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限制极毒废物进入废物燃料调配设施

Restricting Highly Toxic Wastes at Hazardous Waste Fuel Facilities

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引言 [Introduction](#)

Over the last 20 years, hazardous waste fuel (HWF) facilities at cement plants and blenders have developed various means and rationale for restricting highly toxic wastes. Those steps are usually taken outside any specific regulatory frame work or rationale, generally in order to protect facility employees and associated corporate liability.

20 年间，在水泥厂或者废物燃料(HWF)设施已经发展出多种方法和理论基础来限制极毒的废物。那些步骤往往是超越任何特别法规范范围或者理论基础之上，总的来说是为了保护设施里的工作人员和有关事故责任。

限制的理由 [Reasons for Restrictions](#)

While a handful of HWF facilities restrict certain highly toxic wastes out of concern for off-site fugitive emissions, the dominant reason is employee protection. It is generally recognized that personal protective equipment is used as a last resort and has inherent limits. Engineering controls to prevent exposure are the first line of defense and these engineering controls can include restriction on HWF component toxicity. Even with these types of controls, shipment sampling and analysis still poses some risks because of potential unknowns. For this reason, most facilities require organic cartridge respirators and other PPE during sampling and the handling of lab samples in operating fume hoods.

虽然有屈指可数的危险废物燃料调配设施，限制某种极毒的废物是出于关心本身难以捉摸的排放，但最主要的理由是为了保护员工。普遍认为人身保护装备是最后的防护办法，但是它存在着固有的极限。工程技术的控制是防止暴露的第一道防线，这些工程技术控制包括危险废物成分中的毒性。就算有这种类型的控制，对来料的取样和分析还是会有一定的风险，因为隐藏着一些不明的因素。由于这个原因大多数的设施内都备有防毒面具和其他的人身防护装备，在实验室的通风橱内取样和处理化验样板时使用。

使用限制的准则 Criteria Used for Restriction

There are three basic types of criteria used to establish limits on highly toxic compounds. The first of these is arbitrary, meaning a limit on one or more toxicity parameters is set beyond which that compound will not be accepted. Such parameters are frequently based on national or internationally recognized thresholds for "high" toxicity. An example is the oral rat LD₅₀ limit of 50 mg/kg. A facility simply designates that compounds with an oral rat LD₅₀ of D50 mg/kg will not be accepted above a certain concentration, typically 0.1% or 1.0%.

A second type of criteria is based on actual exposure data. Employees are monitored for both short and long term exposure in various work environments. That data can then be used to establish a threshold for compound and/or waste stream rejection based on TLVs and relative vapor pressures.

A third type of criteria that is used is based on reasonable worst case risk scenarios. This type of criteria is particularly valuable for setting limits on compounds that present acute dermal exposures.

This exercise also frequently results in an increased level of PPE use to prevent potential exposure routes instead of overly restricting HWF receipts.

It should be noted that some facilities have historically used a combination of all three of these types of criteria and in doing so have developed rather sophisticated compound/waste stream evaluation models.

对极毒的化合物的限制有三个基本准则。其中第一个是随意定出的，意思是建立一个或多个毒性的参数，超过那个参数的化合物就不会接受。这些参数通常是基于本国的、或者是国际上认可的对高毒性的门槛限制。一个例子是毒性参数（oral rat LD₅₀）50毫克/千克的极限【注1】。一个设施简单地指定化合物的毒性超越 oral rat LD₅₀ of D50 mg/kg 的一定浓度之上就不会被接受，通常为 0.1% 或 1.0%。

第二个准则是基于实际暴露的数据。监察员工们于短期和长期的暴露于不同的工作环境里。然后用那些数据建立一个门槛，作为拒绝化合物再/或废物来料的根据，基于核准的最高暴露浓度(TLV)和相对的汽压力。

第三个准则是根据合理的、最坏的风险情况。这个准则是特别有用，因为是用来建立化合物导致急性皮肤暴露的风险。

这种做法时常造成高度使用个人防护装备，避免潜在的暴露途径，而不是过分限制接受危险废物燃料。

应该注意的是，有些设施历来把上述三种准则混合使用，这样做就会发展出对化合物及废物来料很复杂的评估形式。

评估化合物毒性数据的资料来源 Sources of Compound Toxicity Evaluation Data

Whether limited data, such as oral rat LD₅₀'s, or a more expansive list, including dermal, inhalation, ingestion and chronic toxicity data is needed, the single best source is the "Registry of Toxic Effects of Chemical Substances". This database is available on-line or in CD-ROM format and is cross referenced to CAS numbers. For more limited choices of data on relatively common compounds, "The MERCK Index" is a good choice. In many circumstances, specific types of data for selected compounds may not be available. In these circumstances, an "experienced" chemist or toxicologist can look for surrogate compounds with similar functionality for which the needed data is available.

结果 Results

As a result of these exercises to restrict highly toxic waste, facilities have developed compound lists. These lists generally break down into three categories. First are those compounds acceptable at any concentration in a waste stream. Second is a list of compounds that are restricted in some manner. Restriction can include concentration limits in waste streams and/or special handling procedures such as special use PPE. The third list would be compounds considered unacceptable, either at any concentration or more often at some arbitrary threshold such as 0.1%.

结 论 Conclusion

The HWF management industry has historically gone beyond regulatory requirements to protect workers by developing criteria to restrict highly toxic wastes. Some of these systems are complex toxicity/exposure evaluation models which represent cutting edge developments in controlling employee exposure and limiting corporate liability.

是否限定一个毒性数据, 如 oral rat LD₅₀, 或者是把更广泛数据编列成表, 包括对皮肤、呼吸器官、消化系统和慢性毒性的数据, 唯一的最好的参考资源是 RTECS 【注 2】. 这个数据库在网上找到, 也有光碟, 是可以与 CAS 号码【注 3】互相参照. 如果只是需要有限数据关于一般的化合物, 那么 “The MERCK Index” 【注 4】是个很好的选择. 在有些情况下, 关于所选的化合物的特别数据可能会找不到, 在此情况下一位 ‘资深’ 的化验师或者毒物学家能寻找化合物的代用品, 具有类似功能可以获得需要的数据.

执行限制极毒废物的结果令设施发展出对化合物的列表. 这些列表通常分为三类. 第一表是那些在废物来料中任何浓度都可以接受的化合物. 第二表是列表上有名, 在某些形式下受到限制的化合物. 限制可能由于废物来料里的浓度限制, 需要配戴个人防护装备才可处理的化合物. 第三表就是那些不可接受的化合物, 不是在任何浓度, 就是更常见的一些随意定出的门槛浓度, 如 0.1% .

危险废物处理工业对极毒废物的限制, 历来超越法定的要求, 并且发展出自己的准则, 为了保护员工. 有的这些系统是复合毒性和暴露的评估形式, 那是为了控制员工暴露, 和限制公司承担的事故责任方面的尖端发展.

【注1】 [毒性参数] oral rat LD₅₀ - 的意思是 ‘口服致命剂量’, 即给一群老鼠喂食, 等于它本身体重每公斤 50 毫克分量的某种物质, 作毒性测试, 结果有 50% (即一

半)的老鼠死亡. 依此确定这种物质的毒性参数为 oral rat LD_{50} of 50 mg/kg. LD_{50} 是衡量物质的短期内 (急性) 中毒的可能性。

LD stands for "Lethal Dose". LD_{50} is the amount of a material, given all at once, which causes the death of 50% (one half) of a group of test animals. The LD_{50} is one way to measure the short-term poisoning potential (acute toxicity) of a material.

【注2】 RTECS 的全名是 Registry of Toxic Effects of Chemical Substances. 为美国国家职业安全与健康研究院维持的“化学物质的毒性反应名册”可以在网上找到。 <http://www.cdc.gov/niosh/97-119.html>

【注3】 CAS Number = Chemical Abstracts Service, CAS 号码是美国化学学会对每个化学物质定出的号码, 在文书中描述之用. 用意是使得在数据库搜查更加方便。 <http://www.cas.org/E0/regsys.html>

【注4】 “The MERCK Index” 是历代专业人士寻找化工品、药物和生物的正确、全面资料的随手参考书

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