑的燃烧区域发生的情况那样。

There are no chemical reactions in an incinerator other than those induced directly by incineration (i.e. oxidation). Therefore, gases exiting the incinerator directly reflect what is happening in the combustion zone of the kiln.

在焚化炉里、气体的流向与固体和液体废物的流向相同。这就会扰乱气体平衡的公式、因而增加排放如[重]金属。蒸气的压力成为重要的因素。

In an incinerator, the gases are moving the same direction as solids and liquids. This tends to drive any phase equilibrium to the gaseous side of the equation thus increasing emissions such as metals. Vapor pressure becomes the critical factor.

在一个焚化炉内的发热能力与其稳定性是相对地低。处理过程中易生故障、就算是一分或一秒都会使未经燃烧的有机物质在过程中泄漏出去。这就是为什么要用后置燃烧器的原因。

The thermal capacity and therefore thermal stability of an incinerator is relatively low. Process upsets can occur within a matter of minutes or even seconds that can allow uncombusted organics to escape from the process. The use of an afterburner is largely prompted by this potential.

水 泥 窑

The Cement Kiln

气体与原料停留在水泥窑内的时间、比起在特制的焚化炉要长得多。这样就保证有机物质的组成部份会得到彻底燃烧、使得那些无机的组成部份会牢固地附在烧结块(熟料)里、不再会有生命力。对流的设计可使挥发性的金属离子再次于输入的原料里流通、凝固在成品 - 烧结块(熟料)里。这种情况的发生不理睬金属的来源如何(废油、原油或水泥原料)。正确地使用废物、作为燃料和原料、生产出来的水泥在化学成份方面、与用原油和原材料生产的水泥根本无法分辨。

The gas residence time and the materials residence time in a cement kiln are much longer than in a purpose built incinerator. This ensures that the organic constituents are more thoroughly combusted and toxic inorganic constituents bound into the clinker and no longer bio-available. The counter current flow design allows volatilized metallic ions to be recirculated into the feed materials and bound into the product clinker. This happens regardless of the source of the metal (waste fuel vs. fossil fuel or raw material). Indeed cement produced using wastes properly, as fuels or raw materials, is chemically indistinguishable from cement produced from fossil fuels and virgin materials.

表(一)里提供水泥窑与焚化炉内燃烧区域的情况可作一比较。那些指数有着很大的差别、气体温度与停留时间、对危险废物的销毁至关重要。

Table 1 provides a comparative look at combustion zone conditions in a cement kiln versus an incinerator. Those factors with the most significant difference, gas temperatures and retention times play an important role in insuring the destruction of hazardous wastes.

Table 1
水泥窑与工业废物焚化炉内燃烧区域的情况
Typical Combustion Zone Conditions in Cement Kilns vs. Industrial Waste Incinerators

Parameter 指数 名称	Typical Cement Kiln 典型水泥窑	Typical Industrial Waste Incinerator 典型焚化炉
Maximum Gas Temperatures 气温	>2200C ¹	<=1480C
Maximum Solid Temperatures 固体温度	1420-1480C	<=1370C
Gas Retention Times at >=2000°F 气体滞留时间	6-10 Seconds	0-3 Seconds
Solid Retention Times at >=2000°F 固体滞留时间	2-30 Minutes	2-20 Minutes
Oxidizing Conditions 氧化情况	Yes	Yes
Turbulence (Reynolds' number) 湍流情况(雷诺氏指数)	>100,000	>10,000

¹Peray, Kurt E., The Rotary Cement Kiln, 1986.

生产良好的水泥熟料、用百分之百的纯正原材料和代替燃料是可能的、事实上、已经有不少的水泥窑用废物取代了他们全部的燃料需求。

It is possible to produce quality clinker from 100% raw material and fuel substitution. In fact, some kilns already substitute 100% of their fuel requirements from wastes.

因为大体上许多废物的化学成份、与生产波特兰[普通]水泥的原材料相若且相容的、乘机推广这个理念、对国内的减少废物处理的目标至关重要。

Because the gross chemical makeup of many wastes is similar and compatible with the raw materials used to manufacture Portland cement, the opportunity to expand on this concept and help to meet national goals for minimizing waste disposal is significant.

水、石灰、砂石、矾土与铁是大批废物的主要成份、也是生产水泥的原材料。只要那些有害的成份受到控制、而且在生产过程中、于水泥窑内得以销毁或中和了、那么这些优胜之处就很明显。

The water, lime, silica, alumina, and iron, which make up the primary constituents in a large quantity of wastes, are the raw materials required to manufacture cement. So long as any harmful constituents are controlled and then destroyed or rendered inert in the cement kiln manufacturing process, the advantages are clear.

于水泥生产过程中使用废物燃料的影响

The Effects of Using Waste Fuels in the Cement Manufacturing Process

水泥窑使用废物燃料对于生产水泥的过程有四个不同的影响：水泥窑的控制与操作、水泥熟料(产品)的质素、水泥窑灰(副产品)的质素、及烟囱的排气。使用废物燃料时、正反两方面的反应都应记录在案。如果在生产过程中、恰当地控制废物燃料的质量、会防止负面的影响、增进正面的效果。

The use of waste fuels in cement kilns has the potential for impacting the cement manufacturing process in four different areas: kiln control and operation, cement clinker (product) quality, cement kiln dust (by-product) quality, and stack emissions. Both positive and negative effects have been noted in these categories while using waste fuels. Appropriate levels of quality control on waste fuels will prevent significant negative impacts and enhance positive effects on the process.

水泥窑的控制与操作大致上可以增强、就算是使用少量的废物燃料、因为高度的挥发性会稳定且帮助燃烧、特别在同时使用品质低的煤炭或焦煤的时候、只含有挥发性低的有机物质(使得燃烧困难)。

Kiln control and operation is generally enhanced when using even small quantities of waste fuels because the high level of volatiles stabilizes and aids combustion, particularly while simultaneously using low-grade coals or coke with a low volatile organic content (making them difficult to combust).

废物燃料里含有过量的氯、再或水泥窑运作时缺乏补充调整、会造成大量的氯化砒不断循环流通。在笔直的水泥窑里、它会产生环状物、而减低产量。在预热器或预灼热器里、曾经发生过完全被它阻塞。其它由于含过量的氟或磷也曾经给水泥窑的运作造成不同的问题。

Excessive chlorine levels in waste fuels and/or a lack of compensating adjustments in kiln operations can result in large recirculating loads of alkali chlorides. In a straight kiln, this can result in rings, which reduce production. In a preheater or precalciner, complete plug-ups have occurred. Other problems in kiln operations have occurred with excessive fluorine or phosphorous levels.

水泥熟料是水泥窑的产品、它的品质时常因使用废物燃料而获得增强。在化学作用的过程里、由于使用的废物燃料中含有氯、水泥熟料的硷性也许会显得较低。有几家水泥厂子因此完全取消购买和渗入氯化钙来生产低硷水泥。有些经营者已观察到由于使用废物燃料时、水泥窑里的温度产生了优越的变化形象、增强了熟料的淬火能力、生产出一种产品既有持久的强度、又有较易磨碎的特点。

Cement clinker, which is the product of the kiln, is frequently enhanced when using waste fuels. Chemically, cement clinker may exhibit lower alkali caused by the presence of chlorine in the waste fuel. A number of plants have completely eliminated the need to purchase and add calcium chloride to produce this low alkali cement. Some operators have

also observed that subtle changes in kiln temperature profiles produced while using waste fuels enhance the quenching of cement clinker, producing a product with both better long term strengths and characteristics which allow for easier grinding.

对熟料的最大负面影响来自废物燃料的灰末。大致上、废物燃料所含灰比煤炭的少。但是过高的铅或锌的含量会减低水泥的强度、如果[原料]的规范和质量没有充分的控制的话。过高的铬含量、废物燃料中有时会呈现、会对[Mortar] 水泥的安全性有负面影响。

The greatest potential negative impact on clinker quality comes from the ash in waste fuels. Generally, ash levels are lower in waste fuels than in coal. Excessive levels of lead and/or zinc could, however, reduce cement strengths if specifications and quality control are inadequate. Excessive levels of chromium, which can also be present in waste fuel, could also negatively impact the safety characteristics of mortar cement.

美国的环保部门对水泥窑使用废物燃料作过深入研究、有关烟囱的气体排放方面、发现很少、甚至没有任何负面影响。总的来说、废物燃料于水泥窑中燃烧要比煤炭干净、而且能减少氧化硫和二氧化氮排放。

Extensive research by the U.S. EPA on the use of waste fuels in cement kilns and the associated impact on stack gas emissions reveals little, if any, negative impact. Generally speaking, waste fuel burns cleaner than coal in a cement kiln and can reduce SO_x and NO_x emissions.

废物市场

THE WASTE MARKET

在中国的许多省份里还没有恰当的危险废物管理的基础。他们缺少恰当的处理、储存与销毁(TSD)的设施、是由于不明确的标准、缺乏监管、造成对经营TSD的前景有不明确。允许经营的运输公司及废物循环再造商、他们的技术标准一般偏低。只有容易再造的危险废物会于加工、而那些难于处理的废物通常被[胡乱]抛弃。有些[废物]制造者把他们的危险废物付之出口。许多危险废物制造者把它原地储存、或者转移至核准的收集商、其余的付之出口。那些收集商有时把那些废物再造、或者是非法地把它处理掉。

Many of the Provinces in China do not have a proper hazardous waste management infrastructure in place. They lack proper Treatment, Storage and Disposal (TSD) facilities often due to unclear standards and lack of enforcement, creating uncertainties regarding the prospects of the TSD facility business. Permitted transportation companies and recyclers have limited skills and often low standards. Only easily recyclable hazardous wastes are processed while the more difficult materials are often dumped. Some generators export their hazardous wastes. Many generators of hazardous waste either store such waste on site or transfer it to permitted collectors while others are exported. These collectors sometimes recycle these wastes or dispose of them illegally.

液体有机危险废物、包括废油、储油罐里的积垢经常会被用作小高炉与锅炉[的燃料]。有能源价值的无害废物、如纸、瓦伦纸板、木头、木削、塑料与铝废料通常被收集后再用、或是把它埋在地下、废物制造者所费无几、甚至完全没有费用。因此拿这类废物来代替煤炭通常是并不化算。

Liquid organic hazardous wastes including oil wastes and bunker sludges frequently find their way into small furnaces and boilers. Non-hazardous wastes with energy value such as paper, cardboard, wood, sawdust, plastic and aluminum wastes are often collected and re-used or disposed of to land at little or no cost to the generator. Therefore such wastes are often not economical as coal substitutes.

在发达国家里如美国与欧洲、另类燃料及其原料[AFR]的市场、大致上是强制推行的。那里已经有一个正确的危险废物管理基础、而且处理和销毁[危险废物]的费用起了很大的作用。这种费用同样适用于、以一贯的处理方法把危险有机废物置于焚化炉里销毁、或者是有选择性地把它循环再造、作为水泥窑的能源与原料的回收。

In the developed countries like the US or Europe, the alternative fuels and raw materials (AFR) market is largely regulatory driven. A proper hazardous waste management infrastructure is in place and treatment and disposal fees are significant. This applies equally to conventional treatment and destruction of hazardous organic wastes in incinerators or selectively recycling such wastes for energy and material recovery in cement kilns.

在中国、经营另类燃料及其原料大致上是市场推行的。对水泥业来说、意味着只有收取最低的处理费那么废物才会流向水泥窑[水泥厂子]。待更多的水泥厂子闯入另类燃料市场时、处理费就会大幅下降。由于这个原因、中国的水泥业需要有个危险废物管理基础、同时也要有管理水泥窑使用的另类燃料及其原料的正确法规。必须双管齐下地执行、才能发展可行的、持久的、另类燃料的计划。

In China, the alternative fuels and raw materials business is largely market driven. For the cement industry this means that the wastes tend to flow towards the cement kiln that is proposing the lowest disposal fees. With more cement kilns entering the substitute fuels market, disposal fees tend to spiral down further. **For this reason, the cement industry in China needs a hazardous waste management infrastructure along with the proper regulations for the Management of Alternative Fuels and Raw Materials in cement kilns. Both need to be in place and enforced in order to be able to develop viable and sustainable substitute fuels projects.**

管制的环境

THE REGULATORY ENVIRONMENT

在中国发展正确的危险废物的管理基础、不单是为了保护人们的健康和环境、同时也是为了保持经济的继续发展。

The development of a proper hazardous waste management infrastructure in China is not only required to protect human health and the environment but it is also necessary to sustain continued development of the economies.

在中国的许多省份里、就是有了规章、执法也薄弱。还有、危险废物的运输、储存、处理和销毁尚有不少可以改善地方。液体危险废物、包括废油和储有罐的污垢通常被用作小高炉和锅炉的燃料、这些废物还给废物制造这带来些额外的收入。中国需要建立一套法规、针对使用水泥窑焚烧危险废物、而且把它纳入废物管理的大计中。

In many of the Provinces in China, even when rules and regulations are in place, enforcement of such regulations is weak. In addition, the quality of transportation, storage and treatment and disposal of hazardous wastes leaves much room for improvement. Liquid hazardous wastes including waste oils and bunker sludges are often used as fuel in small boilers and furnaces and such wastes might even generate income for the waste producer. China needs proper rules and regulations for the combustion of hazardous wastes in cement kilns incorporated in its waste management master plan.

水泥资源回收的主导地位

CEMENT RESOURCE RECOVERY STEWARDSHIP

前面说过、大体上应加强制订环保法和执法、特别是在管理水泥窑使用危险废物提炼出来的燃料、那是为了在中国推行水泥资源回收方案、创造一个可行的、可持续性环境的关键。中国的环保部门有诚意监管水泥窑使用另类燃料、但是往往缺乏经济来源和合格的人员。

As mentioned before, strengthening of environmental laws and enforcement in general, specifically for the management of hazardous waste derived fuels in cement kilns, is the key to promoting a viable, sustainable environment for cement resource recovery in China. Environmental agencies in China have good intentions to regulate the use of alternate fuels in cement kilns but often lack financial resources and/or qualified personnel.

这种困境为水泥业创造了个机会、显示它的主导地位、带头为水泥资源回收方案的未来塑造法规和建立群众关系。这样做、那么中国的水泥业可能发展和推荐法规来管理另类燃料及其原料、并且鼓励和帮助环保部门发展和执行那些法规、使得设施得以合理且有弹性地运作、另一方面也保护了人们的健康和环境。不过那样的巨大任务、非个别的水泥厂所能胜任。

This difficult environment creates an opportunity for the Cement Industry to demonstrate stewardship in shaping the legislative and PR future for cement resource recovery. In doing

so, the China Cement Industry may develop recommendations for regulations of Management of Alternative Fuels and Raw Materials and encourage and assist the environmental agencies to develop and enforce rules that allow facilities reasonable operating flexibility while protecting human health and the environment. However, such task may be too large for any individual cement company.

纪元科技相信、由几家著名的水泥公司共同合作来推广、是个更恰当的途径、以达到实行持久的代替燃料计划。法国、作为一个国家、成为有史以来的好例子、那里由多家水泥公司拥有、并且共同发展的代替燃料的市场、为使参与各方得益、他们成立了一个中央废物管理公司、负责收集、处理和供应由危险废物提炼出来的燃料给水泥厂子。

ERAtech believes that a joint effort to promote cement resource recovery between leading Chinese cement companies may be a more appropriate path forward to achieve sustainable substitute fuels projects. France, as a country, is a good historic example where several cement companies took ownership and jointly developed the substitute fuels market to the benefit of all parties involved by the formation of a central waste management company to collect, process and supply the hazardous waste derived fuels to the cement manufactures.

我们坚信这个概念可适用与中国。这种策略性商业夥伴关系的提议、牵涉到挑选几个水泥集团和一家废物管理公司、提供机会给参与各方、各展所长、紧密合作的结果、肯定会比个别的力量强。这个夥伴关系的主要参与者形成一种渊久的关系、而且创造一个对所有参与者都有利的情况。

We firmly believe that such a concept may work well in China. Such a proposed strategic business relationship involving select cement groups and a waste management company provides the opportunity for all of the parties to create a situation where the product is greater than the sum of it's parts. The business principals of such a partnership are the formations of a long-term relationship and the creation of a win-win situation for all parties involved.

推荐危险废物燃料的管理法规

RECOMMENDATION FOR REGULATIONS FOR THE MANAGEMENT OF HAZARDOUS WASTE FUELS

在没有法规和章程管制的环境里、利用有害的工业废料里提炼出来的再生燃料供水泥窑使用、或者是开发可行的、持久的另类燃料(AFR)的项目一定会困难重重。特别是如果几家水泥公司同时到废物市场去[拿货]时、他们会压低处理费、至某个程度会使水泥厂感到不值得去使用废物燃料。基于这种情况、水泥业如要得益、必须显示他们的主导地位、推荐为水泥资源回收方案立法和为公关造势。

In an environment without rules and regulations governing the use of recycled fuels made from industrial hazardous wastes in cement kilns it will be difficult to develop viable,

sustainable substitute fuels programs. Especially if several cement companies enter the waste market simultaneously, they tend to depress the disposal fees to a point where such waste fuels are not economical as coal substitutes any longer. It is in these circumstances that the Cement Industry will benefit from demonstrating leadership in shaping the legislative and PR future for cement resource recovery.

在帮助环保机构发展和执行法规时、应允许设施有合理的运作弹性、同时考虑到保护人们的健康和环境、为水泥窑使用由危险废物提炼出来的再生燃料、我们建议考虑以下的法规的大纲：

In assisting environmental agencies to develop and enforce rules that allow facilities reasonable operating flexibility while protecting human health and the environment we suggest to consider the following outline of regulations for use of recycled fuels derived from hazardous wastes in cement kilns:

1. Storage and Management of Wastes (minimum criteria)
储存和管理废料(最低准则)
 - a. Liquid Storage and Ancillary Systems
液体的储存和补助系统
 - b. Solids Storage and Ancillary Systems
固体的储存和补助系统
2. Shipment Manifesting and Receipt procedures
运输清单和验收手续
3. Waste Analysis Requirements 废物分析的规定
4. Emissions Testing Requirements 排气测试的规定
4. Determinations of Permitted Emissions Limits and Operating Parameters
制订允许的排气限度及其运作细节
6. Monitoring Requirements 监察的规定
7. Record keeping Requirements 保持记录的规定

I. Minimum criteria for Storage and Management of Wastes should include: 储存和管理废物的最低准则应该有：

Tank Design 油库的设计
 Solids Storage Design 固体储存库的设计
 Waste Management Plan 废物管理计划
 Employee health and safety 雇员的健康和安全
 Receipt and storage of ignitable / reactive / highly toxic materials
 收取和储存可燃的/放射性的/极毒性物料的记录
 Emergency response (fires / explosion / releases of toxic gases / spills)
 应急措施 (火灾/爆炸/泄漏毒气/溢出)
 Training outline for each job description 每个工作岗位的详细训练大纲

II. Shipment Manifesting and Receipt Procedure:

运输清单和验收手续:

Conform to the regulatory requirements for any existing manifest system

现有的清单系统必须符合法规的要求

Written procedure for receiving waste shipment

收取废料货物时的书面手续

Sampling procedures for the shipment

[废料]货物抽样的手续

Procedures for rejecting & returning shipment

拒收和退回货物的手续

Unloading procedures 卸货手续

III. *Waste Analysis Requirements* 废物分析的要求

Facility Description 设施[化验所]的名称

Procedural Requirements 程序的规定

Record keeping 保持记录

Waste analysis parameters 废料分析细节

Sampling procedures 取样手续

Laboratory testing and analytical methods 化验测试和分析[所用]的方法

IV. *Emission testing Requirements* 排气测试的要求

Introduction 简介

Objectives 目标

Methodology 使用方法

Stack monitoring 烟囱监察

Material monitoring 物料监察

Operational parameters 运作细节

Waste fuel feeding equipment 废物燃料输入设备

Conduct of trial burn 举行试烧

Evaluation and report 评估与报告

这些大纲还不能满足美国环保部、或者各州的[环保]许可的要求。不过提供了足够的信息资料与设施[废物管理公司或废物燃料调配中心]、使它可以作出决定关于[如何]遵守所建议的法规。

This outline would not be adequate to meet US-EPA or European permit requirements. It is however, sufficient to provide information to a facility for making decisions regarding compliance with proposed regulations.

排气测试的规定、提供了最起码应该知道的资料、来计划和进行试烧。它把取样和分析的

方法具体化了、什么时候和在哪里取样、在取样的当时厂子是在怎样的运作情况。这就提供了足够的资料给环保机构、让他们审议这计划是否针对他们所关心的事。这也足可供那些样板抽取者或分析的化验所来提供成本估计。我们建议每个在不同的运作情况下取得的样板至少要做三个测试、这是我们认为最起码的要求。

The emission testing requirements provide the minimum needed information to plan and execute a test burn. It specifies the sampling and analytical methods, when and where the samples are collected and the operating condition that the plant is to achieve during the sampling. This is sufficient information for an agency to review and determine if the plan addresses their concerns. It is also sufficient for a stack sampling contractor or an analytical laboratory to provide a cost estimate. We propose that there are three runs for each operating condition. This is considered a minimum.

很明显、更多的测试细节、如二恶英或金属的排放测试、需化多些时日、在不同的环境下进行测试(如高的或低的燃料代用比率)会增加测试的成本。不过、如果我们要进行测试、那就应该正确地、彻底地、做得足够提供有用的资料。假如测试马马虎虎地进行、所得的数据就不管用、甚至可令项目受损。

Obviously, additional test parameters such as dioxin or metals emissions testing increases the cost of testing as would additional test days at different test conditions (such as higher or lower fuel substitution rates). However, if the testing is going to be done, it should be done correctly and thoroughly enough to provide useful information. If the testing is not done properly the data generated is useless or may even be damaging to the project.

我们清楚、上述的大纲只不过是向发展中国家里的环保机构、表达一些建议和鼓励。这些机构可自行决定、按他们自身的要求、采纳这些建议到什么程度、来制订自己的管理危险废物燃料的法规。那可能会是个缓慢的过程、但一旦成功那么另类燃料与原料(AFR)的项目更为可行、且能持久地发展下去。

It is understood that the above outline merely represents recommendations and encouragement to the environmental agencies in China. These agencies themselves will determine to what extent these recommendations for regulations for the management of hazardous waste fuels conforms to their requirements. While it will most likely be a slow process, once accomplished it will make substitute fuels programs more viable and sustainable in the long run.

我们极力主张、从刚开始搞(AFR)项目必须设计正确而且计划周详。抱着“过得去”的心理来尝试、走捷径或不做试烧、也不提供文件给当地的环保机构、那是捣毁这个项目的成因。

We strongly recommend that from the very beginning, an AFR program must be correctly designed and well planned. Attempting to “just get by” by cutting corners or by not performing test burns or providing documentation to the local regulatory agencies is a recipe for the destruction of a project.

公关与风险传达

PUBLIC RELATIONS AND RISK COMMUNICATION

我们必须准备、与员工、社区、政府机构、以及人民大众、来讨论和公开、有关使用另类燃料的风险与得益的资料、特别是那些有危险废物里提炼出来的再生燃料。这种准则就是在发展中国家也呼声高涨、不管是由于政府的行动、媒体的揭发、或者是来自环保团体那里来的压力，工业可以闭门造车、不理睬外界一切的日子、已不复存在了。

We must be prepared to discuss and disclose information on the possible risks and benefits associated with the use of alternative fuels, in particular those recycled fuels derived of hazardous wastes at our operations to workers, to community's, government agencies and to the public at large. This will increasingly be the norm also in China, whether the result of government action, media probing, or the pressures of activist groups. The days when it was possible for industry to run its business and ignore the outside world are gone.

工业是被理解为、在很大程度上应该为制造污染和损害环境负上责任、并且人们相信环境正受到逼切的威胁。在这种不信任的形势下、一家公司必需依赖有技巧地运用风险传达、来减少在这个复杂的社会里潜在的批评、和发展出一种合理的、大家可以接受的方式。人们对风险的理解能力是极至复杂的、群众对风险的理解并不按一定的逻辑，而且事实并不一定能成功地减轻担忧。这里包含的意思是我们绝不可以假设、因为事实终会水落石出，风险传达在情绪方面是很强力的、并且往往有压倒性的效果。

Industry is perceived to a great extent as responsible for creating much of the pollution and for the damage to the environment, which is believed to be under immediate threat. In this climate of mistrust, a corporation will need to rely on the skillful use of risk communications, to minimize potential criticism and develop a rational public acceptance of risks in a complex society. The dynamics of risk perception are extremely complex and public perceptions about risk do not follow logical patterns. In addition, facts are not always successful in easing concerns. The implication is that we must not assume, therefore, that facts will carry the day. The emotional aspects of risk communications are powerful and often overwhelming.

另一方面、有一样东西你必须假设、那就是普罗大众都受过良好教育、而且通过互联网可以接触到大量的资料。尝试淡化使用另类燃料的风险、必定会自讨苦吃、而且摧毁将来推行更多项目的机会。风险传达的最主要目的、不是去改变公众对风险大小的意见、而是建立信誉、指出公司会承担责任来控制它。

On the other hand, one thing that you must assume is that the general public is well educated and has access to a huge amount of information through the use of the Internet. Trying to simply down play the use of the alternative fuels will inevitably backfire and has destroyed many a potential project. The primary objective of risk communications is not to

change public opinion about the size of the risk but rather to build trust about the corporate commitment to contain and control it.

如果你告诉群众一个陌生的危害、而且解释[它的]影响很小、多半不会成功、甚至会自讨苦吃。应该是尽力去教育他们关于这个系统、它是可受控制的、风险是可以减少和抑制的、那样就可与人一种信任感。当某人代表一个有切身利益者(例如一家公司)宣布风险资料时、群众会有谨慎的反应。可是公司也只能做到如此而已。如让第三者、有信誉的医学界人士、社区和政界领袖来传达风险可能会有必要。

To tell the public why the risk of an unfamiliar hazard is small is likely to fail or may even backfire. But efforts to educate about systems, which control and reduce risk and work to contain it, can give an outsider confidence. When risk information is presented by or on behalf of self-interested parties (e.g., the corporation), the public will respond with caution but corporate credibility can only go so far. Third party allies – trusted medical, community and political leaders – are essential to risk communication.

有两个主要因素驱使公众如何区分和理解各种各样的风险:

Two primary factors tend to be the driving forces of how the public categorizes and perceives various risks:

第一个关键因素是控制。群众几乎经常会低估风险、因为他们觉得有权作出决定、是否冒这个风险和如何处理它。

The first key element is control. The public will almost always underestimate risks where they feel that they are in charge and can make the decision whether or not to take the risk and how to handle it.

第二个因素是清晰和熟悉地了解风险的能力。如果风险被理解为不详、看不到、陌生的事、那就很可能造成惊慌、因此而变得不可接受。所以在我们搞社区公关工作时、有必须尝试运用技巧来建立一个既能控制又熟悉的形象。

The second element is the ability to understand the risk with some clarity and familiarity. If a risk is perceived as unknown, unseen, and unfamiliar, it is far more likely to create dread and therefore become unacceptable. It is essential, therefore, in our community relations program that we try to use techniques, which create a sense of both control and familiarity.

为水泥窑使用废物燃料的风险传达工作、其最终目的是要在群众中建立某一程度的安全感。要达到这个目标的最佳[方法]、不是尝试去大事宣传风险甚小、而是去增强群众对公司的信心、相信公司有能力来管制这种风险。

The overriding objective of an effective risk communications effort associated with the use of waste derived fuels in cement kilns is to create a level of public comfort. This objective is best achieved, not by attempting to create greater public understanding of the small size

of the risk, but by creating greater confidence that a corporation can be trusted to manage the risk.

最后、有效的风险传达不是靠说、而是靠事实、靠行动、人们就会认为我们是对顾客、员工和社区负责的、以这些事实来赢取公众的信任、一旦有风险问题出现、他们会帮助我们有效地传达。

Finally the best risk communications will not come from words but from deeds, from the actions, which we are seen to take which add value for customers, employees and communities, the winning of public confidence through such deeds will help us to be effective communicators when risk issues arise.

总 结

CONCLUSION

发展中国家所面临的环境与营商之间的矛盾、已达到空前未有的程度，保护那些无可挽回的石化燃料、全球升温、和那些对地球造成危害的、由二氧化碳造成的温室效应、大批量的工业废料、令健康和成为迫切的生态环境的问题，在营商方面、降低成本、全球化的竞争和利润是倍受商业社会所关注的事。

At no time in history have developing countries faced environmental and business concerns of today's magnitude. The preservation of irreplaceable fossil fuels, global warming, greenhouse gases, an overwhelming volume of industrial waste, and health and safety concerns are in the forefront of ecological issues. Cost competitiveness, global competition and profitability are concerns for the business side.

从石油和石化工业那里来的液体、半固体与固体的废物、多年来一直是提炼废物燃料的基础，可燃的油与易燃的物料的能源价值得以回收，适当的调配与管理、这种补充燃料可替代不能挽回的传统的燃料、在生产水泥的过程中将原料加热至产生灼热反应。

Liquid, semi-solid and solid wastes from the petroleum and petrochemical industries for years have been a basis for waste derived fuels programs. The energy value in the combustible oils and flammable materials is recovered in this process. Properly blended and managed, this supplemental fuel replaces the non-renewable conventional fuels used to heat the raw materials to the point the calcinations reaction occurs in the process.

中国不再需要投资建造昂贵的危险废物旋转焚化炉、因为有能力安全地、于水泥窑中使用由工业废物制成的再生燃料。

China may be able to forego the need to invest in costly, hazardous waste rotary kiln incinerators, because of the ability to safely use recycled fuels made from industrial wastes in cement kilns.

在中国水泥资源回收的业务大多是市场主导的、而在发达国家里却是强制推行的。加强环保法律和严格执行是成功建立可行的、持久的另类燃料方案的诀窍。

In China the cement resource recovery business is largely market driven, versus mostly regulatory driven in the developed countries. Strengthening of environmental laws and enforcement thereof is a critical success factor for viable and sustainable alternate fuels programs.

只要有严格的规范与质量控制、水泥窑利用废物燃料对产品的质量、厂子的生产运作、和环境方面会有重大和积极的影响。相反、焚烧炉[或厂子]却会对环境有严重的负面影响、因为那是另一个有害气体排放的源头、如果水泥窑[水泥厂]都能燃烧废物燃料、那么它的存在就没有必要了。

With adequate specifications and quality control, the use of waste fuel in cement kilns can have significant positive impacts in product quality, operations and the environment. In contrast, incinerators have greater negative impacts on the environment because they represent a new source of emissions that need not exist if cement kilns can burn the waste.

现在那些使用废物燃料的水泥窑[厂子]、一直显示出他们符合空气的质量标准。发展和履行物料[废物]的搬运和处理的科技、对于推动利用固体与半固体作为水泥窑的燃料会有重大帮助。

Existing cement kilns burning waste fuels have consistently shown compliance with air quality standards. The development and implementation of material handling and processing technologies is significantly extending the use of solids and sludges as waste fuel in cement kilns.

纪元科技已经开发了多种处理方法、能把那些从石油工业里产生的固体和半固体废物、溶解于废物的有机基质里、可用作燃料、同时回收热量和矿物价值。水泥窑的资源回收的方法已广为人知、且被认为是当今“最实际可行的环保选择”、可处理多种炭氢化合[石油类]的废物。

ERAtch has developed processes where solids and semi-solid wastes such as generated by the Oil Industry can be refluidized in a waste organic matrix and used as a fuel through both the recovery of its heat and mineral value. Cement kiln resource recovery methods are widely regarded as one of the most cost-effective and viable treatment technologies available today. It is also regarded as the Best Practical Environmental Option (BPEO) for many different hydrocarbon wastes.

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