

1. Idealized conditions. The operation of the kiln during the trial burn was controlled and monitored far more carefully than under **routine** daily operation, when variations in waste type and **quantity**, human error, equipment malfunction, and combustion upsets **all** lead to increased emissions. As a result, the trial burn results provide an **overly** optimistic estimate of emissions that can be expected during routine operation.

2. Major omissions. In addition, the test measured **only** smokestack emissions, excluding the following **routes** by which toxic chemicals are **released from kilns** burning waste:

- * fugitive emissions during storage and **handling**;
- * releases during transport;
- * **"puffs"** of gas released from the **kiln's** cold end during kiln **avalanches** and pressure inversions;
- * blowing, leaching, and disposal of contaminated **kiln** dust; and
- * shipments of contaminated cement products for sale.

As a result, any risk assessment based on the test results **will** be so incomplete as to be irrelevant.

3. **Failure** to prevent hysteresis effect. Southdown was warned that a failure to allow adequate time between test runs would **result** in the delayed emissions from one run "contaminating" subsequent tests. For instance, delayed emissions from Condition 2 could contaminate **"coal-only"** Condition 3, **while resulting** in overestimates of the system's **ability** to remove metals and **POHCs** during Condition 2.

In its early test plans, Southdown noted that cement kilns require as much as one week to reach equilibrium after feed concentrations of metals and **chlorine** are changed. Southdown failed to **follow** its own recommendations, as shown below. After waste-burning Condition 1 (ending at 0405 hrs on **4/18**), only 11.5 hours passed before waste-burning Condition 2 began at **1535** hrs on the same day. **After** Condition 2 ended (1622 hrs on **4/19**), coal-only Condition 3 began just 72 hours later -- an insufficient amount of time for the system to stabilize itself under **"coal only** conditions."

Because sampling devices were shut off when wastefeed ceased at the end of each condition, delayed emissions were not measured or reported. As a result, estimates of **metals** emissions during conditions 1 and 2 are underestimated and **DRE** calculations are overestimated.

The test results make clear that significant hysteresis effects occurred from Condition 2 to Condition 3. For instance, cadmium and mercury (important metals in hazardous waste) were detected in condition **3** emissions, despite the lack of any measurable cadmium or mercury in either the coal or the minerals fed to the **kiln**. Further, as additional time passed within Condition 3, emissions of key parameters (**metals**, THC, CO, etc.) continued to fall, suggesting the waning influence of delayed emissions as time passed.

WANING INFLUENCE OF HYSTERESIS DURING CONDITION 3

Condition 3 (coal only)

Date	Run 1 4/22/91 145	Run 2 4/23/91 910-1310	Run 3 4/23/91 1351-1727
Carbon monoxide ppm	189.2	166.0	162.9
Total hydrocarbons ppm	89.0	87.1	75.3
Particulate (lb/hr)	5.74	1.15	.905
PCDD/F (lb/hr ^-9 TEQ)	5.55	3.19	3.86
Arsenic (^-3 lbs/hr)	6.4	< 5.8	< 5.8
Barium (^-4 lbs/hr)	10.6	2.8	9.1
Chromium (^-4 lbs/hr)	5.28	5.26	3.18
Lead (^-4 lbs/hr)	9.54	4.18	6.21
Mercury (^-3 lbs/hr)	1.39	2.04	2.60
Nickel (^-4 lbs/hr)	9.15	c5.26	<5.26
Zinc (^-3 lbs/hr)	3.17	17.6	2.65

4. Last-minute changes. For unknown reasons, Southdown deviated significantly from the test designs published in late 1990, which had been subject to public comment and review and was subsequently approved by RAPCA. Some of these changes appeared in the eleventh-hour plan printed just before the test (March 27, 1991); some do not. In either case, these last minute changes are a violation of public process and -- in my opinion -- completely invalidate the test as a decisionmaking tool in a community's political process. It also betrays a profoundly cynical attitude by Southdown and RAPCA concerning the value of public participation.

For instance, Southdown did not conduct tests to separate the effects of burning tires from those of burning hazardous waste, as specified in the approved plan. As a result, denial of permission to burn wastes based on the trial burn must apply to both hazardous waste and tires.

In addition, Southdown changed its selection of waste chemicals (principal organic hazardous constituents, or POHCs) from that specified in the final plan. Further, the quantities of liquid hazardous waste burned were significantly less than those published in the final test plan, as shown below:

QUANTITY OF LIQUID HAZARDOUS WASTE BURNED (lbs/hr)

	Test plan	Actual t e s t
Condition 1	7040	5605
Condition 2	7040	5573

Of course, the values used in a trial burn provide the maximum operating values that may be permitted. As a result, the maximum wastefeed rate that could be permitted based on this trial burn is 5605 pounds per hour, some 20.5 percent less than the amount specified in Southdown's proposed permit conditions.

Southdown failed to follow the published test design for metals testing. According to the test plan, “cadmium and lead will be spiked into the fuel stream at a sufficient level to approximate worst case conditions. Cadmium and lead are known to be among the most volatile-metals present at greater than trace level in the fuel stream. This will demonstrate the removal efficiency (**RE**) of the system.” This important element of the testing plan was not carried out, as shown below.

METALS IN HAZARDOUS WASTE FEED
(in **lbs/hour**)

	Maximum permitted	Actual feed Condition 1	Actual feed Condition 2
Lead	24.0	18.4	15.6
Cadmium	1.4	1.3	0.5
Nickel	16.8	8.3	6.0

DRE L U R E

The kiln failed to meet the standard of 99.99 percent destruction and removal efficiency for monochlorobenzene. Reported **DREs** for Condition 1 are **<99.97** and ~99.98. This finding in itself disqualifies the kiln from receiving a permit to burn hazardous waste,

We anticipate that Southdown will attempt to discount this result by arguing that DRE in this case was “probably” better than 99.99 percent but detection limits combined with a failure to feed enough monochlorobenzene to the kiln precluded such a finding.

The law states that a permit for a combustion device may be granted only if the facility demonstrates the actual achievement of 99.99 percent for all **POHCs** tested -- not only some of the POHCs, and not only those POHCs for which the test was designed with sufficient foresight to measure a **DRE** of 99.99 percent. Southdown cannot legally be granted a permit on the basis of this trial bum.

DIOXIN/FURAN EMISSIONS

Dioxin and **furan** emissions were far higher in the waste-burning tests than in the coal-only test, as shown below. Given the lack of any **chlorine/organochlorine** content in most grades of coal, we believe that the presence of dioxin in the coal-only run is probably due to delayed emissions from condition 2, which took place less than 72 hours previously.–

PCDD/PCDF emissions are 8 and 5 times higher in waste-burning conditions than in coal-only conditions.

PCDD/F EMISSIONS
(Toxic equivalency factors, **g/yr**)

Condition 1 (waste)	.238
Condition 2 (waste)	.130
Condition 3 (coal)	.029

Such emissions are of great significance. Because **dioxins** and **furans** are extremely persistent and bioaccumulative, emissions of apparently dilute quantities build up in the environment over time. In light of dioxin's extreme toxicity at low doses, emissions measured from **the** kiln during waste-burning runs are cause for great concern. Low doses are thought to have their greatest effect upon the reproductive and immune systems and upon the neurological and sexual development of infants).

Based on the emissions during waste-burning condition 1, the kiln's dioxin emissions are equal to EPA's "acceptable" dioxin dose for 1.5 billion persons. The acceptable dose (**.006 picograms/ kilogram/day**) is based upon a one-per-million risk of fatal cancer, and this calculation assumes an adult weighing 70 kilograms and kiln operation of 8000 hours per year. Under waste-burning condition 2, the kiln's dioxin emissions are equal to the "acceptable" dose for 848 million persons. Of course, not all the **PCDD/F emitted** from the kiln will be directly ingested by humans; this calculation serves only to put the apparently small quantity of this highly persistent chemical into toxicological perspective.

These dioxin emissions are comparable to those of the second tier of combustion sources analyzed in EPA's National Dioxin Study. **While** less than those measured at a secondary copper smelter and several municipal waste incinerators, the kiln's dioxin emissions are of the same order as those **from** a hazardous waste incinerator, a boiler burning salt-soaked wood, an industrial waste incinerator, and a **kraft** paper recovery boiler. The kiln's dioxin emissions are one or more orders of magnitude greater than all other combustion sources analyzed in the study.

PRODUCTS OF INCOMPLETE COMBUSTION

Measurements of total hydrocarbons (THC) during waste-burning runs totaled 190,000 and 151,000 pounds per year respectively (assuming 8000 hours of operation per year). The actual total of **PICs** is presumably significantly higher, since THC has very poor efficiency for measuring chlorinated species, as well as non- and semi-volatile **PICs**.

It is interesting that very few of the **PICs** analyzed for were present in quantities greater than detection limits. As a result, only a tiny fraction of the unburned chemicals emitted from the stack were identified. Over 99 percent remain mystery chemicals. The few compounds identified cannot serve as the basis for a meaningful risk assessment.

The identities of the **PICs** that make up the THC measurements is thus largely undetermined. Presumably, the identities of **PICs** emitted are different when burning waste from those when coal is burned, due to the lack of chlorine in coal. However, it is also notable that the quantities of THC emitted are significantly greater during waste-burning runs than during coal-only conditions.

THC EMISSIONS

	Lbs/hr Main + bypass	ppm Main stack only
Condition 1 (waste)	23.8	109
Condition 2 (waste)	18.9	81
Condition 3 (coal)	18.5	83

The concentrations of THC measured in the main stack in all runs exceed by a factor of **4-5** the regulatory standard of 20 ppm used for both hazardous waste incinerators and waste-burning kilns. Clearly, the **kiln** is not an adequate combustion environment to destroy hydrocarbons (i.e., hazardous wastes).

It is **also notable** that CO emissions are significantly worse during the burning of waste than when coal-only is burned. Increased carbon monoxide emissions are commonly regarded as evidence of incomplete combustion.

Further, the main stack emissions of CO again greatly exceed the regulatory standard of 100 **ppm** required for hazardous waste incinerators and for waste-burning kilns (with some loopholes).

CO EMISSIONS
(main stack only, in parts per million)

	part5 per million, volume
Condition 1 (waste)	232
Condition 2 (waete)	202
Condition 3 (coal)	173

METALS EMISSIONS

As noted above, the failure to account for the hysteresis effect results in underestimates of metal emissions for waste-burning runs and a possible overestimate during **coal-**only runs. Nevertheless, **metals** emissions are **significantly** higher when waste is burned. Total emissions of all metals analyzed were 167 percent and **52** percent higher when wastes were burned than when coal-only was burned.

Not surprisingly, the increases **were** most significant for **the more** volatile metals. Those metals for which hazardous waste makes a relatively small contribution, increases were small or non-existent (i.e., barium, **thallium**, vanadium). **But** those metals of greatest concern -- **lead, mercury**, cadmium, nickel, and zinc -- showed great increases when wastes were burned. Lead emissions in condition I were 6 times greater than in condition 3, and **zinc** emissions were 11 times greater.

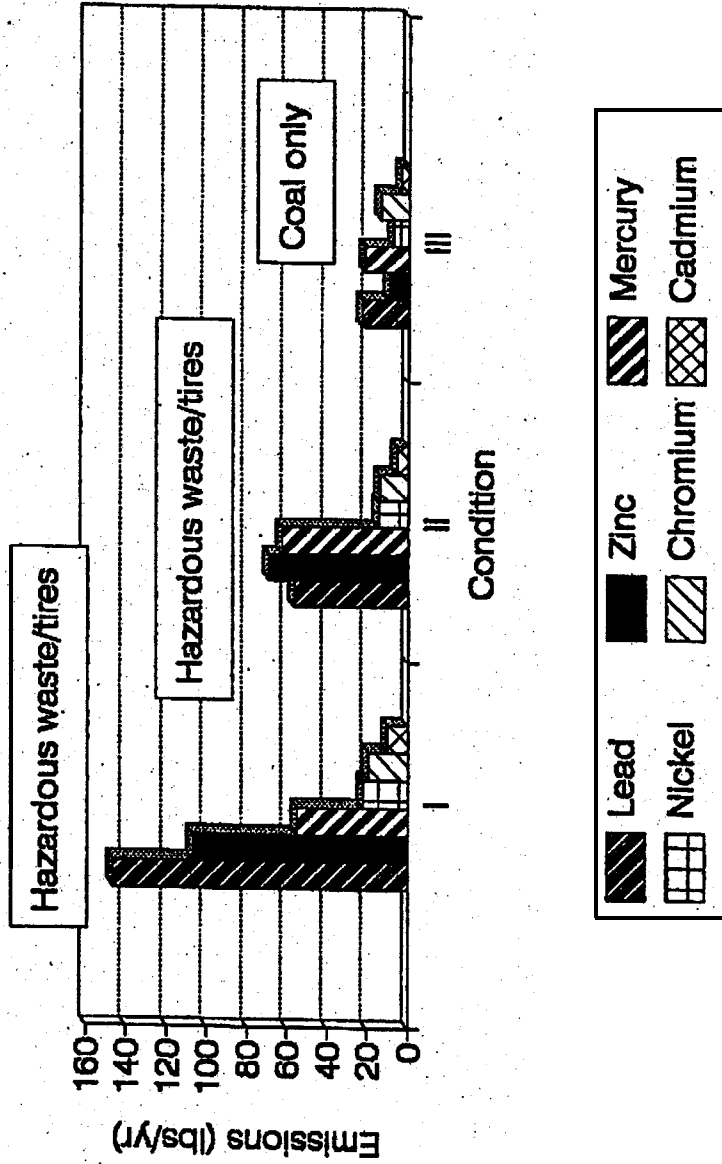
METALS EMISSIONS
Percent increase when burning **waste** over coal-only conditions

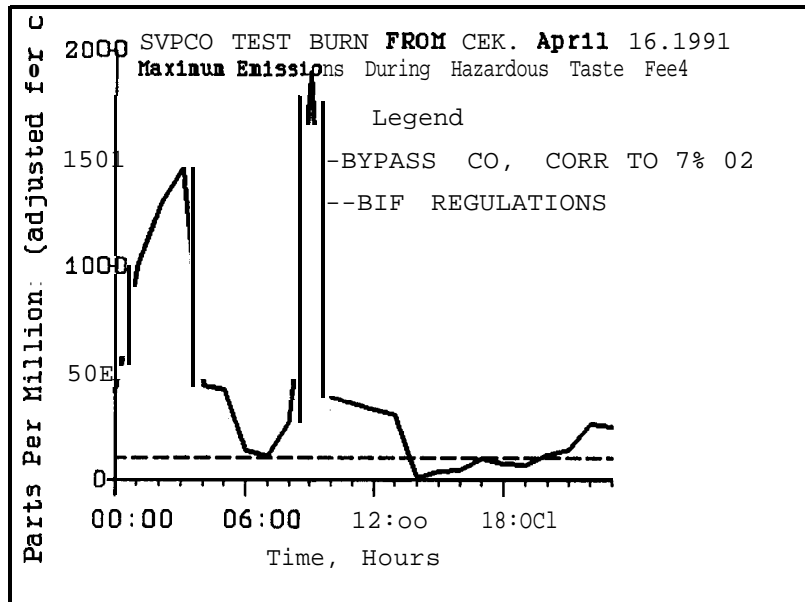
	Condition	
	1	2

Cadmium	184	64
Chromium	41	(-2)
Lead	549	150
Mercury	162	197
Nickel	185	90
Selenium	351	100
Silver	51	05
Zinc	1035	627
ALL METALS	167	52

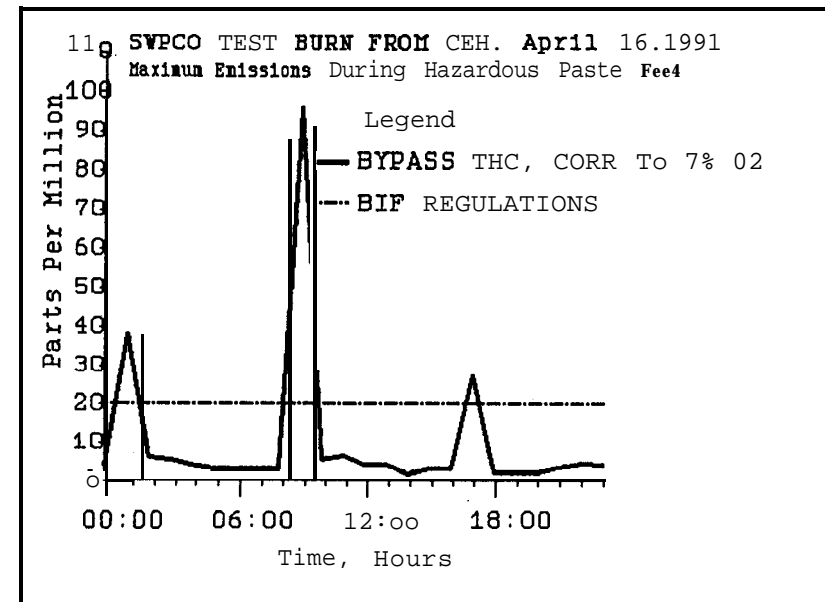
Metals Emissions

(Assuming 8,000 hrs/Year)





Total CARBON MONOXIDE, measured by the Continuous Emissions Monitor during the April test burn.



Total HYDROCARBONS, measured by the Continuous Emissions Monitor during the April test burn.

A recent PR release from Southwestern Portland Cement talks about the "strict limits" placed on their operation by the EPA. Specifically:

Why are carbon monoxide (CO) and total hydrocarbons monitored?

The high temperatures required to make cement destroy 99.99 percent or more of organic chemical wastes. During the process, however, there is a potential for extremely small quantities of other organic chemicals to be formed. They are called PIC's, products of incomplete combustion. Because it is not possible to monitor for the tiny amount of PICs that could be formed in the process, cement kiln operators instead monitor levels of CO or hydrocarbons in stack emissions. This is because emissions of CO are minimized and hydrocarbons created during combustion disappear when the combustion process is complete. In this way, operators are able to make sure destruction efficiency of 99.99 percent or more is always maintained and that they stay within the stringent limits on PIC emissions set by EPA.

The straight line near the bottom of each graph reflects the BIF, Boiler & industrial Furnace Regulations. You don't need a scientist to see that Southwestern had problems keeping their CO (carbon monoxide) and THC (total hydrocarbons) under control during the test burn. They freely admit that they cannot monitor the emissions of PIC's (which could contain dioxin and worse), so they monitor CO and THC instead. With emissions that vary this much, how do they have any idea what is coming out the stack? During the test burn there were EPA and RAPCA officials monitoring every smokestack and this is as good as they could do. Is this the "strict compliance" with EPA guidelines? Call the officials elected to serve you and ask if they know what you are breathing, since the company can't tell you. Attached are copies of the actual test data and several related documents from RAPCA/EPA files.

SWPCO TEST BURN FROM CEM, April 16,1991

Maximum Emissions During Hazardous Waste Feed

