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COVER LETTER FOR TELECOPY

DATE: 1-31-92

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COMPANY'S NAME: EPA

CITY AND STATE: DALLAS TX

TELECOPY NUMBER: 214-655-6460

FROM: WILSON TOLEFREE

NUMBER OF PAGES SENDING INCLUDING THIS COVER PAGE: 26

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STATE OF ARKANSAS
OFFICE OF THE GOVERNOR
State Capitol
Little Rock 72201

Bill Clinton
Governor

FAX TRANSMITTAL
FAX NUMBER 682-1382

DATE 1-31-92

TO: RANDALL MATHIS FROM KEN SMITH

COMPANY ADPCE (501) 682-2345

FAX NUMBER 562-4632

003858

WE ARE SENDING 23 PAGE(S). PLEASE CALL KEN

IF THERE ARE PROBLEMS WITH RECEIVING THIS FAX. THANK YOU.

PLEASE HAVE YOUR STAFF ANALYZE THIS INFORMATION. ALSO, PLEASE FORWARD A COPY OF THIS GREENPEACE REPORT TO EPA-DALLAS THIS P.M. [redacted] FOR EPA'S REVIEW + COMMENT. THANK YOU.

Pat Costne. of Greenpeace, USA, Gregory Ferguson, the attorney for People Against A Chemically Contaminated Environment, and myself, PACCE project coordinator, Sharon Golgan has just emerged from a meeting with some of Governor Clintons' campaign staff. We have presented them with quite a collection of data and information which will allow the Governor to make some quick and decisive choices on the future of the incinerator in Jacksonville Arkansas.

Throughout the past few years Governor Clinton has reassured the citizens of Jacksonville if the trial burn did not show the incinerator could destroy the dioxin to 99.9999% he would not allow the company to burn it. As you have already heard from Pat, they were not able to destroy the dioxin which was accidentally fed into the incinerator on Oct. 11, 1990, during the trial burn.

On January 17, a group of concerned citizens from around central Arkansas met with Senator Bumpers, and asked him to write a letter requesting an investigation into this burn. He agreed to do this for us. We told him of our plans to inform the Governor of our findings. As you all know the Governor has been very buisy and it has taken a while to arrange the meeting, but his staff has been very gracious in working with us to set this up as soon as they could, and we are thankful to them.

It is now the eleventh hour and there is no more time to waste. The citizens health, safety, and well being are at stake here and he must act very soon. We are asking the Governor to stop the Burn immediately, and to call an investigation into the entire project. We especially want to know why the EPA has forced this burn on our State and city knowing there was, in existance a viable alternative to incineration for several years. We want to know why the EPA lists HCB as a chemical which is harder to burn than dioxin, when chemists around the world say it is not harder to burn.

We feel if the EPA had spent as much time and money on research for alternatives as they have on their public relations in selling incineration to the public then we wouldn't be here today. Because of this burn and the findings here today there must be some new laws and regulations written to stop unsafe practices by the incineration industry. The EPA must reevaluate its practices and stop the influence coming from the industry which is controlling the practices of the agency. It must become the agency that practices what its name implies. PROTECTION! Governor Clinton, if you are successful in your bid for President of the United States we ask you to let one of your very first responsibilities be to investigate the EPA and set this most important agency that has the responsibility of protecting our children and families, on the right track. We wish you success in all of this and realize what you are going through is not an aasy struggle. We in Jacksonville know what it is like to struggle against forces that can not be forseen.

Today we place our hope and future in your hands in hope you will care deeply enough to take the time out of your busy schedule and understand what we have been through, trying to protect our families from this vishous attack on our lives, and STOP THE BURN!

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PRELIMINARY DRAFT

THE INCINERATION OF DIOXIN IN JACKSONVILLE, ARKANSAS: A Review of Trial Burns and Related Air Monitoring at Vertac Site Contractors Incinerator Jacksonville, Arkansas

by

Pat Costner,
Research Director
U.S. Toxics Campaign
Greenpeace USA

January 29, 1992

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SUMMARY AND RECOMMENDATIONS

On January 2, 1991, Vertac Site Contractors (VSC) was granted a license to burn dioxin by the Arkansas Department of Pollution Control and Ecology (ADPC&E). The approval of VSC's license was based on the results of a trial burn, conducted during October, 1991, in which the VSC incinerator reportedly achieved a 'destruction and removal efficiency' (DRE) of 99.9999 percent, as required under federal law and under the contract between VSC and ADPC&E.

The 99.9999 percent DRE reported by VSC was not achieved with dioxin but with hexachlorobenzene, which was fed into the incinerator as 2,4-D waste was burned. Hexachlorobenzene has been alleged by VSC to be more difficult to burn than dioxin.

Despite allegations to the contrary by EPA, ADPC&E and VSC, the 2,4-D waste burned during the trial burn contained significant levels of dioxin and other polychlorinated dioxins and furans. According to VSC's trial burn data documenting the rate of input of dioxin into the incinerator and its rate of emission in stack gases, the incinerator achieved a DRE of only 99.96 percent for dioxin.

Reviews of both the 1990 and 1991 trial burns conducted by VSC at their incinerator in Jacksonville show numerous serious deviations from standard trial burn protocol as well as evidence of erroneous and/or falsified data. Further, during the 1991 trial burn, which led to VSC's certification to burn dioxin, the incinerator was releasing polychlorinated dioxins and furans at the rate of 3.18 nanograms per cubic foot of stack gas, or 36,300 nanograms per minute.

Emissions of dioxins and furans during the 1991 trial burn were thousands of times higher than those of the 1990 trial burn,

were thousands of times higher than those of the 1990 trial burn, which had failed to lead to the incinerator's certification to burn dioxin. Moreover, the incinerator's emissions of these chemicals during the 1991 trial burn were more than 1,000 times higher than dioxin emission standards in Germany.

An air monitoring program -- sampling and analysis of ambient air in the area surrounding the Vertac site -- was conducted by URS Consultants, under EPA contract, during the 1990 trial burn. A review of the final report of this program, shows evidence of deviations from the air monitoring plan, prepared by CH2M Hill under contract to EPA, so serious as to render the most important data -- the concentrations of dioxin in the ambient air in Jacksonville during the trial burn -- virtually meaningless. Nonetheless, the air monitoring data from this earlier trial burn show that other components in the Vertac waste -- the herbicides, 2,4-D and 2,4,5-T, and their derivatives -- were present in the air surrounding the Vertac site at detectable levels on a near-continuous basis. No data from the air monitoring during the 1991 trial burn are publicly available at this time.

Allowing the continued operation of the 2,4-D waste and/or 2,4,5-T waste in the VSC incinerator in Jacksonville, Arkansas, is nothing less than reckless endangerment of public health and the environment on the part of those agencies and officials who were responsible parties in the approval of VSC's license on January 2, 1992.

Greenpeace recommends as follows:

* An immediate shutdown of the VSC incinerator by the appropriate state and/or federal officials;

* A full review and careful consideration by EPA and ADPC&E of methods of disposal other than incineration, such as those presented in "Dioxin Treatment Technologies - Background Paper," OTA-BP-O-93, by the U.S. Congress, Office of Technology Assessment.

* A full investigation by the appropriate state and federal agencies of contractors hired by the state and/or EPA to oversee and carry out the trial burn and air monitoring programs.

GENERAL BACKGROUND

When chlorinated chemicals are manufactured, used and burned, many other complex chlorinated chemicals are produced as unwanted by-products. Among these are the polychlorinated dioxins and furans, of which the most widely known is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), commonly referred to

simply as 'dioxin.'

Because of the high concentrations of 2,3,7,8-TCDD identified in the drummed herbicide wastes at the Vertac Chemical Company facility in Jacksonville, Arkansas, and the threat to public health and the environment, the U.S. Environmental Protection Agency placed this site on the Superfund list in 1979. The wastes at Vertac are those remaining from the manufacture of two herbicides -- 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) -- and their formulation into Agent Orange, which was widely used by the U.S. military in the Vietnam War.

More than 28,000 drums of these dioxin-contaminated wastes are stored at the Vertac facility in Jacksonville, awaiting final disposal. The quantities and general types of these wastes are shown in Table 1.

Table 1

Quantities and Types of Agent Orange Waste
Stored at Vertac Chemical Site In Jacksonville, Arkansas

Type	Quantity, in pounds	2,3,7,8-TCDD 2,3,7,8-TCDD, in parts per billion (ppb)	Total PCDDs and PCDFs,* in ppb
2,4-D	13,230,231	3.6 (a)	4,998.8 (a)
2,4,5-T	1,717,643	15,000-50,000	?
Solid waste in 55-gal drums	155,615	12.6 (a)	3,090.5 (a)
Solid waste in 85-gal drums	1,400,110	12.6 (a)	3,090.5 (a)
Total	16,503,599		

* PCDDs = Polychlorinated dioxins; PCDFs = Polychlorinated furans.
(a) These are concentrations of the 2,4-D waste -- 'organic waste' and 'solid waste' reported for the 2,4-D waste burned during the 1991 trial burn. (CAE, 1991)

Source: VSC, 1991

In 1985, Vertac Chemical Company hired Ensco, a commercial hazardous waste disposal firm in El Dorado, Arkansas, to burn the Agent Orange wastes. Ensco already had a special license to burn another group of complex chlorinated chemicals, the polychlorinated biphenyls (PCBs. However, after months of effort, the incineration company declined the contract, evidently because they were unable to meet the criteria for a permit to burn dioxin. (URS, 1991)

In February 1987, EPA launched an immediate removal action to overpack and store the majority of the drummed waste in storage facilities to await disposal. Later in 1987, the Arkansas Department of Pollution Control and Ecology (ADPC&E) signed a contract with a company to burn the Agent Orange wastes. This contract was set aside after the contractor found the available funds to be inadequate. (URS, 1991)

In 1988, ADPC&E officials began negotiating with MRK Incineration, a Louisiana-based company, to burn the waste, although MRK evidently had no experience in hazardous waste incineration. While these negotiations were underway, MRK joined with MK Environmental Service, a division of MK-Ferguson which is, in turn, a wholly-owned subsidiary of Morrison-Knudsen Corporation of Idaho. In 1989, this joint venture, known as Vertac Site Contractors (VSC), signed a contract with ADPC&E to burn the Agent Orange waste in Jacksonville.

Construction of the VSC incinerator was completed in July, 1990. (Efferson, 1990) Preliminary operation of the incinerator began in August, 1990. (Efferson, 1990b)

Protocols for incinerator operations during this period and for the air monitoring program during the entire project were established by the "Engineering and Evaluation/Cost Analysis," a report prepared for EPA by CH2M Hill. According to this report, VSC was allowed to burn 2,4-D waste during this 'shakedown' phase "because dioxins have not been detected in these wastes." (CH2M Hill, 1989)

As shown in Table 1, analyses of the 2,4-D waste conducted during the 1991 trial burn found concentrations of total dioxins and furans ranging from 3,100 to 5,000 parts per billion (ppb), including 2,3,7,8-TCDD at levels ranging from 3.6 to 12.6 ppb. The other dioxins, of which there are 74, and the 135 furans are thought to have potencies ranging from 0 to 50 percent that of 2,3,7,8-TCDD. (USEPA, 1989)

When multiplied by the appropriate 'toxicity equivalence factor' (TEF) -- a measure of each PCDD and PCDF's potency relative to that of 2,3,7,8-TCDD -- the concentrations of these other PCDDs and PCDFs can be expressed as concentrations of 'dioxin-equivalents'.

For example, as shown in Table 1, the total concentration of PCDDs and PCDFs in the 2,4-D waste is 4,998.8 ppb. When the individual concentrations of each of these PCDDs and PCDFs is multiplied by the appropriate TEF and the results summed, the total is 188.5 ppb of dioxin-equivalents (TEQs). I.e., the 4,998.8 ppb of PCDDs and PCDFs are equivalent, in toxicological terms to 188.5 ppb of 2,3,7,8-TCDD. (USEPA, 1989)

VSC conducted their first trial burn during December 4-7, 1990. Still following the erroneous assumption that the 2,4-D waste contained no dioxins, VSC used this waste as the basic feed to the incinerator during the trial burn. The trial burn results indicated that VSC achieved a 'destruction and removal efficiency' of 99.9999 percent for two specially selected chemicals, hexachlorobenzene (HCB) and 1,2,4-trichlorobenzene (1,2,4-TCB) that were burned concurrently with the 2,4-D waste. However, because of a variety of other errors and omissions, ADPC&E refused, at this time, to certify the VSC incinerator for burning the waste at Vertac.

Ten months later, during October 9-11, 1991, VSC conducted a second trial burn, burning HCB and 2,4-D waste in the incinerator. VSC submitted their final trial burn report to ADPC&E on December 9. Within ten days, on December 19, ADPC&E notified VSC that the state's initial review of the report was complete and asked VSC for a few additional pieces of information. On January 2, 1991, ADPC&E gave final approval to VSC to incinerate the Vertac wastes at Jacksonville. VSC began routine burning of the wastes on January 4, 1992.

In both the 1990 and 1991 trial burns the incineration of 2,4-D waste was accompanied by emissions of PCDDs and PCDFs in the stack gases, as described later in more detail. The emissions of PCDDs and PCDFs by the VSC incinerator were predictable given the voluminous research, including EPA's National Dioxin Study, which had found PCDD and PCDFs to be near-ubiquitous products of the combustion of organochlorines, such as 2,4-D, and even inorganic chlorines in the presence of carbon sources, are burned. (Miles, et al., 1985; USEPA, 1985).

A BRIEF EXPLANATION OF TRIAL BURNS

Trial burns, such as those conducted by VSC in Jacksonville, are part of the licensing requirements for all hazardous waste incinerators. A trial burn, which is a series of at least three tests, is intended to prove that an incinerator can meet certain legal performance standards and to establish the operating conditions under which they are met.

Among the most important licensing criteria are scientific data showing that the incinerator has a 'destruction and removal

efficiency' (DRE) of 99.99 percent, in the case of hazardous waste, or 99.9999 percent for dioxin-contaminated waste. DRE actually measures "the penetration, which is the amount of a compound which is not destroyed," according to EPA scientists. (Gorman et al., 1985) In other words, the purpose of the trial burn at Vertac is to gather scientific proof that no more than 0.0001 percent of the dioxin fed into the incinerator is released into the air via the stack.

Most of the wastes burned in hazardous waste incinerators are, like the Agent Orange wastes in Jacksonville, mixtures of many chemicals. Consequently, EPA allows incinerator operators, such as VSC, to determine their incinerator's DREs for only a few chemicals, usually one or two but sometimes as many as six. These 'principal organic hazardous constituents' (POHCs) are selected because (a) they are major constituents of the waste, or (b) they are thought to be more difficult to burn than any of the chemicals that will be burned in the incinerator.

If an incinerator meets the legal performance standards, including the required DRE with the selected POHCs, they are given a license to burn waste. The state and federal authorities who approve this license do so based on the assumption that the incinerator will attain -- with all subsequent wastes, during all hours of operation, throughout the incinerator's operating lifetime -- the same DRE that was achieved with one or two chemicals during a period of 12-18 hours

During a trial burn, it is standard practice to dilute the POHC in a mixture of other waste chemicals. (Gorman et al., 1985) The DRE of that POHC is then calculated from the following basic measurements:

* Concentration of the POHC in the waste mixture;
* Rate at which the POHC/waste mixture is fed into the incinerator;
* Concentration of the POHC in stack gases; and
* the rate of flow of the stack gases.

VSC INCINERATOR EMISSIONS OF DIOXINS DURING PRE-TRIAL PERIOD

VSC began burning 2,4-D waste in their incinerator in August prior to the trial burn in December. At ADPC&E's request, VSC analyzed their stack gases for dioxins and furans on October 1, 10, and 13. Unfortunately, ADPC&E did not insure that VSC follow the standard practice of determining the concentrations of those individual PCDDs and PCDFs that have, according to EPA, potencies ranging from 0.1 to 50 percent that of 2,3,7,8-TCDD.

On October 10, no detectable concentrations were found for those few PCDDs and PCDFs for which analyses were attempted. On October 1 and 13, the following emission rates of the listed

furans were measured:

Table 2

Stack Emission Rates of
2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) and
1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-PeCDF)
During Pre-Trial Burn Period

PCDF	Date	Nanograms per minute ng/min	TEF (a)	TEQs (b), ng/min
2,3,7,8-TCDF	Oct. 1	2,204.1	0.1	220.4
2,3,7,8-TCDF	Oct. 13	170.7	0.1	17.1
1,2,3,7,8-PeCDF	Oct. 13	160.1	0.05	8.0

(a) TEF = Toxicity Equivalence Factor (USEPA, 1989)
(b) TEQ = Toxic Equivalents, also called dioxin-equivalents, and TCDD-equivalents.
Note: As the calculations above show, the emission of 170.7 ng/min of 2,3,7,8-TCDF and 160.1 ng/min of 1,2,3,7,8-PeCDF is equivalent, in terms of potential impacts on public health and the environment, of the release of 2,3,7,8-TCDD at a rate of 25.1 ng/min.

On October 1, as shown in Table 2, the VSC incinerator was emitting a quantity of PCDFs equivalent to 25.1 nanogram per minute of 2,3,7,8-TCDD. This quantity of dioxin-equivalents, 25.1 nanograms, can be compared to EPA's estimate that, among a population of average-sized adults, the ingestion of more than 0.00042 nanograms of dioxin per day per adult throughout their lifetimes can be expected to cause a cancer death rate exceeding one death among one million people. (USEPA, 1989) If this death rate of one in one million is considered acceptable, as is now common under many state and federal laws, then VSC was emitting, in one minute, a quantity of dioxin-equivalents that exceeds the acceptable daily intake for 500,000 adults.

PROCEDURES AND PRACTICES DURING THE 1990 TRIAL BURN

Following EPA's advice, ADPC&E agreed to allow VSC to establish their incinerator's DRE with HCB and 1,2,4-TCB, rather than 2,3,7,8-TCDD. According to EPA's ranking system, which is based on heats of combustion, both of these chemicals are more difficult to burn than 2,3,7,8-TCDD. Thus far, however, EPA's own research has not found "a significant positive correlation" between a chemical's heat of combustion and its incinerability.

(Trenholm et al., 1984; USEPA, 1989b)

Under the erroneous impression that the 2,4-D waste contained no dioxins, ADPC&E also agreed for VSC to use 2,4-D as the waste matrix for the trial burn. EPA's "Practical Guide - Trial Burns for Hazardous Waste Incinerators," describes three methods preparing a POHC/waste mixture for a trial burn. For each method, the Agency stresses that it is "especially important" that the POHC be well mixed in the waste matrix. (Gorman et al., 1985)

VSC, however, did not mix their POHC, hexachlorobenzene, with the waste matrix, 2,4-D. Instead, a series of small plastic bottles were filled with HCB and fed into the incinerator at the rate of one each thirty seconds. The feedrates to the incinerator were 30 pounds per hour HCB and 1,552 pounds per hour of 2,4-D waste. (VSC, undated)

The effect on DRE of this novel method of POHC introduction has not been well researched. However, the incinerability of a pure chemical has been shown to be different from that of the same chemical mixed in a sludge matrix. (Mazer et al., 1987) There is no scientific basis for the assumption that a DRE achieved by burning such 'slugs' of pure HCB concurrently with 2,4-D waste is identical to a DRE achieved by burning a well mixed blend of HCB and 2,4-D.

Further, had the HCB been properly mixed with the 2,4,-D waste during this trial burn, its concentration would have been 18,960 parts per million (ppm). By comparison, the concentration of 2,3,7,8-TCDD in the 2,4,5-T waste is reportedly an average of 40 ppm.

In other words, during the trial burn, the concentrations of HCB were more than 400 times higher than the concentration of 2,3,7,8-TCDD in the 2,4,5-T waste. It has been well established, as described in EPA's review of critical fundamental issues in hazardous waste incineration, that the lower a chemical's concentration, the poorer the DRE: "Field data show a remarkable correlation between compound concentration in the feed and DRE." (Kramlich et al., 1989)

The other dioxin surrogate, 1,2,4-TCB was mixed with diesel fuel and fed into the secondary combustion chamber at an average rate of 16 pounds per hour with a concomitant average diesel fuel feedrate of 1,878 pounds per hour. This concentration of 1,2,4-TCB -- 8,520 ppm -- is more than 200 times higher than the concentration of 2,3,7,8-TCDD in the 2,4,5-T.

According to the 1990 trial burn final report, VSC achieved the required DRE of 99.9999 percent with both HCB and 1,2,4-TCB during all three test burns. Due, however, to other factors,

including evident breaches of protocol in sample management, ADPC&E did not approve VSC's permit application to burn dioxin.

VSC's incinerator was reputedly capable of burning waste at the rate of 10,000 pounds per hour. However, during the trial burn, the maximum waste feedrate was reported as 1,551 pounds per hour, some 15 percent of the design rate.

STACK EMISSIONS DURING 1990 TRIAL BURN

Contrary to standard practice, VSC did not determine the concentrations in stack gases of those PCDDs and PCDFs having toxicity equivalence factors greater than zero or of total PCDDs and PCDFs. During each of the three test burns of the trial burn, stack gases were analyzed only for 2,3,7,8-TCDD; five of the remaining 74 PCDDs; and nine of the 135 PCDFs.

The PCDD/PCDF emissions presented in the trial burn report were contradictory (see VSC, undated: pages 13-16). Further, contrary to standard practice, these data were presented only as total PCDDs/PCDFs, rather than in dioxin-equivalents.

Applying EPA's toxic equivalency factors to those fifteen PCDDs and PCDFs for which stack gas concentrations were reported (see VSC, undated: pages 14, 15, 16), this fraction of the incinerator's PCDDs and PCDFs were emitted at a rate equivalent, on the average, to 90.9 nanograms of 2,3,7,8-TCDD per minute, as shown in Table 3.

Table 3

1990 Trial Burn: Emissions Rates of PCDDs/PCDFs

Test No.	PCDDs/PCDFs, as Dioxin-Equivalents, in nanograms/minute
1	53.9
2	138.1
3	80.8
Average	90.9

At the average emission rate shown in Table 3, the incinerator was releasing, in one minute, a quantity of dioxin-equivalents in excess of the acceptable daily intake for 215,000 adults, based on data and conclusions described earlier.

Contrary to standard practice, the trial burn report offered no information on stack emissions of unburned 2,4-D or other components known to be in this waste. Also contrary to standard

practice, the trial burn report offered no information on the identities and quantities of any of the products of incomplete combustion that are known always to be present in incinerator stack gases. I.e., either these essential analyses were not conducted or they were not reported in the trial burn report summary available for public review.

AIR MONITORING DURING 1990 TRIAL BURN

The plan for the air monitoring program at the Vertac site was presented in the "Engineering Evaluation/Cost Analysis" (EE/CA), prepared by CH2M Hill under contract to EPA in partial fulfillment of the requirements of the National Environmental Policy Act. According to the EE/CA, the concentrations in ambient air of selected chemicals were to be determined before the trial burn, during the trial burn and during the commencement of formal incineration operations.

Following the EE/CA plan, six air sampling stations were placed outside the fence surrounding the incinerator site. Stations 1, 2, 3, and 4 were to monitor "Potential Passive Dioxin Drift." Only Stations 5 and 6 were designated monitors for "Potential Stack Dioxin Emissions." (CH2M Hill, 1989)

As evident in EE/CA maps and those from the final report of air monitoring during the 1990 trial burn (URS, 1991), neither Station 5 or 6 were located in residential areas near the maximum potential impact of the incinerator stack plume, as determined by computer modeling.

According to the EE/CA, the chemicals to be studied during the air monitoring program were as follows (CH2M Hill, 1989):

* Dioxins: To be reported as a TCDD Toxicity Equivalent Value (TEV) (Appendix B)
* Herbicides: 2,4-D; 2,6-D; 2,4,5-T; and 2,4,6-T
* Semivolatile Organics: 2,4-Dichlorophenol; 2,6-Dichlorophenol; 1,2-Dichlorobenzene; 1,2,4-Trichlorobenzene; and 2,4,5-Trichloroanisole.

Besides its obvious inadequacies in the siting of the air monitoring stations, the EE/CA plan also failed to specify that ambient air samples be analyzed for all PCDDs and PCDFs. Well before the EE/CA was prepared, it had been established that PCDFs were present in greater concentrations than the PCDDs and contributed, by far, the greatest portion of dioxin-like toxicity in the stack emissions of facilities burning complex chlorinated chemicals, such as PCBs.

CH2M Hill's failure to require that both PCDDs and PCDFs be monitored was further exacerbated by URS Consultants' failure to monitor the PCDDs in ambient air. Analysis at the air monitoring

stations were carried out only for the tetrachlorinated dioxins. In summary, URS Consultants deviated radically from the EE/CA plan, conducting the air monitoring program in such a fashion as to render meaningless the most important segment of the plan, the determination of dioxins in ambient air.

Further, URS Consultants compounded their failure to analyze air samples for total dioxins by failing to provide congener-specific data for those tetrachlorinated dioxins that were monitored. These deviations by URS Consultants from the EE/CA plan and from standard practice rendered the air monitoring data for dioxins useless.

Other chemicals listed by the EE/CA for analysis in ambient air that were also omitted during the air monitoring program are as follows (CH2M Hill, 1989; URS, 1991):

* 2,6-Dichlorophenoxyacetic acid (2,6-D),
* 2,4,6-Trichlorophenoxyacetic acid (2,4,6-T), and
* 2,4,5-Trichloroanisole.

It is interesting to note that, in the 1989 EE/CA, all of the air sampling stations were characterized as being "outside the fence," e.g., off-site. For example, Stations 1 and 2 were set up to "indicate if measurable pollutant levels occur outside the site boundary."

However, in their final report of the results of the air monitoring conducted during the 1990 trial burn, URS Consultants had reclassified the stations as "On-Site Locations" -- Stations 1, 2, 3, and 4 -- and "Off-Site Locations" -- Stations 5 and 6. Such reclassification clearly served the political purpose of changing the perception, both of the public and regulatory authorities, of the significance of any detectable levels of pollutants.

Those analyses for airborne pollutants that URS Consultants apparently carried out according to EE/CA directives show detectable concentrations of many of these pollutants, with the exception of the tetrachlorinated dioxins, on a near-continuous basis.

DIOXIN IN AMBIENT AIR

During the test period, six ambient air samples contained detectable quantities of tetrachlorinated dioxins, at concentrations ranging from 0.03 picograms per cubic meter (pg/m3) to 0.43 pg/m3. High variability in sampling and analysis was reflected in the wide variation of detection limits, which ranged from 0.01 pg/m3 to 0.42 pg/m3.

Table 3

Tetrachlorinated Dioxins in Ambient Air
During 1990 Trial Burn at Vertac Site

Date	Station	Concentration, in pg/m3	Wind Direction
9/17/90	2 (Weather)	0.43	Variable
9/23/90*	1 (Trailer)	0.07	SSW
	5 (Water T.)	0.32	SSW
9/28/90*	2 (Weather)	0.30	SSW
1/28/90	1 (Trailer)	0.09	Variable
	5 (Water T.)	0.03	Variable

* VSC commenced burning 2,4-D waste at a "slow rate" on 9/25/90.
Source: URS, 1991

It is interesting to note that no tetrachlorinated dioxins and, consequently, no 2,3,7,8-TCDD were detected in stack gases during any of the three test burns of the 1990 trial burn. (VSC, undated) The detection in ambient air of levels of tetrachlorinated dioxins as high as 0.32 pg/m3 at Station 5, the water tower which is 820 feet north of the incinerator, suggests two very serious problems:

* Massive "passive dioxin drift" during waste transfer operations at the site, and/or
* Major errors in stack gas analysis during the trial burn.

BAsed on an average adult's breathing rate of 20 cubic meters per day, an adult who spent 24 hours at the water tower on September 23, 1990, would have inhaled 6.4 picograms of tetrachlorinated dioxins. If this were all 2,3,7,8-TCDD, this person would have inhaled more than fifteen times the acceptable daily intake of dioxin. Further, if the relative concentrations of PCDDs and PCDFs in the air were, as might be expected, similar to those in the stack gases during the 1991 trial burn, as detailed later in this report, this adult would have inhaled 300 times the acceptable daily inteke of dioxin.

A general compilation of the frequency of occurrence of detectable levels of those pollutants for which analyses were conducted during the trial burn phase of the air monitoring program, at the Stations 1, 2 and 5, where dioxin was detected, is presented in Table 4.

Table 4

Air Monitoring During 1990 Trial Burn:
Frequency of Occurrence and Maximum Concentrations
of Selected Pollutants

Pollutant	Station 1 - Trailer	2- Weather	5 - Water Tower
Tetrachlorinated Dioxins	2 of 31	1 of 32	2 of 31
Conc'n, pg/m3	0.07; 0.09	0.30; 0.43	0.03; 0.32
2,4-D	18 of 32	19 of 32	17 of 32
Max. conc'n, ng/m3	0.95	0.97	0.64
2,4,5-T	14 of 31	14 of 31	14 of 31
Max. conc'n, ng/m3	0.51	0.62	0.62
1,2-DCB	5 of 33	0 of 9	4 of 32
Max. conc'n, ug/m3	0.013	--	0.007
2,4-DCP	21 of 33	7 of 8	16 of 33
Max. conc'n, ug/m3	0.24	0.30	0.093
2,6-DCP	18 of 33	7 of 8	12 of 33
Max. conc'n, ug/m3	0.043	0.059	0.019
1,2,4-TCB	8 of 33	2 of 9	4 of 33
Max. conc'n, ug/m3	0.017	0.016	0.007

As the data above indicate, the air in the vicinity of the Vertac facility carried detectable levels of a broad array of fugitive emissions and/or stack emissions on a frequent, if not near-continuous, basis.

1991 TRIAL BURN

In October, 1991, VSC conducted another trial burn, burning only one POHC -- HCB. As discussed earlier, the selection of HCB as a surrogate for 2,3,7,8-TCDD was based on an EPA ranking

system that is well known by the Agency to be flawed. (USEPA, 1989b) Also, all parties involved -- EPA, ADPC&E and VSC -- were evidently still under the erroneous impression that the 2,4-D waste contained no 2,3,7,8-TCDD, and, as in the 1990 trial burn, used 2,4-D as the waste matrix.

Once again, VSC deviated from EPA protocol in their preparation of the POHC/waste mixture. As discussed earlier, normal procedure entails mixing the POHC in the waste matrix, determining the POHC concentration in the waste and measuring the feedrate of the mixture to the incinerator. Instead, VSC mixed the HCB into buckets of sand which were then "fed into the solids feed stream via a small screw feeder." (VSC, 191b) No substantiation was provided that this novel method of POHC preparation and introduction leads to the determination of a DRE that is the same as the DRE achieved when standard practices are followed.

Further, rather than burning a well-characterized waste mixture, VSC may also have burned aqueous wastes and some quantity of "filter paper, floor sweeping, soil, trash, personal protective clothing and other trash contaminated with chlorobenzenes and chloroproprionic (sic) acids." (VSC, 1991b) According to VSC's "Trial Burn Sampling and Analysis Plan," three waste streams -- "solid waste, liquid organic waste and aqueous waste" -- were to be fed into the primary combustion chamber at composite feedrate of 10,000 pounds per hour.

No information was provided in the final trial burn report summary on the quantity of aqueous wastes, soil, trash or other such materials fed into the kiln during the trial burn. HCB was fed into the kiln at a rate of 100 pounds per hour during each of the three test burns, while the 2,4-D waste -- evidently referred to as "organic waste" in the trial burn report - and another unspecified "solid waste" were fed into the kiln at the rates shown in Table 5.

Table 5

1991 Trial Burn: Waste Feedrates, in Pounds per Hour

	Material Burned, in Lbs/Hr			Concentration of HCB in Total
Test	HCB	Organic Waste	Solid Waste	Waste, in ppm
1	100	937.85	1,172.8	45,235
2	100	506.52	1,670.6	43,915
3	100	182.6	1,616.0	52,670

Source: CAE, 1991

As the data in Table 5 indicate, the concentrations of HCB in the wastefeed during the test burns varied from approximately 1,100 to 1,300 times the concentration of 2,3,7,8-TCDD reportedly present in the 2,4,5-T waste. As discussed earlier, it has been well established that higher DREs are achieved at higher POHC concentrations; lower DREs at lower POHC concentrations. (Kramlich et al., 1989)

The concentrations of HCB in the wastestream fed into the incinerator during the trial burn were more than three orders of magnitude higher than the concentrations of 2,3,7,8-TCDD in the 2,4,5-T waste to be burned after certification. There is no scientific basis for the assumption that the DRE achieved with such relatively high concentrations of HCB will be achieved with the much lower concentrations of 2,3,7,8-TCDD present in the 2,4,5-T waste.

As stated earlier, the design feedrate of the VSC incinerator is at least 10,000 pounds per hour. The maximum waste feedrate reported in the final trial burn report summary was 2,210 pounds per hour, approximately 22 percent of the design rate.

STACK EMISSIONS

In contrast to the 1990 trial burn and contrary to standard practice, the concentrations of PCDDs and PCDFs in stack gases were determined in only one of the three 1991 test burns. The feedrate of "organic waste" during this test, Test 3, was approximately 20 percent that burned in Test 1 and roughly 30 percent that burned in Test 2. These data suggest that the conditions during Test 3 may have been those in which the lowest concentrations of dioxins and furans were being fed into the incinerator and, consequently, those in which stack emissions of PCDDs and PCDFs would be lowest. Further, the "liquid organic flow meter was not operating properly" during Test 3, according to the trial burn report. (CAE, 1991)

It is also interesting to note that VSC's unusual decision to conduct PCDD and PCDF analyses during only one of the three test burns was mentioned only twice in their trial burn plan. In both cases, this remarkable deviation from standard practice was mentioned only in the footnotes of two tables of data. (VSC, 1991b) Further, according to the laboratory data sheets from Triangle Laboratory, the stack gas sample taken for analysis of [illegible] was collected on "10/10/91," while

dioxins and furans. This is more than 1,000 times higher than the German standards for dioxin emissions from incinerators, which is 0.1 ng/m3. Applying the appropriate toxicity equivalence factors to each of the PCDDs and PCDFs, these emissions are equivalent to the release of 3.31 ng/m3 of 2,3,7,8-TCDD.

At the VSC incinerator's reported stack gas flow rate of 11,425 dry standard cubic feet per minute, or 323.6 cubic meters per minute, the incinerator was releasing the equivalent of 1,071 nanograms of 2,3,7,8-TCDD per minute into the air. This emission rate is 90 times higher than the average emission rate reported during the 1990 trial burn.

At this rate of dioxin emissions, the VSC incinerator was releasing a quantity of dioxin in one minute that is larger than the acceptable daily dose for 2.5 million people, following the same rationale presented earlier.

Contrary to standard practice, the trial burn report prepared by Clean Air Engineering offered no information on stack emissions of unburned 2,4-D or other major components of the waste burned. Also contrary to standard practice, the trial burn report offered no information on the identities and quantities of the products of incomplete combustion, those chemicals that are always formed and released in stack gases during the incineration of chemical wastes. Evidently some of these analyses were conducted but were not submitted as part of the trial burn report available for public review.

AIR MONITORING DURING 1991 TRIAL BURN

These data have not been provided for public review at this time. It is to be hoped that the errors and deviations that occurred during the air monitoring program of the 1990 trial burn have not been repeated during the monitoring program of the 1991 trial burn.

DRE ACHIEVED WITH 2,3,7,8-TCDD AND TOTAL PCDD/PCDFS DURING 1991 TRIAL BURN

Although sufficient data were generated during the 1991 trial to enable VSC to determine the DRE achieved with both 2,3,7,8-TCDD and total PCDDs and PCDFs during Test 3 of the trial burn, these DREs were not presented in the trial burn report.

Among the data sheets in the appendices of the trial burn report are those evidently containing PCDD and PCDF analyses of the "organic waste" and "solid waste" burned during Test 3 of the 1991 trial burn. The data presented below in Table 6 are excerpted and/or calculated from those data sheets.

Table 6

PCDD/PCDF Content of Wastes Burned
During 1991 Trial Burn, Test 3,
in nanograms per gram of dioxin-equivalents (TEQs)

	Organic Waste		Solid Waste	
	ng/g	% of Total	ng/g	% of Total
2,3,7,8-TCDD	3.6	1.9	12.6	8.9
PCDDs	22.2	11.8	20.2	14.8
PCDFs	166.3	88.2	120.6	85.7
Total TEQs	188.5		140.8	

It is interesting to note that 2,3,7,8-TCDD contributes such a small portion of the total dioxin-equivalents in these wastes, while the PCDFs account for more than 80 percent. This is of particular importance in regard to the air monitoring program which was intended, in part, to determine "Passive Dioxin Drift" related to waste handling activities. As discussed earlier, the consultants, URS Consultants, who carried out the air monitoring program during the 1990 trial burn tested ambient air near the Vertac site only for tetrachlorinated dioxins. Obviously, the air monitoring program, as conducted, greatly underestimated potential public exposure to airborne PCDDs and PCDFs.

According to the 1991 trial burn report, feedrates of wastes to the kiln during Test 3 were those presented below in Table 7.

Table 7

1991 Trial Burn: Test 3 Waste Feedrates

	Pounds per Hour	Grams per Hour
"Organic Waste"	182.6	82,810
"Solid Waste"	1,615	687,000

Based on the concentrations of 2,3,7,8-TCDD and of total PCDDs and PCDFs, expressed as dioxin-equivalents, in these wastes, the input to the incinerator of total PCDDs and PCDFs, expressed in dioxin-equivalents (TEQs), and of 2,3,7,8-TCDD, is shown in Table 8.

Table 8

1991 Trial Burn: Test 3 Feedrates of Total PCDD/PCDFs and 2,3,7,8-TCDD

	PCDD/PCDFs, as TEQs, ng/hr	2,3,7,8-TCDD, ng/hr
Organic Waste	15,600,000	298,100
Solid Waste	96,700,000	8,657,000
Total	112,300,000	8,955,000

These feedrates to the incinerator of 2,3,7,8-TCDD and total PCDDs/PCDFs are well above the minimum feedrates required to prove a DRE of 99.9999 percent at the stated total waste feed rates and the limits of detection during stack gas sampling and analysis. Following calculations presented by Freestone, the minimum feedrate required to demonstrate a DRE of 99.9999 percent for 2,3,7,8-TCDD under conditions similar to those of Test 3 is 25,440 nanograms per hour. (Freestone, 1984)

As discussed earlier, PCDDs and PCDFs, expressed as TEQs, were emitted in stack gases at the rate of 1,070 nanograms per minute, or 64,200 nanograms per hour, as detailed in Table 9.

Table 9

1991 Trial Burn:
Test 3, Emissions Rates of PCDDs and PCDFs and 2,3,7,8-TCDD in Stack Gases

	ng/hr	% of Total TEQs
2,3,7,8-TCDD	3,200	5.0
PCDDs	14,630	22.7
PCDFs	49,780	77.3
Total	64,410	

Again, it is important to note the relatively small contribution to the total dioxin-equivalents that is made by 2,3,7,8-TCDD. Samples taken at those air monitoring stations

which were sited to determine "potential stack dioxin emissions" (CH2M Hill, 1989) were, like those sited to determine passive dioxin drift, analyzed only for tetrachlorinated dioxins (URS, 1991). If these same relative ratios of PCDDs and PCDFs were operative during the air monitoring program, the ambient air concentrations of dioxin-equivalents were at least five times higher than the levels of tetrachlorinated dioxins reported.

Based on the feedrate and emission rate of PCDDs and PCDFs, expressed in dioxin-equivalents, the DRE for these chemicals can be calculated as shown in Table 10.

Table 10

1991 Trial Burn: Test 3,
DRE of Total PCDDs/PCDFs

DRE = (Input - Output)/Input

DRE = (112,300,000 - 64,410)/112,300,000

DRE = 99.94 percent for total PCDDs and PCDFs

Following this same format, the DRE for 2,3,7,8-TCDD can be calculated from its feedrate during Test 3 of 8,955,000 ng/hr and its emission rate of 3,200 ng/hr, as shown in Table 11.

Table 11

1991 Trial Burn: Test 3,
DRE of 2,3,7,8-TCDD

DRE = (Input - Output)/Input

DRE = (8,955,000 - 3,200)/8,955,000

DRE = 99.96 percent for 2,3,7,8-TCDD

The determination of the DRE achieved using hexachlorobenzene was based on the easily contradicted supposition that this chemical is not formed as a product of incomplete combustion during the burning of the 2,4-D waste. Likewise, these determinations of the DREs achieved with total PCDD/PCDFs and with 2,3,7,8-TCDD are based on the equally ill-

founded premise that these chemicals are not formed as products of incomplete combustion. In any event, the data gathered during Test 3 of the 1991 trial burn by Vertac Site Contractors clearly shows that the DRE with 2,3,7,8-TCDD was 99.96 percent, not the required 99.9999 percent.

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