001434

MEMORANDUM

SUBJECT: Summary of Results from Base Catalyzed Decomposition Technology SITE Demonstration at Koppers Wood Preserving Facility in Morrisville, NC

FROM: Terrence M. Lyons
START Team Leader
Regional Support Section

TO: Beverly Hudson
Regional Project Manager
Region 4

This preliminary data summary report provides information on the performance of the Base Catalyzed Decomposition (BCD) Technology evaluated under the Superfund Innovative Technology Evaluation (SITE) program in September 1993 on the subject site.

The BCD process is a chemical and physical process that decomposes chlorinated organic compounds by removing the chlorine atoms from the atomic structure in each such compound. The BCD process was developed by EPA's Risk Reduction Engineering Laboratory (RREL). The demonstration was performed by ETG Environmental, Inc. (ETG).

The BCD process as demonstrated by ETG consists of modified soil thermal desorption treatment (some BCD reagent is introduced with the soil prior to thermal desorption) which desorbs the contaminants in the soil into an oil phase with a hot oil vapor recovery system (VRS). The resultant contaminated oil is then treated in a BCD reactor. Approximately 15 tons of soil were treated during the technology demonstration. A total of seven soil test runs were conducted during the thermal desorption phase of the demonstration and three contaminated oil test runs were processed in the BCD reactor.

The first three soil tests runs were conducted for the purpose of setting process parameters (test runs 1,2, and 3). During the remaining four test runs the retention time was approximately one hour at an operating temperature of 800°F. Two BCD oil reactor runs were successfully completed for the demonstration. Approximately 40 gallons of VRS scrubber oil were treated during each test run. The BCD reactor was heated to 650°F for six hours, cooled overnight and sampled.

MODIFIED THERMAL DESORPTION SOIL RESULTS

Analytical results for the thermal desorption phase of the soil treatment for PCP in untreated (input) and treated (output) soil samples collected for test runs 4, 5, 6, and 7 show PCP contaminant removal efficiencies (CREs) were 99.99% or better for each test run. Treated soil met the target cleanup objective of 95 parts per million (ppm) for all test runs. Analytical results of the output soil samples for all dioxin (PCDD) and Furan (PCDF) compounds from the thermal desorption unit indicate that the concentrations of these compounds were at or near the detection limit (1 ug/kg) for all test runs. However, since input soil concentrations for

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2,3,7,8 TCDD and TCDF were also at or near detection limits, it cannot be determined conclusively that the process effectively reduced the concentrations of these compounds.

BCD REACTOR OIL RESULTS

BCD reactor phase analytical results revealed PCP concentrations in the untreated (input) oil samples ranged from 170,000 to 180,000 ug/kg in the first untreated oil sample and 1,300,000 to 1,700,000 in the second untreated oil sample. Output treated oil concentrations ranged from non-detect to 15,000 ug/kg for a CRE of 96.92% in the first treated oil run, and 3,300 to 3,400 ug/kg for a CRE of 99.96% in the second treated oil run.

BCD reactor phase analytical results for all PCDD/PCDF compounds in the first oil sample test run resulted in a range of CREs of 99.84% to greater than or equal to 99.99%. The second oil sample test run CREs ranged from 99.98 to greater than or equal to 99.99%.

The concentration of PCP and PCDD/PCDF materials in the treated oil indicates that the treated oil can be reused and may not have to be subjected to RCRA dioxin disposal regulations.

AIR TREATMENT SYSTEM

The results from the semi volatile organic compound (SVOC) analysis (specifically PCP) of the off-gas from test runs 1,2,4,5,6, and 7 of the soil reactor showed an inlet (prior to activated carbon filtration) concentration range of <27 to 6974 ug/dscm and an outlet (after activated carbon filtration) concentration range of 1.2 to 41.7 ug/dscm.

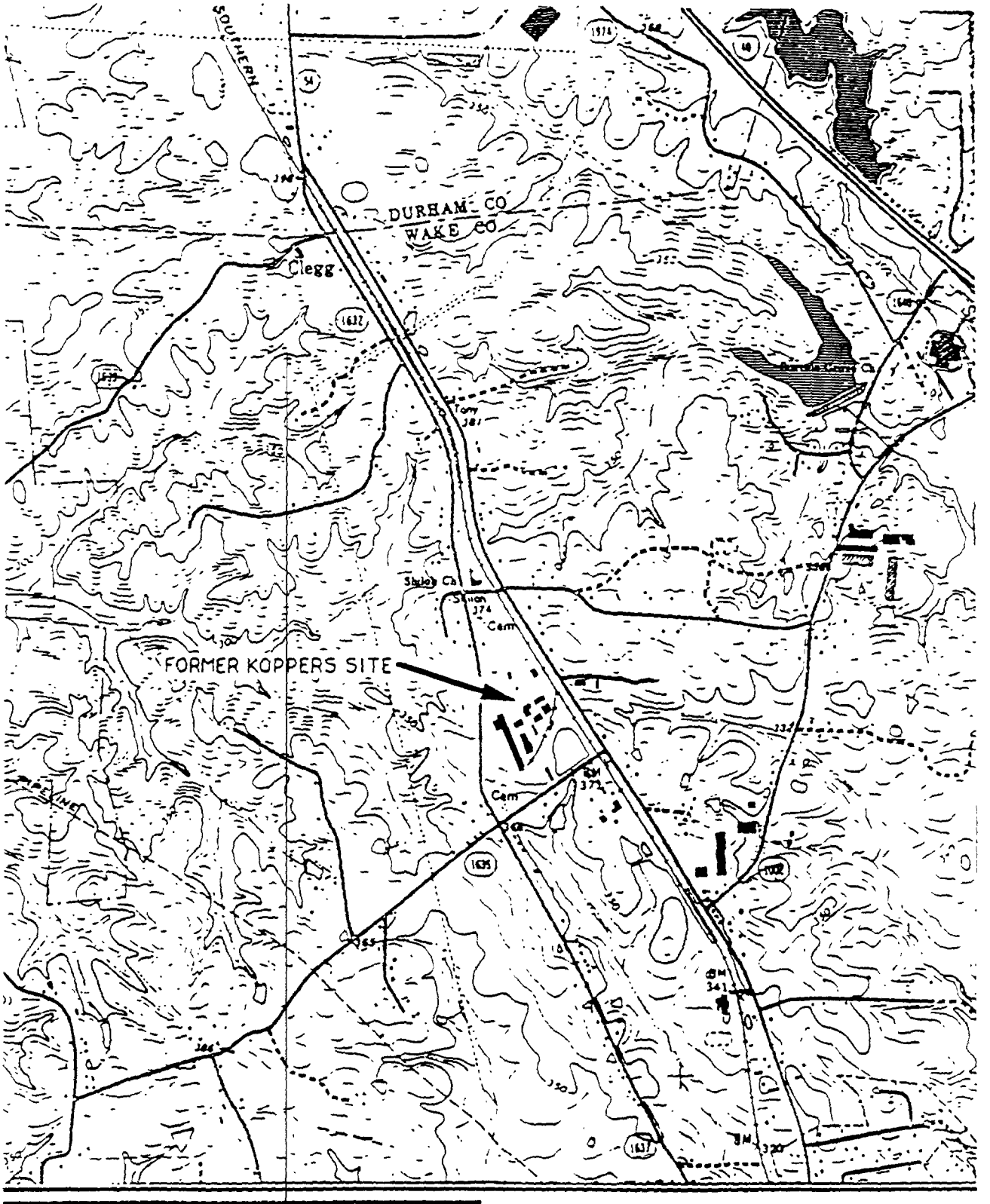
The results from the analysis of the off-gases from the soil reactor and air treatment system for all PCDD and PCDF compounds for test runs 1,2,4,5,6, and 7 show variations in the effectiveness of the configuration of the air treatment system. TCDD analysis revealed in inlet concentration ranges of 14.9 to 264 ng/dscm with outlet concentration ranges of 3.23 to 447 ng/dscm. NOT TOTAL EQVS

Since stack emissions were an issue of consideration, they were subjected to dispersion modeling (specifically the Industrial Source Complex Dispersion Model (ISCM)) to determine maximum ground level impact. The model predicted that the TCDD was the only emission of concern and its maximum annual concentration would be 4.5×10^{-10} mg/m^3 at the point of maximum impact. For the six days of testing, this figure was well within the established North Carolina Toxic Air Pollutant Guidelines of 3.0×10^{-9} mg/m^3. Further, the point of maximum concentration was found to be 40 meters from the stack, well within the facility boundary.

While emissions from the test were found to be within State Guidelines, the emissions were determined to be the result of an inadequate implementation of the air pollution control system, resulting in poor performance of the activated carbon filtration system. Utilization of a BCD system for actual site remediation will require redesign with utilization of a system which protects the carbon filters from moisture. Treatability testing should be conducted with the redesigned system to ensure proper performance.

KOPPERS BCD DEMONSTRATION
PRELIMINARY PLANNING

- Initial Site Visit - RPM and PRP implore START to find innovative technology other than incineration (3/16/91)
- PRP decides to excavate and off-site incinerate contaminated soil
- Citizens Group reject ROD and request EPA evaluate other technologies (1/4/93)
- Region request START reopen prior innovative technology investigations (1/4/93)
- Koppers BCD accepted into SITE program (1/22)
- RREL and Region 4 notify State of N. Carolina of demonstration and desire for close participation and coordination (6/21)



Reference:

U.S.G.S. 7.5 Minute Topographic Map
Cary, North Carolina, 1973 Photo Revised 1987

Scale 1" = 2000'

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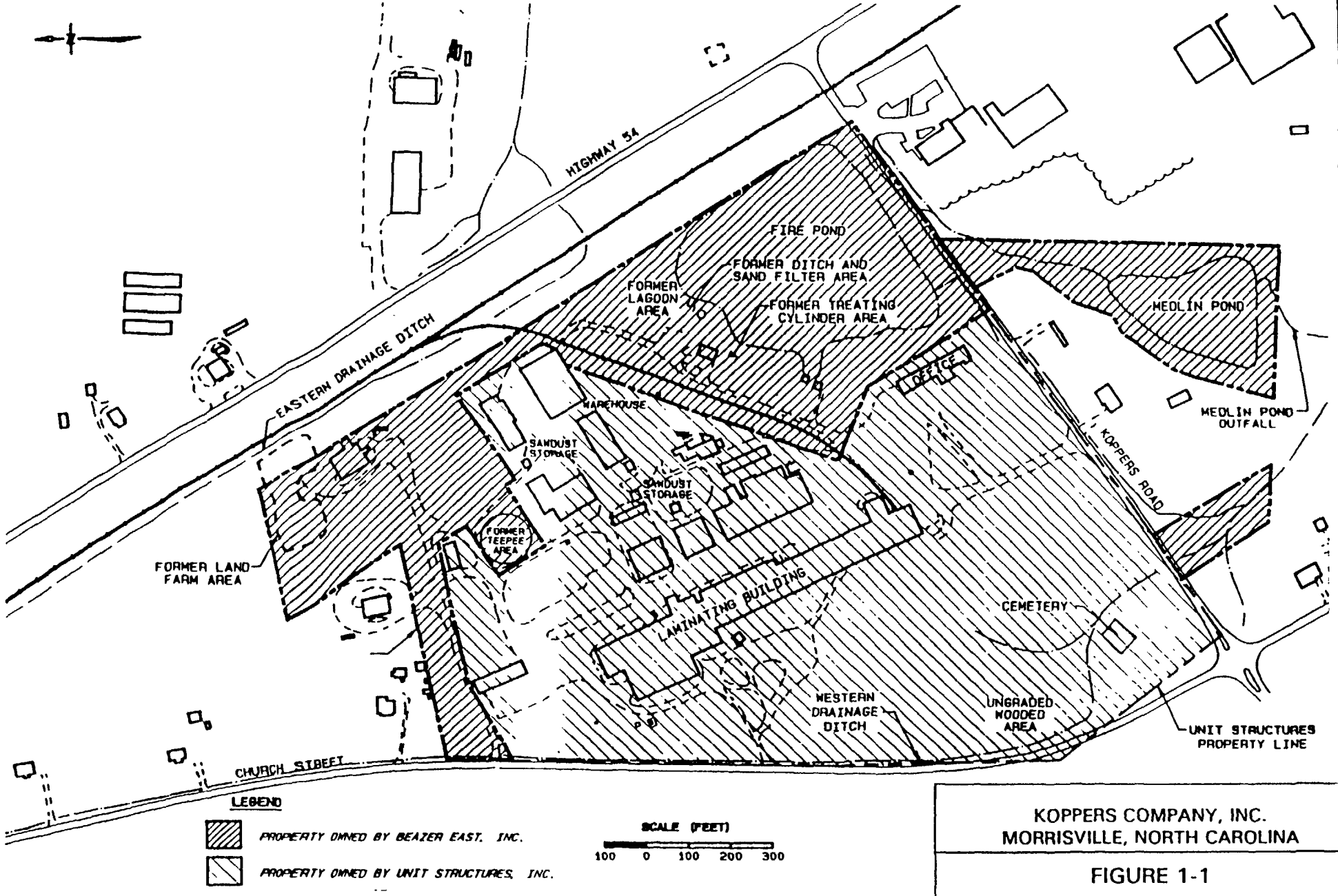
KOPPERS COMPANY, INC.
MORRISVILLE, NORTH CAROLINA

FIGURE 1-1
SITE LOCATION MAP

PMC ENVIRONMENTAL MANAGEMENT, INC



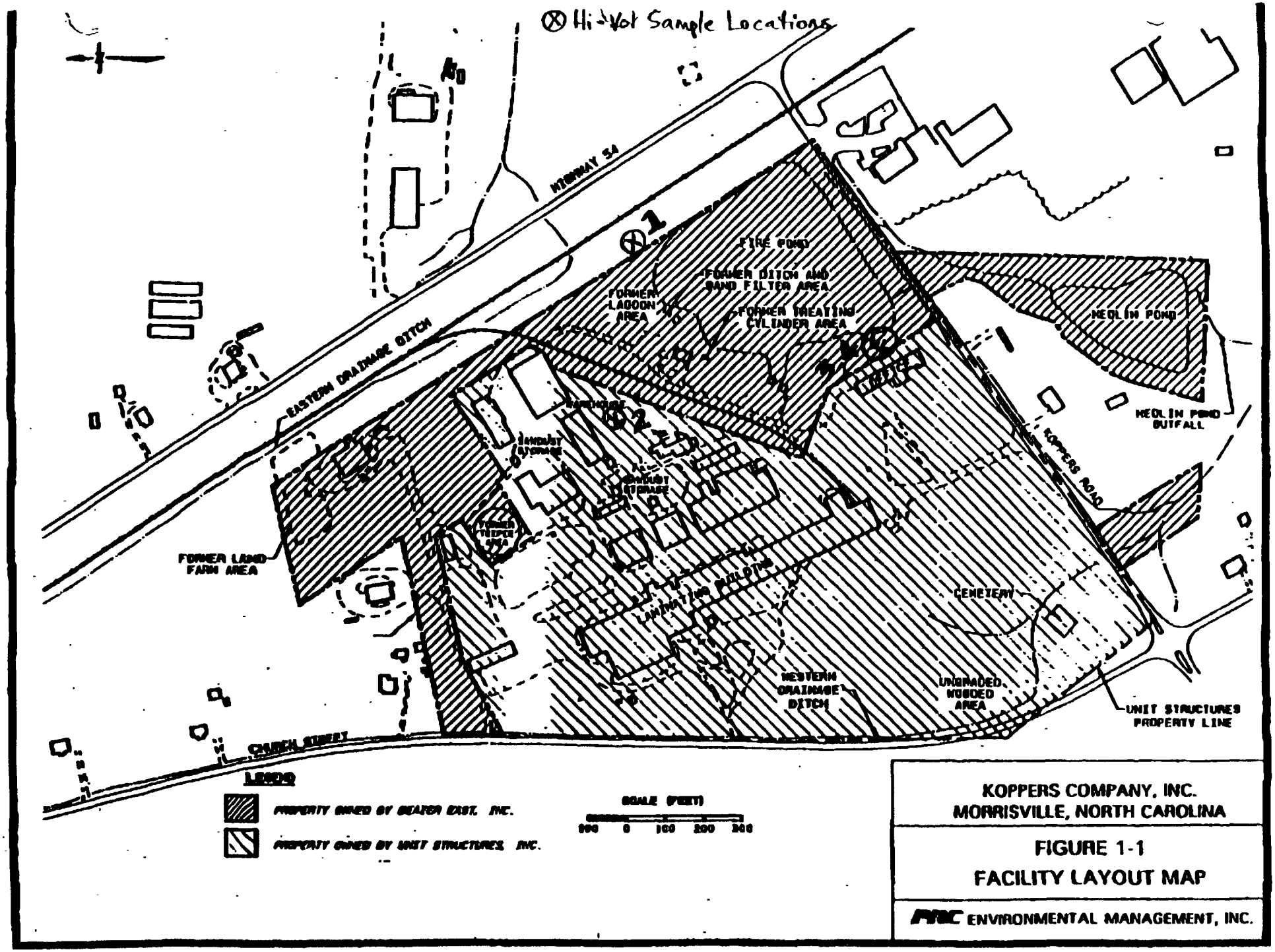
KOPPERS COMPANY, INC.
MORRISVILLE, NORTH CAROLINA

FIGURE 1-1
FACILITY LAYOUT MAP

PRC ENVIRONMENTAL MANAGEMENT, INC.

KOPPERS BCD DEMONSTRATION
NEGOTIATIONS

- USI recinds prior verbal access agreement and prevents ADA trailers from entering site (7/28)
- Agreement secured with help from region 4 GC.
  ADA equipment enters site (8/3)
  ETG mobilizes to site (8/9)
- Beazer recinds their agreement and requires EPA indemnification for waste generated, and community and visitor liability (8/5)
- Agreement reached with help of HQ OGC
  No indemnification, visitors will be kept off of Beazer property USI allows visitors bused to their property (8/20)
- N. Carolina DEHNR expresses reservation about level of air sampling (8/13)
- DEHNR verbally changes some of the initial requirements and adds additional requirements, which we scramble to meet (8/26)



NOV 23 '94 01:07PM PRC EMI ATLANTA P.2/2

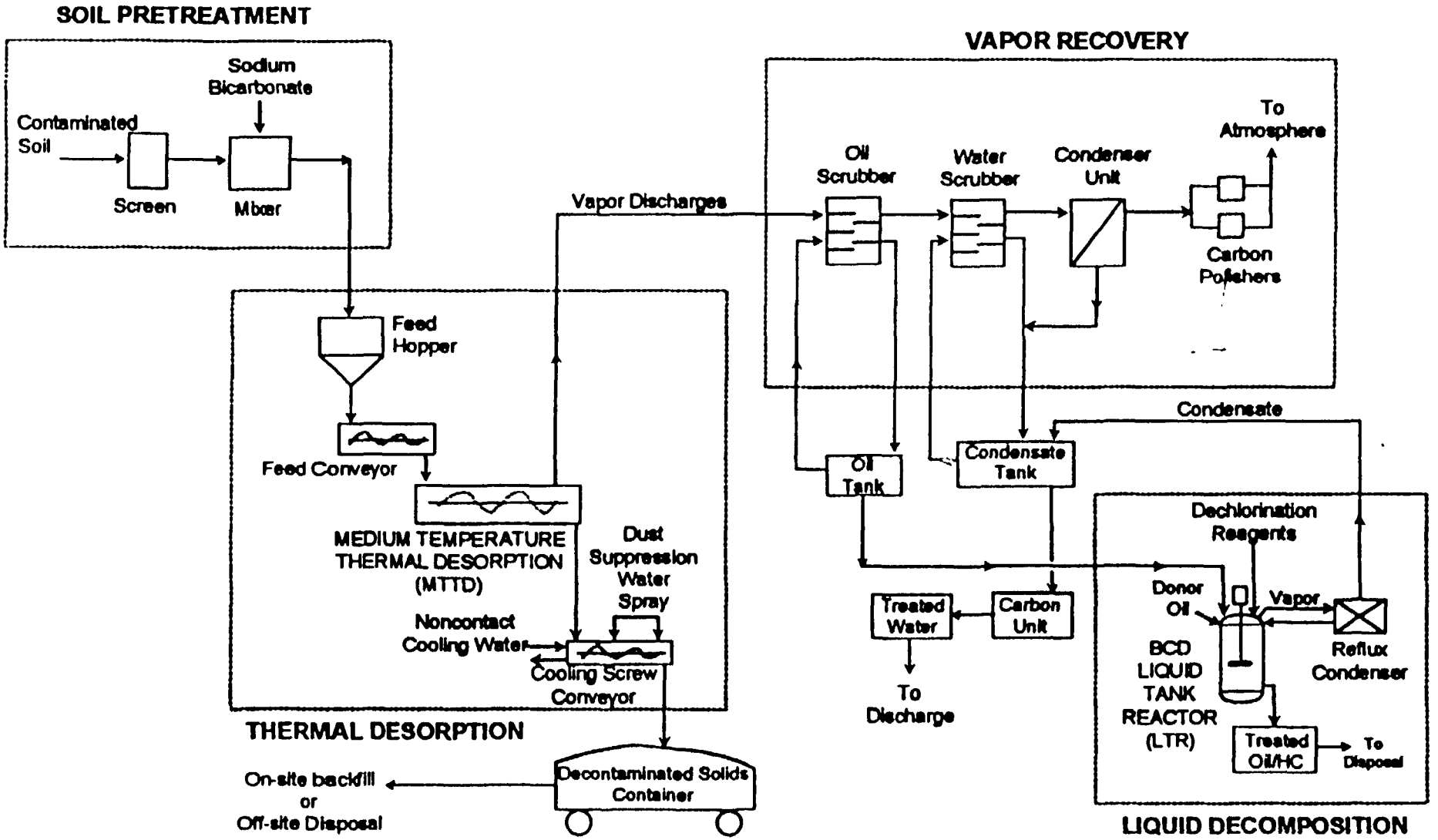


Figure 1: The BCD Process and SAREX® THERM-O-DETOX® System as demonstrated

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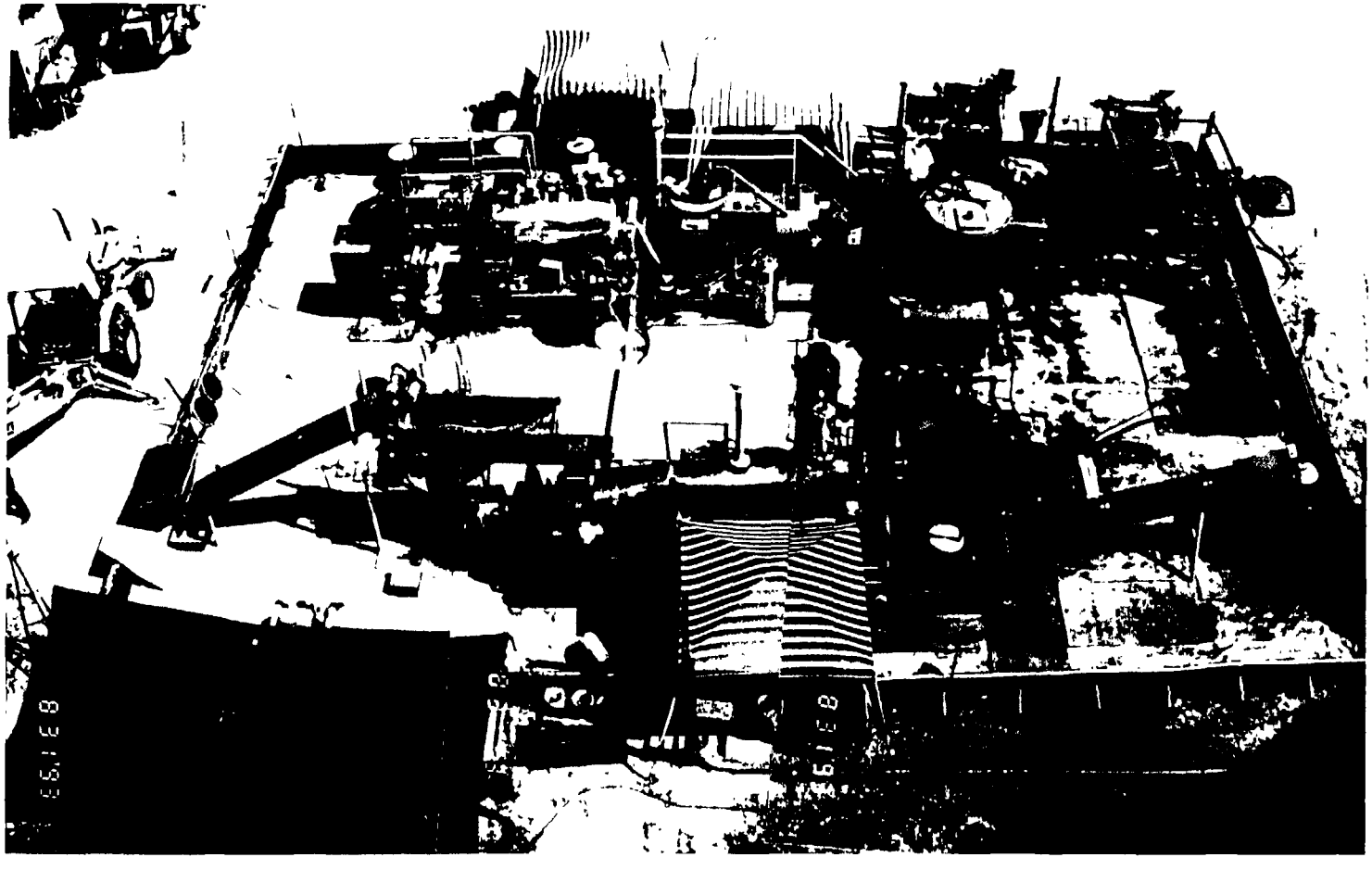

KOPPERS BCD DEMONSTRATION

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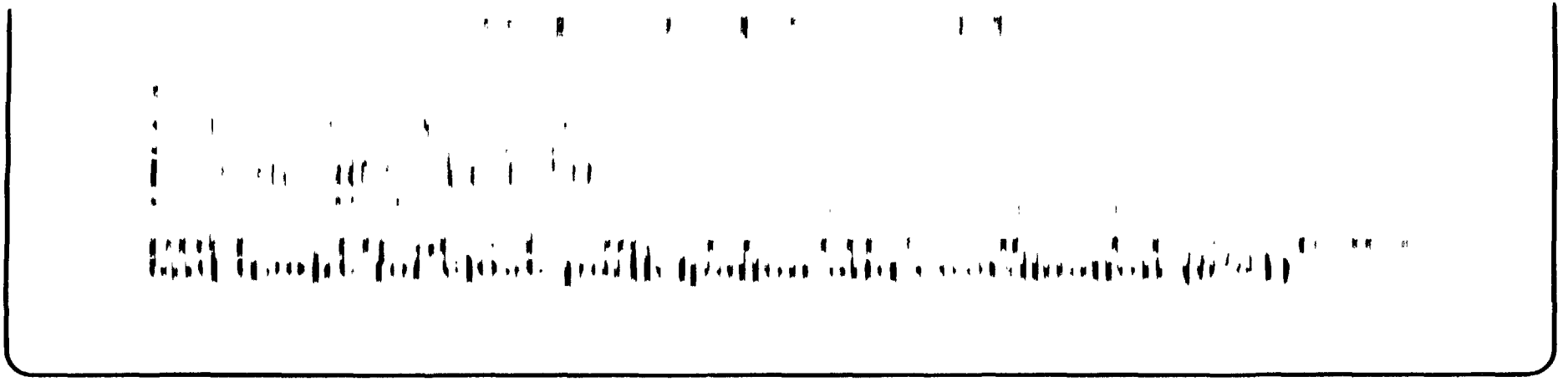

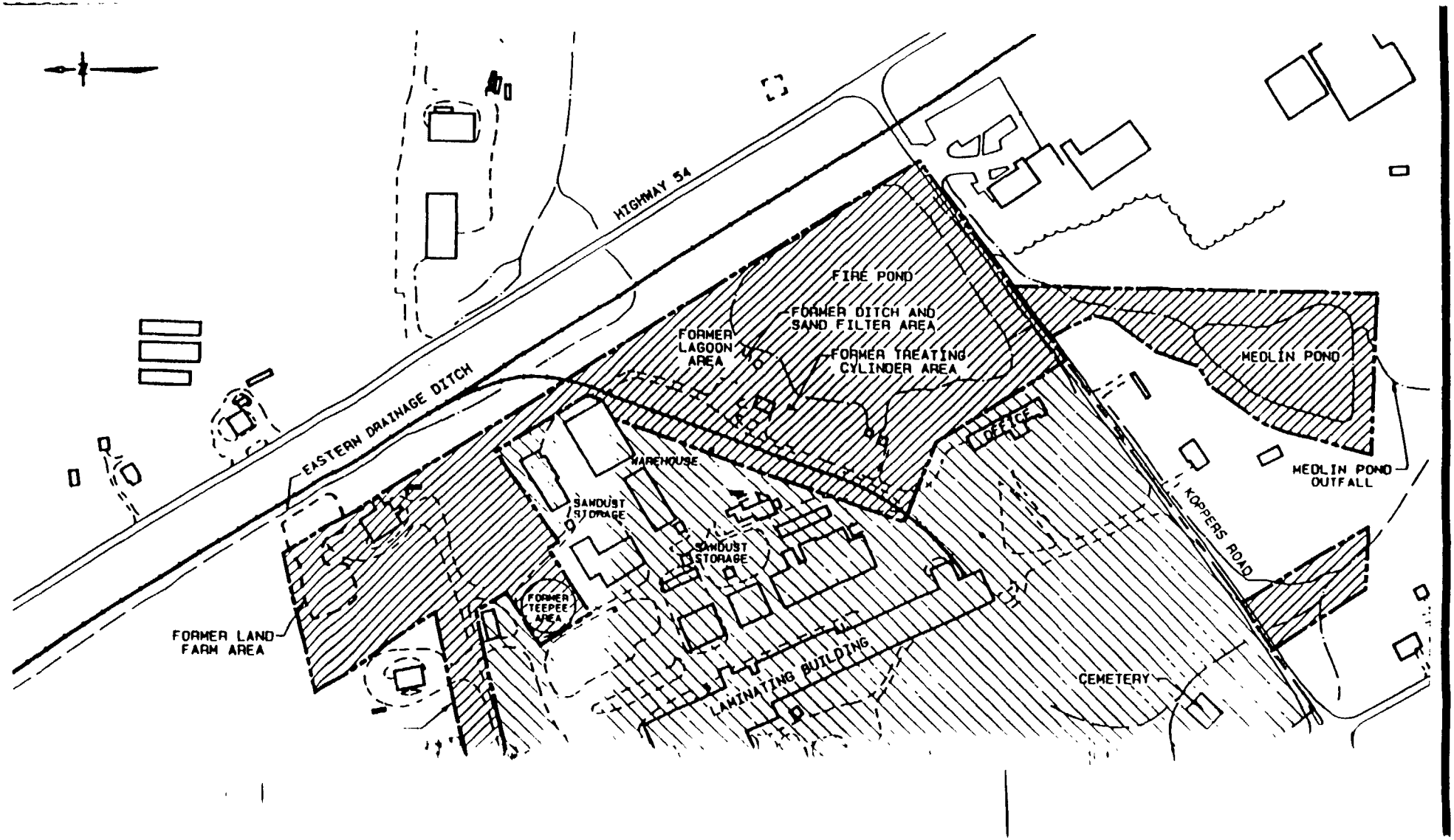
HIGHWAY 54
EASTERN DRAINAGE DITCH
FIRE POND
FORMER DITCH AND SAND FILTER AREA
FORMER LAGOON AREA
FORMER TREATING CYLINDER AREA
MEDLIN POND
MEDLIN POND OUTFALL
OFFICE
WAREHOUSE
SAWDUST STORAGE
SAWDUST STORAGE
KOPPERS ROAD
FORMER TEEPEE AREA
FORMER LAND FARM AREA
LAMINATING BUILDING
CEMETERY

KOPPERS BCD DEMONSTRATION
NEGOTIATIONS

- USI recinds prior verbal access agreement and prevents ADA trailers from entering site (7/28)
- Agreement secured with help from region 4 GC.
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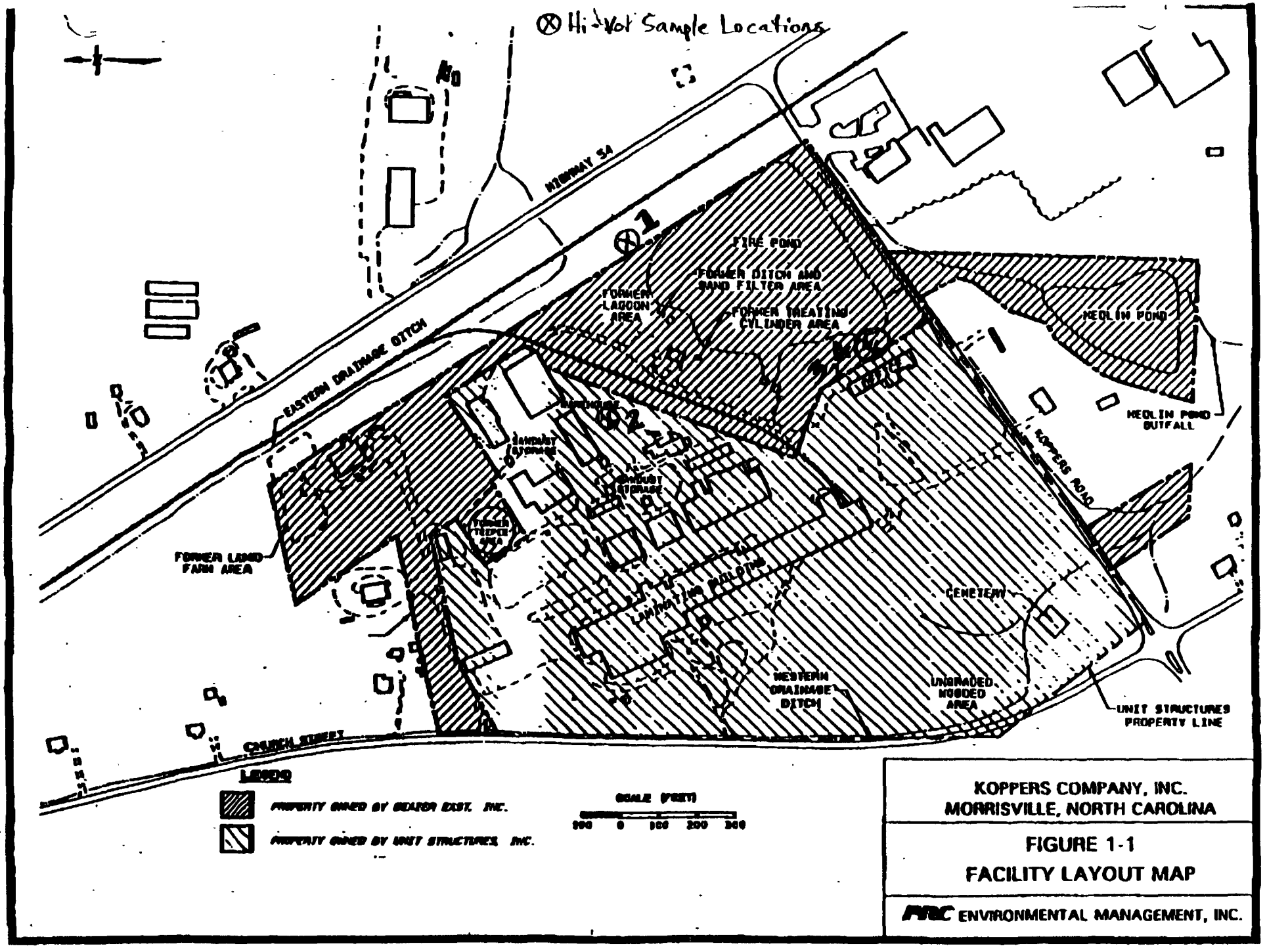

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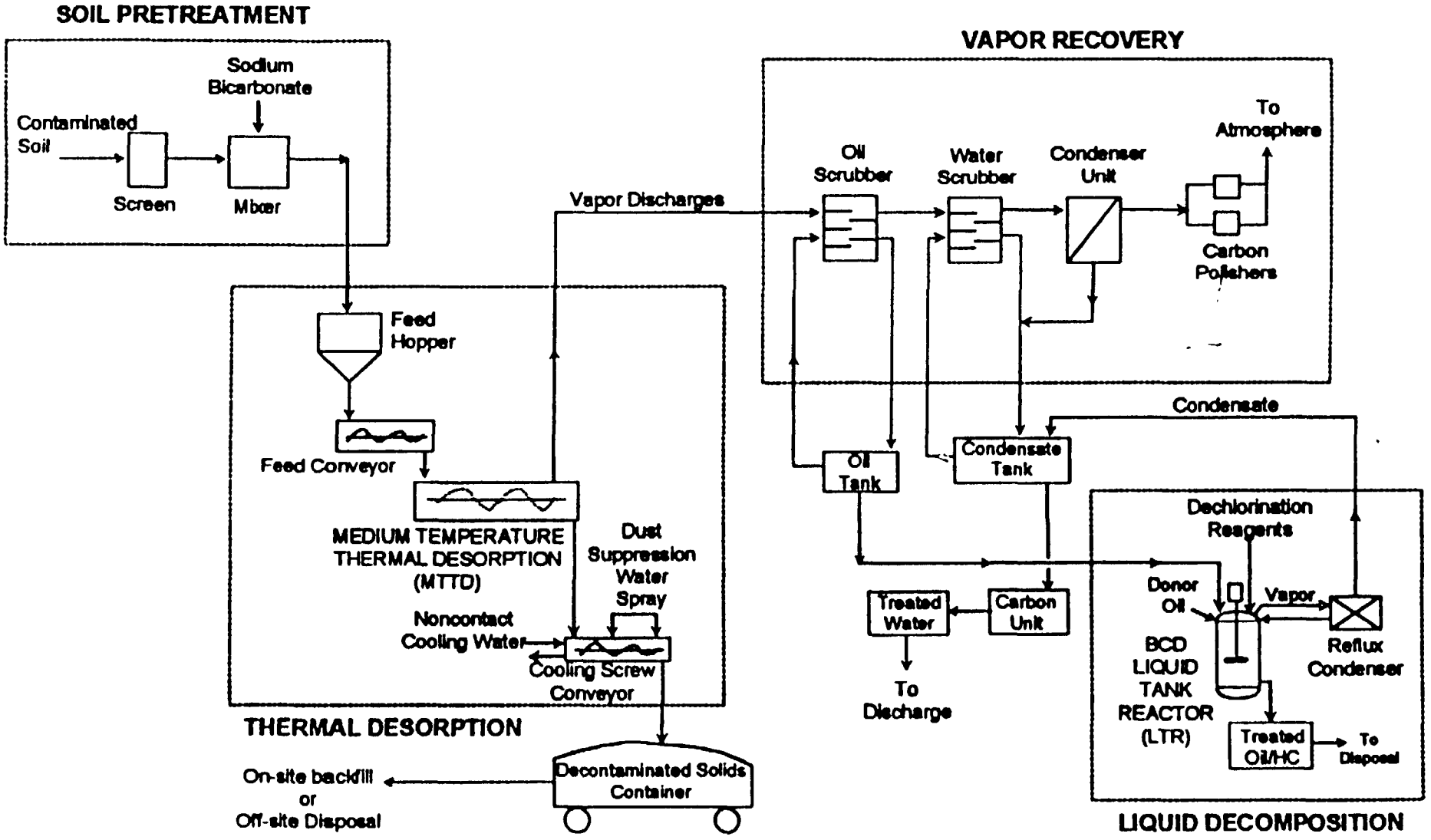

Figure 1: The BCD Process and SAREX® THERM-O-DETOX® System as demonstrated

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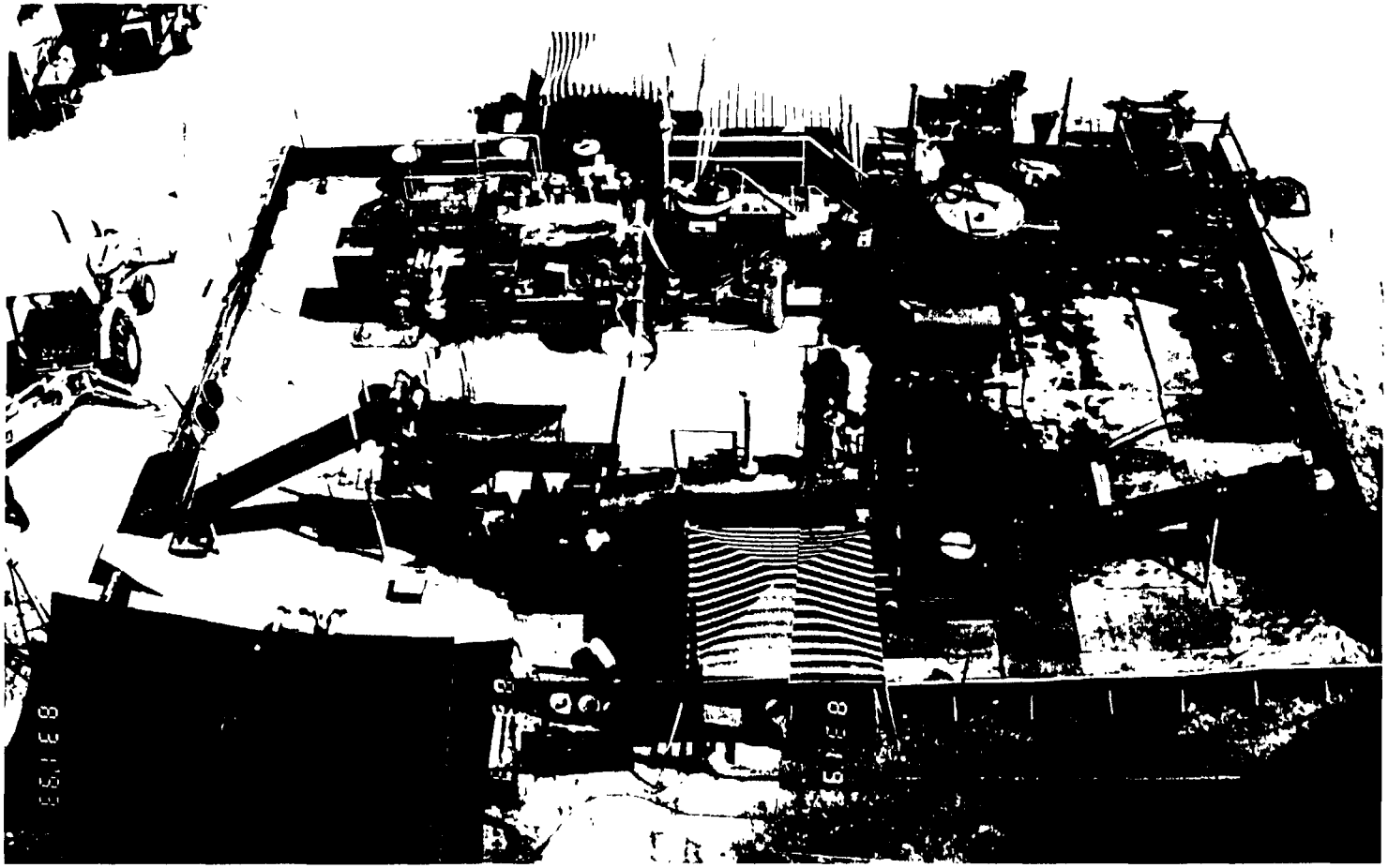

BCD Test Parameters
Solid Reactor

Runs	Temp °F	Reagent	Retention
1	800	Bicarb (5%)	30 min
2	800	Non-Bicarb	30 min
3	650	Bicarb (5%)	30 min
4	650	Non-Bicarb	30 min
5	800	?	30 min
6	800	?	30 min

BCD Test Parameters
Liquid Reactor

Caustic Powder Reagent	2 grams/gram PCP
Organic Catalyst Reagent (powder)	0.1% of waste oil volume
High Boil Point Oil	10-15% of waste oil volume
Waste Oil	Sunpar LW110
LTR Residence Time	4 to 6 hours
LTR Temperature	600 to 650 °F

KOPPERS BCD DEMONSTRATION
EXECUTION

- Excavation, homogenization, sampling and analysis, 10% bicarb addition, drumming and weighing of contaminated soils (8/27)
- First and second thermal desorption runs with 2 cu yds per run with bicarbonated soils at 800 F (8/28 and 8/29)
- Third thermal desorption run at 650 F cancelled when vendor increases temperature to 800 F during run. Decide to increase retention time and maintain 800 F throughout demonstration (8/30)
- Fourth thermal desorption run initiated. After that 70 of 110 gal contaminated scrubber oil pumped into BCD reactor for first BCD run. Reactor heated to 650 F for three hours (8/31)
- Seventh thermal desorption run initiated with non-bicarb soil Second BCD reactor run begins with 70 gal scrubber oil (9/3)

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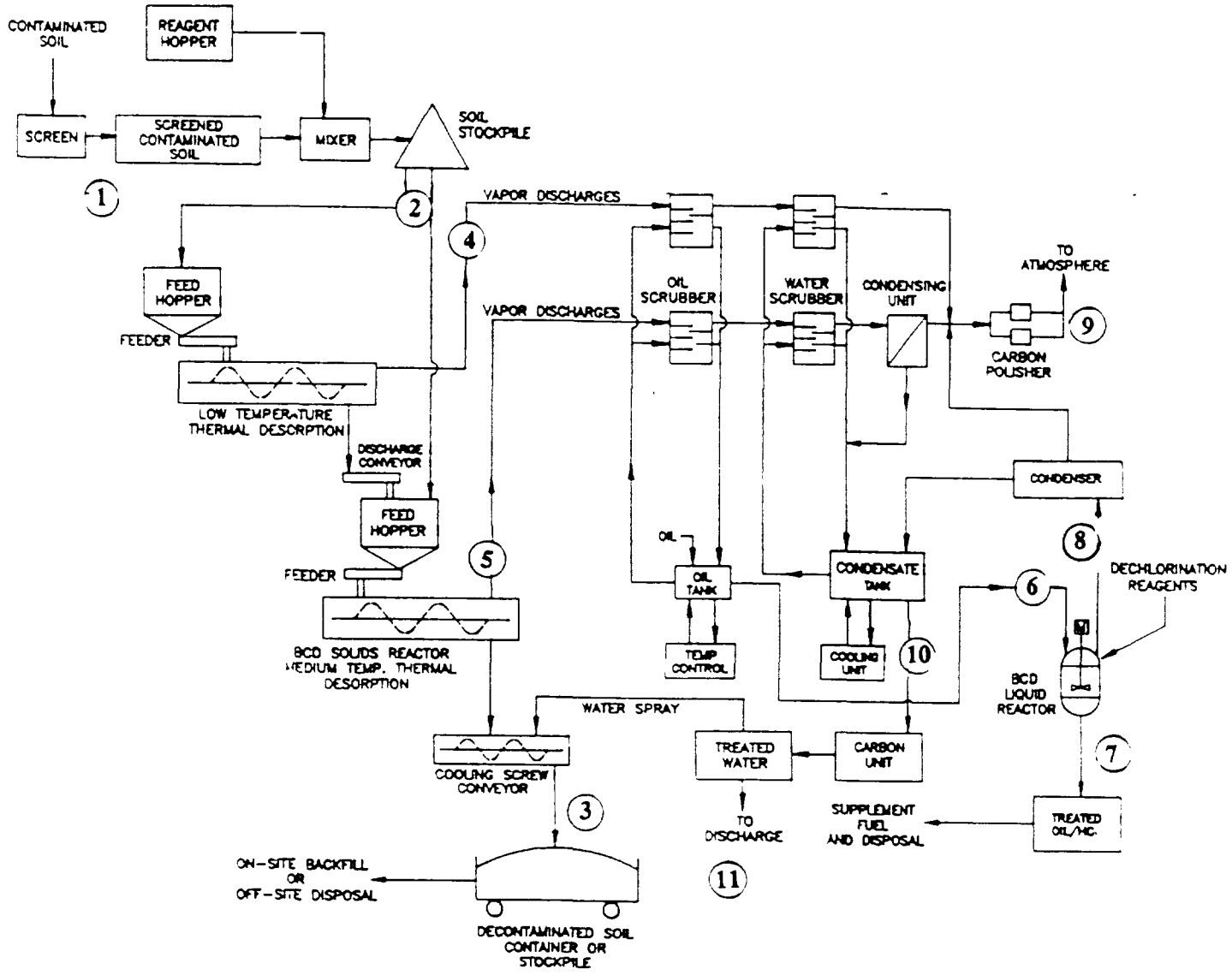

LEGEND

6 - Sample Location Number

KOPPERS COMPANY, INC.
MORRISVILLE, NORTH CAROLINA

FIGURE 4-1
BCD PROCESS FLOW DIAGRAM
SAMPLE LOCATIONS

EMC ENVIRONMENTAL MANAGEMENT, INC

KOPPERS BCD DEMONSTRATION

DECONTAMINATION

- During decontamination and demobilization of equipment 3 inches of rainfall fill 70 'x 40' pad with PCP and dioxin contaminated decon water overnight (9/8)
- Notified DEHNR of initiative to carbon filter contaminated water and release on site. State requires meeting 1.0 ppq level for dioxins (9/20)
- Meet State's requirement and discharge 6,000 gallons of treated water to fire pond saving approximately $250,000 (10/1)

C01454

KOPPERS BCD DEMONSTRATION

OIL SAMPLE CLEANUP

- Lab audits of Versar labs identifies potential matrix interference in some of the initial PCP in oil samples. Request investigation and recommendation for most appropriate clean-up method (9/17/93)

- Received draft data for dioxins and semi-volatiles. Detection limits for PCP 1,200 ppm (10/24)

- Results from acid-base/GPC clean-up bring detection limit down to 0.5 ppm for PCP in oil samples. Show BCD provide 99.99% reduction in oil (11/17/94)

KOPPERS BCD DEMONSTRATION
DIOXIN

- Receive letter from Fred Striley of Times Beach Citizen's Group requesting information on BCD demonstration and prepare response (4/14)
- T. Lyons and C. Brunner brief Region 7 Administrator on BCD demo (5/10)
- Receive Hi Vol sampler results from BCD demo which show trace of dioxin in one down wind sampler (5/12)
- Initiate investigation of Air Modeling of dioxin emissions from air treatment system (6/20)

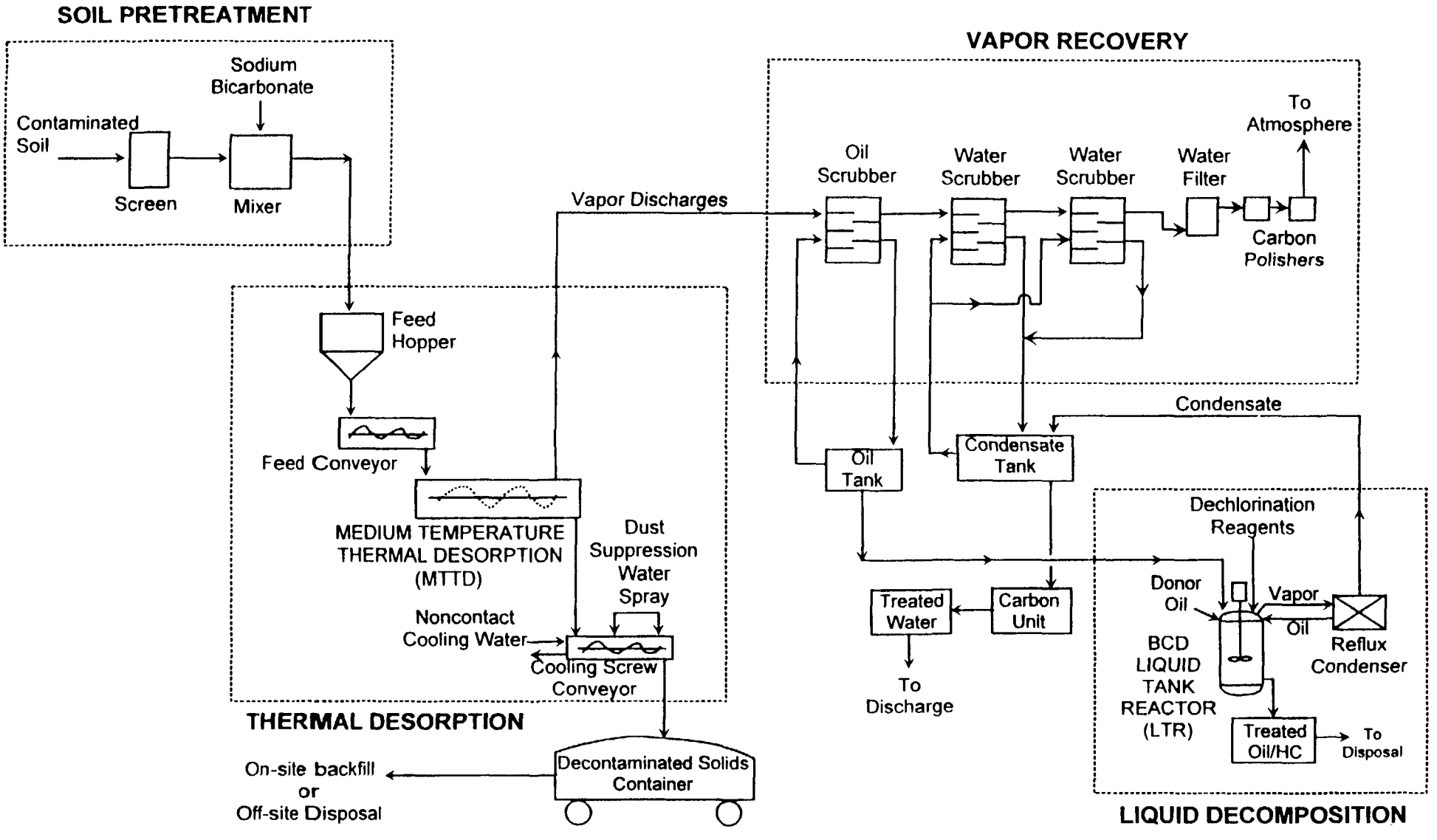

Figure 1: *The BCD Process and SAREX® THERM-O-DETOX® System as demonstrated*

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KOPPERS BCD DEMONSTRATION

DIOXIN (CONT)

- Results of SCREEN2 Air Model show a predicted concentration of 60% of N. Carolina's DEHNR Toxic Air Pollutant Guidelines for only 2, 3, 7, 8, TCDD
- Notify N Carolina DEHNR. DEHNR concurs with results of SCREEN2 model (10/13)
- RREL proceeds with the full scale Industrial Source Complex Model and request if DEHR has any additional modeling requirements. They have none and await results (10/19)
- Results of ISCMST shows a 15% level of State's annual emmission rate (11/18)

C01150

Table 2-1

Summary of Analysis Results for Semivolatile Organic Compounds in Soil Reactor Off-Gas (µg/dscm)

Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93		Run 6 9-02-93		Run 7 9-03-93		Field Blanks 9-03-93		
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Inlet Dup	Outlet
1,2-Dichlorobenzene	173	<0.2	247	<0.2	112	<0.2	203	<0.2	253	<0.2	300	<0.2	<0.2	<0.2	<0.2
1,2,4-Trichlorobenzene	77.2	<0.2	165	<0.2	40.7	<0.2	46.6	<0.2	64	<0.2	109	<0.2	<0.2	<0.2	<0.2
1,3-Dichlorobenzene	245	<0.2	542	<0.2	118	<0.2	225	<0.2	277	<0.2	416	<0.2	<0.2	<0.2	<0.2
1,4-Dichlorobenzene	44	<0.2	82.6	<0.2	21.8	<0.2	47.4	<0.2	66.7	<0.2	83.1	<0.2	<0.2	<0.2	<0.2
2-Methylnaphthalene	197	<0.1	143	<0.1	166	<0.1	240	<0.1	231	<0.1	611	<0.1	<0.1	<0.1	<0.1
2-Methylphenol	25.7	<0.1	30.2	<0.01	<9.2	<0.1	<4.3	<0.1	<8.6	<0.1	<7.5	<0.1	<0.1	<0.1	<0.1
2,4-Dichlorophenol	<3.7	<0.2	233	<0.2	<17	<0.2	<18	<0.2	<16	<0.2	<14	<0.2	<0.2	<0.2	<0.2
2,4,5-Trichlorophenol	<3.3	<0.2	59.9	<0.2	<15	<0.2	<7.1	<0.2	<15	<0.2	<13	<0.1	<0.2	<0.2	<0.2
2,4,6-Trichlorophenol	<3.3	<0.2	95.8	<0.2	<15	<0.2	<7	<0.2	<15	<0.2	<13	<0.1	<0.2	<0.2	<0.2
4-Methylphenol	32.9F	<0.2	33.5F	<0.1	<14	<0.2	<6.4	<0.1	<13	<0.1	<12	<0.1	<0.1	<0.1	<0.1
Acenaphthene	<1.8	<0.1	9.5	<0.1	<8.1	<0.1	3.8	<0.1	<7.6	<0.1	18.8	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	98.3	<0.1	45.8	<0.1	<12	<0.1	8.3	<0.1	<12	<0.1	20.5	<0.1	<0.1	<0.1	<0.1
Anthracene	4.0	<0.1	4.5	<0.1	<11	<0.1	<5.1	<0.1	<11	<0.1	20.3	<0.1	<0.1	<0.1	<0.1
Benzoic acid	19.1J	<13	<231	2J	<1145	0.4J	<540	0.5J	<1100	0.6	<940	1.3	<12	<12	<12
Benzo(b)fluoranthene	<5.9	0.5F	<5.4	<0.3	<27	<2.3	<13	1.2F	<26	1.4	<22	<0.3	<0.3	<0.3	<0.3
Benzo(k)fluoranthene	<6.5	0.5F	<6	<0.3	<30	<0.3	<14	1.2F	<28	1.4	<25	<0.3	<0.3	<0.3	<0.3
Benzyl alcohol	18.5	<0.2	<3.7	<0.2	<18	<0.2	<8.5	<0.2	<17	<0.2	<15	<0.2	<0.2	<0.2	<0.2
Benz(a)anthracene	<2.9	1.0	2J	<0.1	<13	<0.1	<6.2	0.9	<13	0.8	<12	1.9	<0.1	<0.1	<0.1
Benz(a)pyrene	<3.4	0.1J	<3.1	<0.2	<16	<0.2	<7.2	0.2	<15	0.1	<13	<0.1	<0.2	<0.2	<0.2
bis(2-Ethylhexyl)phthalate	6.0	4.6	24.6	<0.2	<18	51.4E	7.5J	22.8	<17	63.6	<14	23.7	1.02	1.03	<0.2

Table 2-1

(Continued)

Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93		Run 6 9-02-93		Run 7 9-03-93		Field Blanks 9-03-93		
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Inlet Dup	Outlet
Butylbenzylphthalate	5.8	3.3	25.2	<0.2	<19	0.7	8J	3.7	<18	2.0	<16	<0.2	<0.2	<0.2	<0.2
Chrysene	<3.5	1.1	40.2	<0.2	<16	<0.2	<7.4	1.9	<15	1.2	<13	2.4	<0.2	<0.2	<0.2
Dibenzofuran	26.4	<0.2	38.9	<0.2	<16	<0.2	7.8	<0.2	12.6J	<0.2	30.7	<0.1	<0.2	<0.2	<0.2
Diethylphthalate	23.8	3.3	<3.1	<0.2	<16	0.3	<7.2	0.1J	<15	0.2	<32	<0.1	0.207	0.212	<0.2
Dimethylphathalate	<2.2	<0.1	1.6J	<0.1	<10	<0.1	<4.4	<0.1	<9.3	<0.1	<8.1	<0.1	<0.1	<0.1	<0.1
Di-n-butylphthalate	4.8	0.6	13.7	<0.1	<10	0.3	<4.5	0.2	<9	0.3	<7.8	<0.1	<0.1	<0.1	<0.1
Di-n-octylphthalate	<2.3	<0.1	<2.1	<0.1	<11	<0.1	<4.9	0.1	<9.8	<0.1	<8.5	<0.1	<0.1	<0.1	<0.1
Fluoranthene	7.8	0.7	51.0	<0.1	<14	<0.1	6.1J	16.1	9.5	0.3	24.1	2.2	<0.1	<0.1	<0.1
Fluorene	11.3	<0.01	34.2	<0.1	<12	<0.1	<5.3	<0.1	<11	<0.1	15.0	<0.1	<0.1	<0.1	<0.1
Hexachlorobenzene	<2	<0.1	48.6	<0.1	<9.3	<0.1	<4.4	<0.1	<8.7	<0.1	<7.6	<0.1	<0.1	<0.1	<0.1
Isophorone	17.4	<0.2	<3.7	<0.2	<19	<0.2	<8.6	<0.2	<18	<0.1	<15	<0.1	<0.2	<0.2	<0.2
Naphthalene	967	<0.2	748	0.1J	629	0.1J	730	<0.1	843	<0.1	2826	<0.1	<0.1	<0.1	<0.1
Pentachlorophenol	495	1.2	6974	41.7	<27	26.9	36.6	16.1	160	8.9	3285	24	3.76	3.76	<0.3
Phenanthrene	18.4	<0.2	36.5	<0.1	<14	<0.1	<6.5	<0.1	9.4J	<0.1	59.9	0.1	<0.1	<0.1	<0.1
Phenol	384	<0.3	521	<0.3	229	<0.3	224	<0.3	306	<0.3	493	<0.3	<0.3	<0.3	<0.3
Pyrene	5.9	0.7	9.3	<0.1	<13	<0.1	5.9	0.4	10J	0.6	29.2	5.7	<0.1	<0.1	<0.1
Surrogate Recoveries (%)															
2-Fluorobiphenyl	89	98	91	94	NC	92	99	94	NC	93	112	93	93	91	89
2-Fluorophenol	95	96	100	92	NC	90	110	94	NC	88	124	90	93	88	94

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Table 2-1

(Continued)

Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93		Run 6 9-02-93		Run 7 9-03-93		Field Blanks 9-03-93		
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Inlet Dup	Outlet
Nitrobenzene-d5	101	86	107	87	NC	86	272 Q,F	99	NC	93	264 Q,F	92	89	87	83
Phenol-d5	117	95	113	94	NC	90	97	94	NC	90	102	89	96	93	93
Terphenyl-d14	98	95	103	101	NC	97	95	94	NC	90	104	87	100	98	96
2,4,6-Tribromophenol	56	81	76	82	NC	81	59	79	NC	77	68	81	79	76	76

Note: All < values are detection limits for analytes not detected. Results for analytes detected below detection limits are reported and J flagged.

Qualifiers:

E - Analyte concentration exceeded calibration range.
F - Interference or coelution suspected.
J - Result is less than stated Detection Limit.
NC - Not calculable.

Table 2-2

Summary of Analysis Results for Particulate and Anions in Soil Reactor Off-Gas

Analyte	Units	Run 1		Run 2		Run 4		Run 5		Run 6		Run 7		Field Blank	
		Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
HCl*	(mg/dscm)	0.197	0.113	6.027	0.153	0.232	0.067	0.169	0.052	0.400	0.230	5.71	0.47	0.160	0.11
Cl2*	(mg/dscm)	0.094	0.089	0.184	0.406	0.090	0.037	0.105	0 039	0.109	0.073	0.361	0.0214	0.016	0.005
HF	(mg/dscm)	NA	<0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA	<0.01
Particulate	(gr/dscf)	0.037	0.021	0.040	0.021	0.001	0.0004	0.005	0.005	0.021	0.012	0.049	0.028	NA	NA
Particulate	(lb/hr)	0.024	0.013	0.022	0.012	0.001	0.0002	0.003	0.003	0.009	0.005	0.023	0.013	NA	NA

* = Reported as chloride.

NA = Not analyzed.

Table 2-3

Summary of Analysis Results for Volatile Organic Compounds in Soil Reactor Off-Gas (ppbv)

Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93			Run 6 9-02-93		Run 7 9-03-93		Trip Blank 8-28-93	Field Blank 8-28-93
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Inlet Dup	Outlet	Inlet	Outlet	Inlet	Outlet[a]		
1,1,1-Trichloroethane	<8	<0.7	<55	<3.1	<900	<5000	<280	<280	<60	<290	<190	<900	NA	<0.5	<0.9
1,2-Dichlorobenzene	18	<0.7	<55	<3.1	<900	<5000	<280	<280	<60	<290	<190	<900	NA	<0.5	<0.9
1,2,4-Trichlorobenzene	18	<0.7	<55	<3.1	<900	<5000	<280	<280	<60	410	<190	<900	NA	<0.5	<0.9
1,2,4-Trimethylbenzene	64	<0.7	58	<3.1	<900	<5000	3000	3000	<60	<290	<190	<900	NA	<0.5	<0.9
1,3-Butadiene	740	<0.7	2000	<3.1	62000	<5000	24000	24000	10000	10000	11000	46000	NA	<0.5	<0.9
1,3-Dichlorobenzene	28	<0.7	<55	<3.1	<900	<5000	<280	<280	<60	<290	<190	<900	NA	<0.5	<0.9
1,3,5-Trimethylbenzene	22	<0.7	<55	<3.1	<900	<5000	1300	1300	<60	<290	<190	<900	NA	<0.5	<0.9
Acetonitrile	<80	<7	<550	<31	<9000	<50000	36000	36000	2000	9000	<1900	<9000	NA	<5	<9
Benzene	1200	<0.7	1600	<3.1	16000	<5000	<280	<280	<60	7400	<190	38000	NA	<0.5	<0.9
Bromomethane	160	11	1000	8.9	<900	<5000	1400	1200	<60	<290	<190	<900	NA	<0.5	<0.9
Chlorobenzene	63	<0.7	130	<3.1	<900	<5000	1500	1500	<60	<290	<190	<900	NA	<0.5	<0.9
Chloroethane	200	<0.7	500	<3.1	<900	<5000	<280	<280	<60	<290	<190	<900	NA	<0.5	<0.9
Chloromethane	910	71	13000E	110	1100	<5000	12000	12000	600	980	500	10000	NA	<0.5	1.8
Ethyl benzene	130	0.85	120	<3.1	1100	<5000	6500	6400	<60	820	<190	1600	NA	<0.5	<0.9
Ethyl toluene	80	<7	<550	<31	<9000	<50000	3600	3600	<600	440	<1900	<9000	NA	<5	<9
Methylene chloride	84	29	310	190	<900	<5000	<280	<280	<60	<290	<190	<900	NA	<0.5	<0.9
m,p-Xylene	300	2.8	350	<3.1	2500	<5000	14000	14000	<60	1700	<190	3100	NA	<0.5	<0.9
n-Octane	200	<0.7	210	<3.1	2000	<5000	4000	3900	<60	1200	<190	<900	NA	<0.5	<0.9
o-Xylene	150	1.5	170	<3.1	1100	<5000	7300	7200	<60	820	<190	1400	NA	<0.5	<0.9
Propylene	3800E	2.5	7300	610	350000E	630000	110000E	110000E	22000E	75000E	31000	220000E	NA	<0.5	1.9

CS1465

Table 2-3

(Continued)

Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93			Run 6 9-02-93		Run 7 9-03-93		Trip Blank 8-28-93	Field Blank 8-28-93
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Inlet Dup	Outlet	Inlet	Outlet	Inlet	Outlet[a]		
Tetrachloroethene	<8	1.1	<55	<3.1	<900	<5000	<280	<280	<60	<290	<190	<900	NA	<0.5	<0.9
Toluene	870	3.3	1100	<3.1	12000	<5000	39000	39000	<60	5300	<190	18000	NA	<0.5	1
Vinyl chloride	<8	<0.7	100	<3.1	<900	<5000	<280	<280	<60	<290	<190	<900	NA	<0.5	<0.9
Surrogate Recoveries (%)															
Octafluorotoluene	100	96	100	99	99	101	102	104	101	97	97	97	NA	99	99
Toluene-d8	100	95	96	94	97	102	102	104	101	95	98	97	NA	95	94
4-Bromofluorobenzene	102	104	93	104	94	89	96	95	96	97	94	99	NA	106	106

[a] Run 7 outlet sample was lost due to flow controller becoming clogged.

E - Estimated value, result exceeds instrument calibration range.

C02484

Table 2-4

Summary of Analysis Results for Polychlorinated Dibenzo-dioxins and Dibenzofurans in Soil Reactor Off-Gas (ng/dscm)

	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93		Run 6 9-02-93		Run 7 9-03-93		Field Blank 9-03-93
Analyte	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Outlet
2,3,7,8-TCDD	140E	78.2E	131E	222E	14.9E	3.23	47.2E	447E	264E	147E	179E	119E	1.31
2,3,7,8-TCDF	7.36C	3.93C	12.5C,E	30.7C,E	1.2C	0.206C	2.94C	29.3E,C	15.6C,E	7.06C	29.5C,E	12.8C,E	0.11C
Surrogate Recovery (%)													
13C-2,3,7,8-TCDD	57	26	52	49	17	34	51	27	22	55	19	41	28
13C-2,3,7,8-TCDF	50	24	47	31	19	34	47	23	20	51	19	35	28
Analyte													
Total TCDD	3490 B,E	2120B,E	3770B,E	8840B,E	6190B,E	145B,E	1720B,E	11800E	7820E	3880E	7250E	5100E	583B,E
1,2,3,7,8-PeCDD	509B,E	333B,E	358B,E	680B,E	33.9B,E	12.1B,E	346B,E	1750E	734E	472E	487E	306E	3.73B
Total PeCDD	5390 B,E	3,600B,E	5710B,E	11600B,E	525B,E	188B,E	3650B,E	24300E	8650E	5480E	8800E,Q	5900E	810B
1,2,3,4,7,8-HxCDD	580 B,E	362B,E	409B,E	674B,E	21.9B,E	6.7B	498B,E	1060E	506E	333E	402E	291E	3.53B
1,2,3,6,7,8-HxCDD	702 B,E	442B,E	403B,E	638B,E	25.8B,E	8.29B	578B,E	1260E	563E	370E	263E	157	2.31B
1,2,3,7,8,9-HxCDD	1150B,E	669B,E	885B,E	1430B,E	50.7B,E	16.2B	947B,E	2150E	931E	5970E	690E	572E	7.97B
Total HxCDD	12,400B,E	7480B,E	8760B,E	14,700B,E	556B,E	195B,E	11200B,E	28900E	6210E	4020E	4560E	3920	933B,S
1,2,3,4,6,7,8-HpCDD	5100B,E	3570B,E	3090B,E	5140B,E	163B,E	38B,E	3890B,E	5640E	1070E	776E	636E	474E	17.83B,E
Total HpCDD	10,400B,E	7420B,E	6220B,E	10,200B,E	398B,E	99.2B,E	7890B,E	11900E	2340E	1670E	1550E	1210E	503B,E
OCDD	15600B,E	8630B,E	5430B,E	14100B,E	408B,E	63.8B,E	9930B,E	12700E	1720E	1500E	856E	565E	27.6B,E
Total TCDF	5520B,E,I	316B,E,I,Q	757B,E,I	2020B,E,I	85.7E,I	14.7I	339E,I	1890E,I	1110E,I	453I	2140E,I	1240E,I	9.27I
1,2,3,7,8-PeCDF	42.2B,C	24.8B,E,I	33.8B,E,I	53.6B,E	2.52B,I	0.805B,I	21.9B,C,E,I	125I	57.5I	37.4I	27.6	18.2	0.26
2,3,4,7,8-PeCDF	14.4C	8.41C,I	31.6C,E	38.1C,E,I	1.11I	0.25	7.79I	46.9	13.3	9.21	13.3	7.91	0.1

Table 2-4

(Continued)

Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93		Run 6 9-02-93		Run 7 9-03-93		Field Blank 9-03-93
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Outlet
Total PeCDF	562 B,E,I,Q	413B,E,I	1010B,E,I	1720B,E,I,Q	56.9B,E,I	18.3B,I	383B,E,I	2430E	1160I	781I	1290E,I	868I	10.87I
1,2,3,4,7,8-HxCDF	39.8	29.7E,I	53.8E,I	85.2E,I	2.18I	0.752I	36.4E,I	89.9I	38.1I	31.8I	41.1E	30.1	0.41
1,2,3,6,7,8-HxCDF	38.7	29.5E,I	35E,I	54.1E,I	1.89I	0.888I	35.6E,I	86.8I	26.4	22.8	31.6E	10.2	0.13
2,3,4,6,7,8-HxCDF	4.2	2.88	4.41	7.81Q	0.249	0.0874	3.73	6.68	3.53	2.72	3.82	2.34	0.52B,I
1,2,3,7,8,9-HxCDF	8.87	5.27	4.42	7.22	0.313	0.0917	5.85E	12.8	6.77	5.66	2.58	1.66	0.03
Total HxCDF	442B,E,I	607B,E,I	729B,E,I	1150B,E,I,Q	25.6B,I	9.21B,I	437B,E,I	1160I	543I	475I	472E,I	316I	5.5B,I,Q,S
1,2,3,4,6,7,8-HpCDF	108E	86.8E	85.9E	132E	3.98	1.08	92.4E	143	71.7	56.6	54.3E	32.5	0.49B
1,2,3,4,7,8,9-HpCDF	30.5B	23.5B,E	18.5	29B,E	0.88B	0.028B	19.2B,E	29.2	13.4	10.6	8.84	5.74	0.09B
Total HpCDF	313B,E,I	327B,E	298B,E	480B,E,I	14B	3.54B	348B,E	5350	277	224	196E	122	1.7B
OCDF	502B,E	301B,E	251B,E	792B,E	5.01B	0.0939B	747B,E	497E	88.4	89.2	38.7	19.1	0.36B,S
Surrogate Recovery (%)													
13C-2,3,7,8-TCDD	56	23	68	68	64	26	57	40	62	69	87	71	29
13C-123,7,8-PeCDD	57	25	72	58	65	29	55	29	71	85	73	75	41
13C-1,2,3,6,7,8-HxCDD	58	31	69	65	80	41	63	36	60	72	75	62	40
13C-1,2,3,4,6,7,8-HpCDD	67	32	66	65	88	48	64	43	68	70	86	80	48
13C-OCDD	25	10	14	6.9	63	32	5	6.5	28	19	87	64	43
13C-2,3,7,8-TCDF	55	22	71	75	63	27	55	33	67	75	70	62	32
13C-1,2,3,7,8-PeCDF	56	24	59	57	64	29	56	33	71	82	88	73	40
13C-1,2,3,4,7,8-HxCDF	63	32	74	71	85	39	75	44	69	69	81	63	38
13C-1,2,3,4,6,7,8-HpCDF	64	28	61	60	80	46	66	42	63	65	80	62	43

C01133

Table 2-4

(Continued)

Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93		Run 6 9-02-93		Run 7 9-03-93		Field Blank 9-03-93
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Outlet
MM5 Surrogate Recovery (%)													
13C-1,2,3,4-TCDF	71	71	58	52	72	74	75	71	79	81	76	82	80

Note: Field Blank values calculated using a nominal volume of 3 dscm.

Qualifiers:

B - Analyte found is associated laboratory method blank.
C - Coeluting isomer present.
E - Estimate only; exceeds instrument calibration range.
I - Positive polychlorinated diphenyl ether interference.
J - Estimate only; below instrument calibration range.
NA - Not analyzed.
Q - Peak present outside ion ratio limits.
U - Not detected at the level reported.

CO1467

Table 2-5

Summary of Analysis Results for Volatile and Semivolatile Organic Compounds in Liquid Reactor Off-Gas

Volatile Organic Compound	LTR Run 1 9-1-93 (ppbv)
1,1,1-Trichloroethane	8700
1,2-Dichlorobenzene	<3500
1,2,4-Trichlorobenze	<3500
1,2,4-Trimethylbenze	14000
1,3-Butadiene	<3500
1,3-Dichlorobenzene	<3500
1,3,5-Trimethylbenze	6900
Acetonitrile	<35000
Benzene	<3500
Bromomethane	<3500
Chlorobenzene	<3500
Chloroethane	<3500
Chloromethane	<3500
Ethyl benzene	56000
Ethyl toluene	19000
Methylene chloride	<3500
m,p-Xylene	120000
n-Octane	180000
o-Xylene	71000
Propylene	1100000E
Tetrachloroethene	<3500
Toluene	320000
Vinyl chloride	<3500
Surrogate Recoveries (%)	
Octafluorotoluene	101
Toluene-d8	103
4-Bromofluorobenzene	86

C0746S

Table 2-5

(Continued)

Semivolatile Organic Compound	LTR Run 2 9-3-93 (μg/dscm)
1,2-Dichlorobenzene	<2050
1,2,4-Trichlorobenze	<1900
1,3-Dichlorobenzene	<2310
1,4-Dichlorobenzene	<1900
2-Methylnapthalene	28035
2-Methylphenol	<1000
2,4-Dichlorophenol	<1830
2,4-5-Trichlorophenol	<1650
2,4,6-Trichlorophenol	<1650
4-Methylphenol	<1500
Acenaphthylene	<1350
Anthracene	<1745
Benzoic acid	<12400
Benzo(b)fluoranthene	<2920
Benzo(k)fluoranthene	<3220
Benzel alcohol	<1970
Benz(a)anthracene	<1450
Benz(a)pyrene	<1670
bis(2-Ethylhexyl)phthalate	<1870
Butylbenzylphthalate	<2000
Chrysene	<1750
Dibenzofuran	<1750
Diethylphthalate	<1660

RADIAN CORPORATION

Table 2-5

(Continued)

SVOC Analyte	Run 2 9-3-93 (µg/dscm)
Dimethylphathalate	<1080
Di-n-butylphthalate	445J
Di-n-octylphthalate	<1140
Fluoranthene	1350J
Fluorene	3494
Hexachlorobenzene	<1010
Isophorone	<1980
Napthalene	68740
Pentachlorophenol	<2860
Phenanthrene	10830
Phenol	2840
Pyrene	1952
Surrogate Recoveries (%)	
2-Fluorobiphenyl	NC
2-Fluorophenol	NC
Nitrobenzene-d5	NC
Phenol-d5	NC
Terphenyl-d5	NC
2,4,6-Tribromophenol	NC

Note: All < values are Detection Limits for analytes not detected. Results for semivolatile organic analytes detected below detection limits are J-flagged.

Qualifiers:

E - Result exceeds instrument calibration range.
J - Result is below sample-specific detection limit.
NC - Not calculated due to high dilutions.

Table G-2

Summary of PCDD/PCDF Results for Ambient Hi-Volume Filter Samples

Analyte	Hi-Vol Filter 8-28-93		Hi-Vol Filter Blank	
	Result (ng/dscm)	Qualifier	Result (ng/dscm)	Qualifier
2,3,7,8-TCDD	1.59e-04		1.19e-06	J
2,3,7,8-TCDF	8.39e-06		8.13e-07	J
Surrogate Recovery (%)				
13C-2,3,7,8-TCDD	69		65	
13C-2,3,7,8-TCDF	74		71	
Analyte				
Total TCDD	1.73e-03	B	5.14e-05	B,Q
1,2,3,7,8-PeCDD	1.23e-03	B	4.63e-06	B,J,Q
Total PeCDD	8.03e-03	B	5.08e-05	B,Q
1,2,3,4,7,8-HxCDD	2.91e-03	B	3.63e-06	B,J
1,2,3,6,7,8-HxCDD	4.27e-03	B	3.50e-06	B,J
1,2,3,7,8,9-HxCDD	7.79e-03	B	7.81e-06	B,J
Total HxCDD	5.78e-02	B	6.56e-05	B
1,2,3,4,6,7,8-HpCDD	5.78e-02	B,E	2.33e-05	B
Total HpCDD	1.18e-01	B,E	5.44e-05	B
OCDD	1.23e-01	B,E,S	9.19e-05	B
Total TCDF	1.77e-04	I	5.50e-06	J,Q
1,2,3,7,8-PeCDF	4.82e-05		1.75e-06	U
2,3,4,7,8-PeCDF	1.95e-05	J	1.06e-06	U
Total PeCDF	6.76e-04	I,Q	3.94e-06	J,Q
1,2,3,4,7,8-HxCDF	1.64e-04	I	9.38e-07	U
1,2,3,6,7,8-HxCDF	8.94e-05	S	1.19e-06	U
2,3,4,6,7,8-HxCDF	9.78e-05		9.38e-07	B,J
1,2,3,7,8,9-HxCDF	5.89e-05		8.75e-07	U
Total HxCDF	1.55e-03	B,I	4.69e-06	J,Q
1,2,3,4,6,7,8-HpCDF	1.58e-03	B	1.56e-06	B,J
1,2,3,4,7,8,9-HpCDF	4.20e-04	B	1.13e-06	U
Total HpCDF	7.85e-03	B	4.38e-06	B,J
OCDF	5.75e-03	B,S	5.38e-06	B,J
Surrogate Recovery (%)				
13C-2,3,7,8-TCDD	68		69	
13C-1,2,3,7,8-PeCDD	93		96	
13C-1,2,3,6,7,8-HxCDD	90		90	
13C-1,2,3,4,6,7,8-HpCDD	113		91	
13C-OCDD	113		68	
13C-2,3,7,8-TCDF	78		77	

Table G-2

(Continued)

Analyte	Hi-Vol Filter 8-28-93		Hi-Vol Filter Blank	
	Result (ng/dscm)	Qualifier	Result (ng/dscm)	Qualifier
13C-1,2,3,7,8-PeCDF	92		96	
13C-1,2,3,4,7,8-HxCDF	87		89	
13C-1,2,3,4,6,7,8-HpCDF	85		96	
MM5 Surrogate Recovery (%)				
13C-1,2,3,4-TCDF	NA		NA	

Qualifiers:
B - Analyte found is associated laboratory method blank.
C - Co-eluting isomer present.
E - Estimate only; exceeds instrument calibration range.
I - Possible polychlorinated diphenyl ether interference.
J - Estimate only; below instrument calibration range.
NA - Not analyzed.
Q - Peak present outside ion ratio limits.
U - Not detected at the level reported.

Hi-Vol Filter Blank values calculated using a nominal volume of 1600 dscm.

TABLE 2

DRAFT

BCD-KOPPERS DEMONSTRATION
MTTD TEST RUNS
ANALYTICAL RESULTS FOR
SEMIVOLATILE ORGANIC COMPOUNDS (METHOD 8270)
IN SOIL SAMPLES (μg/kg)

Analyte	TEST RUN 4				
	Input	Output			CRE (%)
	BAT1-CN1-SL2[b]	TR4-CN1-SL3[c]	TR4-CN2-SL3	TR4-CN3-SL3	
Pentachlorophenol	8,100,000	870[e] (1,700)	510[e] (3,400)	470[e] (3,400)	≥ 99.99
Unknown substituted phenol	ND	ND	ND	ND	

Analyte	TEST RUN 5				
	Input	Output			CRE (%)
	BAT2-CN1-SL2[b]	TR5-CN1-SL3[c]	TR5-CN2-SL3[d]	TR5-CN3-SL3	
Pentachlorophenol	5,200,000[e] (8,000,000)	280[e] (1,700)	330[e] (6,000)	170[e] (3,400)	≥ 99.99
Unknown substituted phenol	ND	ND	ND	ND	

C01475

DRAFT

TABLE 2 (CONTINUED)

Analyte	TEST RUN 6				
	Input	Output			CRE (%)
	BAT3-CN1-SL2[b]	TR6-CN1-SL3	TR6-CN2-SL3	TR6-CN3-SL3[e]	
Pentachlorophenol	1,600,000[a] (2,600,000)	150[a] (3,600)	ND (3,500)	130[a] (1,600)	≥ 99 99
Unknown substituted phenol	ND	170 JN(1)	ND	ND	

Analyte	TEST RUN 7				
	Input	Output			CRE (%)
	BAT4-CN1-SL2[b]	TR7-CN1-SL3	TR7-CN2-SL3	TR7-CN3-SL3	
Pentachlorophenol	1,500,000[a] (3,200,000)	ND (3,600)	ND (3,500)	190[a] (3,500)	≥ 99.76
Unknown substituted phenol	ND	ND	ND	ND	

Notes:

BAT - Batch number
TR - Test run number
CN - Composite number
SL - Sample location number
CRE - Contaminant removal efficiency
[a] - Detected at a concentration below the reporting limit shown in parentheses
[b] - Only the output samples were GPC cleaned-up and reanalyzed. The results for the input samples are from the original analysis.
[c] - Results from clean-up study. Reextraction results are presented because the QC results were better and detection limits were lower than for the clean-up of the original extracts.
[d] - Results from clean-up study. Only original extract was cleaned and reanalyzed, so no reextraction results are available
[e] - Only Tentatively Identified Compounds (TIC) that are chlorinated phenols are included in this table.
ND - Analyte was not detected above the detection limit. The number shown in parentheses, when provided, is the reporting limit.
JN - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification". The associated number is an estimated value. The number in parentheses identifies the number of compounds which sum to the listed estimated concentration.

C01474

TABLE 3

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BCD-KOPPERS DEMONSTRATION
MTTD TEST RUNS
ANALYTICAL RESULTS FOR
PCDDs/Fs (METHOD 8280)
IN SOIL SAMPLES (μg/kg)

Analyte	TEST RUN 4				CRE (%)
	INPUT	OUTPUT			
	BAT1-CN1-SL2	TR4-CN1-SL3	TR4-CN2-SL3	TR4-CN3-SL3	
2,3,7,8-TCDD	2.1 U	0.74 U	1.4 U	1.6 U	NA
Total TCDD	3.4 U	5.1 U	7.6 U	4.9 U	NA
2,3,7,8-TCDF	1.2 U	1.4 U	1.0 U	0.96 U	NA
Total TCDF	22.0 J	2.1 U	1.1 U	1.1 U	95.19
Total PeCDD	7.2 U	8.4 U	8.1 U	4.1 U	NA
Total PeCDF	122 J	3.1 U	1.2 U	1.5 U	99.05
Total HxCDD	117	15.4 U	4.2 U	11.9 U	96.54
Total HxCDF	607 J	2.1 U	1.8 U	2 4 U	99.71
Total HpCDD	2,000 J	23.1 U	12.2 U	13 9 U	99.41
Total HpCDF	1,070 J	3.4 U	1.5 U	1 4 U	99 87
OCDD	15,000 J	42.4 U	19.0 U	22.7 U	99.88
OCDF	3,390 J	2.5 U	1.9 U	1.0 U	99.97

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TABLE 3 (CONTINUED)

Analyte	TEST RUN 5								CRE (%)
	INPUT		OUTPUT						
	BAT2-CN1-SL2		TR5-CN1-SL3		TR5-CN2-SL3		TR5-CN3-SL3		
2,3,7,8-TCDD	0.85	U	2.2	U	2.2	U	2.0	U	NA
Total TCDD	2.2	U	4.2	U	4.4	U	5.5	U	NA
2,3,7,8-TCDF	1.1	U	1.3	U	1.9	U	1.3	U	NA
Total TCDF	36.3	J	1.6	U	2.8	U	2.2	U	96.71
Total PeCDD	6.4	U	4.1	U	7.2	U	3.7	U	NA
Total PeCDF	93.9	J	1.6	U	2.6	U	3.0	U	98.49
Total HxCDD	87.4		7.4	U	10.6	U	8.8	U	92.52
Total HxCDF	482	J	1.5	U	3.0	U	1.34	U	99.75
Total HpCDD	1,520	J	8.1	U	12.6	U	9.4	U	98.53
Total HpCDF	793	J	1.9	U	2.8	U	1.8	U	99.80
OCDD	7,400	J	12.4	U	17.0	U	12.4	U	99.85
OCDF	1,420	J	1.9	U	6.4	U	0.48	U	99.97

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TABLE 3 (CONTINUED)

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Analyte	TEST RUN 6						CRE (%)
	INPUT		OUTPUT				
	BAT3-CN1-SL2	BAT3-CN1D-SL2	TR6-CN1-SL3	TR6-CN2-SL3	TR6-CN3-SL3		
2,3,7,8-TCDD	0.37 U	0.60 U	1.7 U	3.1 U	0.92 U		NA
Total TCDD	6.6	3.4 U	1.9 U	1.7 U	2.2 U		75.56
2,3,7,8-TCDF	1.7 U	1.2 U	1.4 U	3.0 U	1.4 U		NA
Total TCDF	55.1 J	24.3 J	1.2 U	0.70 U	1.4 U		98.79
Total PeCDD	7.7 U	6.6 U	4.0 U	7.4 U	5.0 U		NA
Total PeCDF	125 J	155 J	1.5 U	2.1 U	3.1 U		99.08
Total HxCDD	135	141	6.7 U	7.2 U	7.2 U		95.48
Total HxCDF	701 J	826 J	1.4 U	1.3 U	2.3 U		99.85
Total HpCDD	1,930 J	2,660 J	8.1 U	8.8 U	9.0 U		99.71
Total HpCDF	1,260 J	1,540 J	1.9 U	3.7 U	1.3 U		99.92
OCDD	9,050 J	11,200 J	11.7 U	12.8 U	11.4 U		99.90
OCDF	1,840 J	2,550 J	1.1 U	1.9 U	2.3 U		99.96

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TABLE 3 (CONTINUED)

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Analyte	TEST RUN 7								CRE (%)
	INPUT		OUTPUT						
	BAT4-CN1-SL2		TR7-CN1-SL3		TR7-CN2-SL3		TR7-CN3-SL3		
2,3,7,8-TCDD	0.94	U	1.2	U	1.4	U	0.9	U	NA
Total TCDD	9.7	J	4.3	U	3.0	U	6.5	U	71.89
2,3,7,8-TCDF	1.0	U	2.4	U	1.9	U	3.4	U	NA
Total TCDF	61.1	J	1.4	U	1.9	U	3.4	U	99.92
Total PeCDD	21.1		3.2	U	8.1	U	8.2	U	93.97
Total PeCDF	134	J	1.8	U	3.0	U	4.4	U	98.78
Total HxCDD	278		9.0	U	16.2		20.1		97.06
Total HxCDF	695	J	2.5	U	1.9	U	2.9	U	99.75
Total HpCDD	3,690	J	9.7	U	18.9	U	21.6	U	99.76
Total HpCDF	1,150	J	6.1	U	2.7	U	3.5	U	99.79
OCDD	10,200	J	15.5	U	22.2	U	28.5	U	99.86
OCDF	2,670	J	0.62	U	1.6	U	4.3	U	99.98

Notes:

BAT - Batch number
CN - Composite number
SL - Sample location number
TR - Test run number
TEC - Toxicity Equivalence Concentration
D - Field duplicate sample
U - The analyte was analyzed for, but was not detected at the level reported.
J - The analyte was positively identified. The associated number is an estimated value.
TCDD - Tetrachlorinated dibenzo-p-dioxin
TCDF - Tetrachlorinated dibenzofuran
HpCDD - Heptachlorinated dibenzo-p-dioxin
HpCDF - Heptachlorinated dibenzofuran
HxCDD - Hexachlorinated dibenzo-p-dioxin
HxCDF - Hexachlorinated dibenzofuran
PeCDD - Pentachlorinated dibenzo-p-dioxin
PeCDF - Pentachlorinated dibenzofuran
OCDD - Octachlorodibenzo-p-dioxin
OCDF - Octachlorodibenzofuran

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TABLE 4

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BCD-KOPPERS DEMONSTRATION
MTTD TEST RUNS
ANALYTICAL RESULTS FOR SEMIVOLATILE
ORGANIC COMPOUNDS (METHOD 8270)
IN OFF-GAS SAMPLES ($\mu g/dscm$)

Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93		Run 6 9-02-93		Run 7 9-03-93	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
1,2 Dichlorobenzene	173	ND(0.2)	247	ND(0 2)	112	ND(0.2)	203	ND(0 2)	253	ND(0 2)	300	ND(0 2)
1,2,4-Trichlorobenzene	77.2	ND(0 2)	165	ND(0 2)	40 7	ND(0 2)	46 6	ND(0 2)	64	ND(0 2)	109	ND(0 2)
1,3-Dichlorobenzene	245	ND(0.2)	542	ND(0.2)	118	ND(0 2)	225	ND(0 2)	277	ND(0 2)	416	ND(0 2)
1,4-Dichlorobenzene	44	ND(0.2)	82 6	ND(0 2)	21 8	ND(0 2)	47 4	ND(0 2)	66 7	ND(0 2)	83 1	ND(0 2)
2-Methylnaphthalene	197	ND(0.1)	143	ND(0 1)	166	ND(0 1)	240	ND(0 1)	231	ND(0 1)	611	ND(0 1)
2-Methylphenol	25 7	ND(0.1)	30 2	ND(0 01)	ND(9.2)	ND(0 1)	ND(4 3)	ND(0 1)	ND(8 6)	ND(0 1)	ND(7 5)	ND(0 1)
2,4-Dichlorophenol	ND(3.7)	ND(0.2)	233	ND(0 2)	ND(17)	ND(0 2)	ND(18)	ND(0 2)	ND(16)	ND(0 2)	ND(14)	ND(0 2)
2,4,5-Trichlorophenol	ND(3.3)	ND(0 2)	59 9	ND(0 2)	ND(15)	ND(0.2)	ND(7 1)	ND(0 2)	ND(15)	ND(0 2)	ND(13)	ND(0 1)
2,4,6 Trichlorophenol	ND(3.3)	ND(0.2)	95.8	ND(0 2)	ND(15)	ND(0.2)	ND(7)	ND(0 2)	ND(15)	ND(0 2)	ND(13)	ND(0 1)
4 Methylphenol	32.9 F	ND(0.2)	33.5 F	ND(0 1)	ND(14)	ND(0 2)	ND(6 4)	ND(0 1)	ND(13)	ND(0 1)	ND(12)	ND(0 1)
Acenaphthene	ND(1.8)	ND(0.1)	9 5	ND(0 1)	ND(8.1)	ND(0 1)	3 8	ND(0 1)	ND(7 6)	ND(0 1)	18 8	ND(0 1)
Acenaphthylene	98.3	ND(0.1)	45.8	ND(0.1)	ND(12)	ND(0 1)	8 3	ND(0 1)	ND(12)	ND(0 1)	20 5	ND(0 1)
Anthracene	4 0	ND(0.1)	4 5	ND(0 1)	ND(11)	ND(0 1)	ND(5 1)	ND(0 1)	ND(11)	ND(0 1)	20 3	ND(0 1)
Benzoic acid	19.1 J	ND(13)	ND(231)	2 J	ND(1145)	0 4 J	ND(540)	0 5 J	ND(1100)	0 6	ND(940)	1.3
Benzo(b)fluoranthene	ND(5 9)	0 5 F	ND(5 4)	ND(0 3)	ND(27)	ND(2 3)	ND(13)	1 2 F	ND(26)	1 4	ND(22)	ND(0 3)
Benzo(k)fluoranthene	ND(6.5)	0.5 F	ND(6)	ND(0 3)	ND(30)	ND(0.3)	ND(14)	1.2 F	ND(28)	1 4	ND(25)	ND(0 3)
Benzyl alcohol	18.5	ND(0.2)	ND(3 7)	ND(0 2)	ND(18)	ND(0.2)	ND(8 5)	ND(0 2)	ND(17)	ND(0 2)	ND(15)	ND(0 2)

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TABLE 4 (CONTINUED)

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Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93		Run 6 9-02-93		Run 7 9-03-93	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Benz(a)anthracene	ND(2.9)	1.0	2 J	ND(0.1)	ND(13)	ND(0.1)	ND(6.2)	0 9	ND(13)	0 8	ND(12)	1.9
Benz(a)pyrene	ND(3.4)	0.1 J	ND(3.1)	ND(0.2)	ND(16)	ND(0 2)	ND(7 2)	0.2	ND(15)	0.1	ND(13)	ND(0.1)
bis(2-Ethylhexyl)phthalate	6.0	4.6	24.6	ND(0.2)	ND(18)	51.4 E	7.5 J	22 8	ND(17)	63 6	ND(14)	23.7
Butylbenzylphthalate	5.8	3.3	25.2	ND(0.2)	ND(19)	0 7	8 J	3.7	ND(18)	2 0	ND(16)	ND(0.2)
Chrysene	ND(3.5)	1.1	40.2	ND(0.2)	ND(16)	ND(0.2)	ND(7 4)	1.9	ND(15)	1.2	ND(13)	2.4
Dibenzofuran	26.4	ND(0.2)	38.9	ND(0.2)	ND(16)	ND(0.2)	7 8	ND(0 2)	12 6 J	ND(0 2)	30.7	ND(0.1)
Diethylphthalate	23.8	3.3	ND(3.1)	ND(0.2)	ND(16)	0 3	ND(7 2)	0 1 J	ND(15)	0 2	ND(32)	ND(0.1)
Dimethylphathalate	ND(2.2)	ND(0.1)	1.6 J	ND(0.1)	ND(10)	ND(0.1)	ND(4.4)	ND(0 1)	ND(9.3)	ND(0 1)	ND(8.1)	ND(0.1)
Di-n-butylphthalate	4.8	0.6	13.7	ND(0.1)	ND(10)	0 3	ND(4 5)	0 2	ND(9)	0 3	ND(7 8)	ND(0.1)
Di-n-octylphthalate	ND(2.3)	ND(0.1)	ND(2.1)	ND(0.1)	ND(11)	ND(0.1)	ND(4.9)	0.1	ND(9.8)	ND(0.1)	ND(8.5)	ND(0.1)
Fluoranthene	7.8	0.7	51.0	ND(0.1)	ND(14)	ND(0.1)	6 1 J	16.1	9.5	0 3	24 1	2.2
Fluorene	11.3	ND(0.01)	34.2	ND(0.1)	ND(12)	ND(0.1)	ND(5.3)	ND(0 1)	ND(11)	ND(0 1)	15 0	ND(0 1)
Hexachlorobenzene	ND(2)	ND(0.1)	48.6	ND(0.1)	ND(9.3)	ND(0.1)	ND(4 4)	ND(0.1)	ND(8.7)	ND(0.1)	ND(7 6)	ND(0 1)
Isophorone	17.4	ND(0.2)	ND(3.7)	ND(0 2)	ND(19)	ND(0.2)	ND(8 6)	ND(0.2)	ND(18)	ND(0 1)	ND(15)	ND(0 1)
Naphthalene	967	ND(0.2)	748	0.1 J	629	0.1 J	730	ND(0 1)	843	ND(0.1)	2826	ND(0 1)
Pentachlorophenol	495	1.2	6974	41.7	ND(27)	26.9	36 6	16 1	160	8 9	3285	24
Phenanthrene	18.4	ND(0.2)	36.5	ND(0.1)	ND(14)	ND(0 1)	ND(6 5)	ND(0 1)	9.4 J	ND(0 1)	59 9	0 1
Phenol	384	ND(0.3)	521	ND(0.3)	229	ND(0 3)	224	ND(0 3)	306	ND(0 3)	493	ND(0.3)
Pyrene	5.9	0.7	9.3	ND(0.1)	ND(13)	ND(0.1)	5.9	0 4	10 J	0 6	29 2	5.7

Notes:

E - Analyte concentration exceeded calibration range.
F - Interference or coelution suspected.
J - Result is less than stated Detection Limit.
NC - Not calculable

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dscm - Dry Standard Cubic Meter
Inlet - Sample colleted prior to carbon absorption bed
Outlet - Sample collected after acrbon absorption bed but prior to discharge to the atmosphere.
ND - Analyte was not detected above the detection/reporting limit. The number shown inparentheses is the detection/reporting limit. Results for analytes detected below the detection/reporting limit are reported and J-flagged.

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TABLE 5

PCD KOPPERS DEMONSTRATION
MITD TEST RUNS
ANALYTICAL RESULTS FOR PCDDs/Fs (METHOD 8270)
IN OFF-GAS SAMPLES (ng/dscm)

	Test Run 1		Test Run 2		Test Run 4		Tst Run 5		Test Run 6		Test Run 7	
Analyte	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
2,3,7,8-TCDD	140 J	78.2 J	131 J	222 J	14.9 J	3 23	47 2 J	447 J	264 J	147 J	179 J	119 J
Total TCDD	3,490 J	2,120 J	3,770 J	8,840 J	6,190 J	145 J	1,720 J	11,800 J	7,820 J	3,880 J	7,250 J	5,100 J
2,3,7,8-TCDF	7.36 J	3.93 J	12.5 J	30.7 J	1.2 J	0 206 J	2 94 J	29.3 J	15 6 J	7.06 J	29 5 J	12.8 J
Total TCDF	5,520 J	316 J	757 J	2,020 J	85 7 J	14 7	339 J	1,890 J	1,110 J	453 J	2,140 J	1,240 J
1,2,3,7,8-PeCDD	509 J	333 J	358 J	680 J	33 9 J	12 1 J	316 J	1,750 J	734 J	472 J	487 J	306 J
Total PeCDD	5,390 J	3,600 J	5,710 J	11,600 J	525 J	188 J	3,650 J	24,300 J	8,650 J	5,480 J	8,800 J	5,900 J
1,2,3,7,8-PeCDF	42.2 J	24.8 J	33.8 J	53.6 J	2.52 J	0 805 J	21 9 J	125 J	57 5 J	37 4 J	27 6 J	18 2
2,3,4,7,8-PeCDF	14 4 J	8 41 J	21 6 J	38 1 J	1 11	0 25	7 39 J	46 9	13 3	9.21	13 3	7.91
Total PeCDF	562 J	413 J	1,010 J	1,720 J	56 9 J	18 3	383 J	2,430 J	1,160 J	781 J	1,290 J	868 J
1,2,3,4,7,8-HxCDD	580 J	362 J	409 J	674 J	21 9 J	6.7 J	498 J	1,060 J	506 J	333 J	402 J	291 J
1,2,3,6,7,8-HxCDD	702 J	442 J	403 J	638 J	25.8 J	8.29	578 J	1,260 J	563 J	370 J	263 J	157
1,2,3,7,8,9-HxCDD	1,150 J	669 J	885 J	1,430 J	50.7 J	16 2	947 J	2,150 J	931 J	597 J	690 J	572 J
Total HxCDD	12,400 J	7,480 J	8,760 J	14,700 J	556 J	195 J	11,200 J	28,900 J	6,210 J	4,020 J	4,560 J	3,920
1,2,3,4,7,8-HxCDF	39.8	29.7 J	53 8 J	85 2 J	2 18	0.752 J	36 4 J	89 9 J	38 1 J	31 8 J	41 1 J	30 1
1,2,3,6,7,8-HxCDF	38.7	29.5 J	35 J	54.1 J	1.89	0 888 J	35 6 J	86 8	26 4	22 8 J	31 6 J	10 2
2,3,4,6,7,8-HxCDF	4.2	2 88	4.41	7.81	0.249	0 0874	3 73	6.68	3 53	2 72	3 82	2 34
1,2,3,7,8,9-HxCDF	8 87	5.27	4.42	7.22	0.313	0.0917	5 85 J	12 8	6 77	5 66	2 58	1 66

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TABLE 5 (CONTINUED)

Analyte	Test Run 1		Test Run 2		Test Run 4		Tst Run 5		Test Run 6		Test Run 7	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Total HxCDF 0	442 J	607 J	729 J	1,150 J	25.6 J	9.21 J	437 J	1,160 J	543 J	475 J	472 J	316
1,2,3,4,6,7,8-HpCDD .01	5,100 J	3,570 J	3,090 J	5,140 J	163 J	38 J	3,890 J	5,640 J	1,070 J	776 J	636 J	474 J
Total HpCDD 0	10,400 J	7,420 J	6,220 J	10,200 J	398 J	99.2 J	7,890 J	11,900 J	2,340 J	1,670 J	1,550 J	1,210 J
1,2,3,4,6,7,8-HpCDF .01	108 J	86.8 J	85.9 J	132 J	3.98	1.08	92.4 J	143	71.7	56.6	54.3 J	32.5
1,2,3,4,7,8,9-HpCDF .01	30.5	23.5 J	18.5 J	29 J	0.88	0.28	19.2 J	29.2	13.4	10.6	8.84	5.74
Total HpCDF 0	313 J	327 J	298 J	480 J	14	3.54	348 J	535	277	224	196 J	122
OCDD .001	15,600 J	8,630 J	5,430 J	14,100 J	408 J	63.8 J	9,930 J	12,700 J	1,720 J	1,500 J	856 J	565 J
OCDF .001	502 J	301 J	251 J	792 J	5.01	0.939	747 J	497 J	88.4	89.2	38.7	19.1

Notes:

dscm - Dry Standard ubic Meter
HxCDD - Hexachlorinated dibenzo-p-dioxin
HxCDF - Hexachlorinated dibenzofuran
PeCDD - Pentachlorinated dibenzo-p-dioxin
PeCDF - Pentachlorinated dibenzofuran
OCDD - Octachlorodibenzo-p-dioxin
OCDF - Octachlorodibenzofuran
TCDD - Tetrachlorinated dibenzo-p-dioxin
TCDF - Tetrachlorinated dibenzofuran
HpCDD - Heptachlorinated dibenzo-p-dioxin
HpCDF - Heptachlorinated dibenzofuran
J - The analyte was positively identified. The associated number is an estimated value.
Inlet - Sample collected prior to carbon absorption bed
Outlet - Sample collected after carbon absorption bed, but prior to discharge to the atmosphere

TABLE 6

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BCD-KOPPERS DEMONSTRATION
MTTD TEST RUNS
ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS (METHOD)
IN OFF-GAS SAMPLES (ppbv)

Analysis Dates:

	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93			Run 6 9-02-93		Run 7 9-03-93	
Analyte	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Inlet Dup	Outlet	Inlet	Outlet	Inlet	Outlet*
1,1,1-Trichloroethane	ND(8)	ND(0.7)	ND(55)	ND(3.1)	ND(900)	ND(5,000)	ND(280)	ND(280)	ND(60)	ND(290)	ND(190)	ND(900)	NA
1,2-Dichlorobenzene	18	ND(0.7)	ND(55)	ND(3 1)	ND(900)	ND(5,000)	ND(280)	ND(280)	ND(60)	ND(290)	ND(190)	ND(900)	NA
1,2,4-Trichlorobenzene	18	ND(0.7)	ND(55)	ND(3.1)	ND(900)	ND(5,000)	ND(280)	ND(280)	ND(60)	410	ND(190)	ND(900)	NA
1,2,4-Trimethylbenzene	64	ND(0.7)	58	ND(3.1)	ND(900)	ND(5,000)	3,000	3,000	ND(60)	ND(290)	ND(190)	ND(900)	NA
1,3-Butadiene	740	ND(0 7)	2,000	ND(3.1)	62,000	ND(5,000)	24,000	24,000	10,000	10,000	11,000	46,000	NA
1,3-Dichlorobenzene	28	ND(0 7)	ND(55)	ND(3.1)	ND(900)	ND(5,000)	ND(280)	ND(280)	ND(60)	ND(290)	ND(190)	ND(900)	NA
1,3,5-Trimethylbenzene	22	ND(0 7)	ND(55)	ND(3 1)	ND(900)	ND(5,000)	1,300	1,300	ND(60)	ND(290)	ND(190)	ND(900)	NA
Acetonitrile	ND(80)	ND(7)	ND(550)	ND(31)	ND(9,000)	ND(50,000)	36,000	36,000	2,000	9,000	ND(1,900)	ND(9,000)	NA
Benzene	1,200	ND(0.7)	1,600	ND(3 1)	16,000	ND(5,000)	ND(280)	ND(280)	ND(60)	7,400	ND(190)	38,000	NA
Bromomethane	160	11	1,000	8 9	ND(900)	ND(5,000)	1,400	1,200	ND(60)	ND(290)	ND(190)	ND(900)	NA
Chlorobenzene	63	ND(0 7)	130	ND(3.1)	ND(900)	ND(5,000)	1,500	1,500	ND(60)	ND(290)	ND(190)	ND(900)	NA
Chloroethane	200	ND(0.7)	500	ND(3.1)	ND(900)	ND(5,000)	ND(280)	ND(280)	ND(60)	ND(290)	ND(190)	ND(900)	NA
Chloromethane	910	71	13,000 E	110	1,100	ND(5,000)	12,000	12,000	600	980	500	10,000	NA
Ethyl benzene	130	0.85	120	ND(3.1)	1,100	ND(5,000)	6,500	6,400	ND(60)	820	ND(190)	1,600	NA
Ethyl toluene	80	ND(7)	ND(550)	ND(31)	ND(9,000)	ND(50,000)	3,600	3,600	ND(600)	440	ND(1900)	ND(9,000)	NA
Methylene chloride	84	29	310	190	ND(900)	ND(5,000)	ND(280)	ND(280)	ND(60)	ND(290)	ND(190)	ND(900)	NA
m,p-Xylene	300	2.8	350	ND(3 1)	2,500	ND(5,000)	14,000	11,000	ND(60)	1,700	ND(190)	3,100	NA

C01424

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TABLE 6 (CONTINUED)

Analyte	Run 1 8-28-93		Run 2 8-29-93		Run 4 8-31-93		Run 5 9-01-93			Run 6 9-02-93		Run 7 9-03-93	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Inlet Dup	Outlet	Inlet	Outlet	Inlet	Outlet*
n-Octane	200	ND(0.7)	210	ND(3.1)	2,000	ND(5,000)	4,000	3,900	ND(60)	1,200	ND(190)	ND(900)	NA
o-Xylene	150	1.5	170	ND(3.1)	1,100	ND(5,000)	7,300	7,200	ND(60)	820	ND(190)	1,400	NA
Propylene	3,800 E	2.5	7,300	610	350,000E	630,000	110,000E	110,000E	22,000 E	75,000 E	31,000	220,000E	NA
Tetrachloroethene	ND(8)	1.1	ND(55)	ND(3.1)	ND(900)	ND(5,000)	ND(280)	ND(280)	ND(60)	ND(290)	ND(190)	ND(900)	NA
Toluene	870	3.3	1,100	ND(3.1)	12,000	ND(5,000)	39,000	39,000	ND(60)	5,300	ND(190)	18,000	NA
Vinyl chloride	ND(8)	ND(0.7)	100	ND(3.1)	ND(900)	ND(5,000)	ND(280)	ND(280)	ND(60)	ND(290)	ND(190)	ND(900)	NA

Notes:

* - Run 7 outlet sample was lost due to flow controller becoming clogged.
NA - Not Analyzed
E - Estimated value, result exceeds instrument calibration range.
Inlet - Sample collected prior to carbon absorption bed
Outlet - Sample collected after carbon absorption bed, but prior to discharge to the atmosphere
ND - Analyte was not detected above the detection/reporting limit. The number shown in parentheses is the detection/reporting limit

001135

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TABLE 7

BCD-KOPPERS DEMONSTRATION
MTTD TEST RUNS
ANALYTICAL RESULTS FOR VARIOUS INORGANIC AND PHYSICAL PARAMETERS IN OFF-GAS SAMPLES

Analyte	Units	Run 1		Run 2		Run 4		Run 5		Run 6		Run 7	
		Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
HCl*	(mg/dscm)	0.197	0.113	6.027	0.153	0.232	0.067	0.169	0.052	0.400	0.230	5.71	0.47
Cl2*	(mg/dscm)	0.094	0.089	0.184	0.406	0.090	0.037	0.105	0.039	0.109	0.073	0.361	0.0214
HF	(mg/dscm)	NA	ND(0.01)	NA	ND(0.01)	NA	ND(0.01)	NA	ND(0.01)	NA	ND(0.01)	NA	ND(0.01)
Particulate	(gr/dscf)	0.037	0.021	0.040	0.021	0.001	0.0001	0.005	0.005	0.021	0.012	0.049	0.028
Particulate	(lb/hr)	0.024	0.013	0.022	0.012	0.001	0.0002	0.003	0.003	0.009	0.005	0.023	0.013

Notes:

*	-	Reported as chloride
NA	-	Not analyzed
dscm	-	Dry Standard Cubic Meter
dscf	-	Dry Standard Cubic Foot
Inlet	-	Sample collected prior to carbon absorption bed
Outlet	-	Sample collected after carbon absorption bed, but prior to discharge to the atmosphere
ND	-	Analyte was not detected above the detection/reporting limit. The number shown in parentheses is the detection reporting limit

C02135

TABLE 8

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BCD KOPPERS DEMONSTRATION
MTTD TEST RUNS
ANALYTICAL RESULTS FOR SEMIVOLATILE
ORGANIC COMPOUNDS (METHOD 8270)
IN WATER SCRUBBER SAMPLES (µg/l)

Analyte	CW-SL9-G1	CW-SL9-G2	CW-SL9-G3	CW-SL9-G3D
Pentachlorophenol	150,000	150,000	170,000	180,000
2,4,5-Trichlorophenol	9,900ª (14,000)	12,000ª (16,000)	12,000ª (16,000)	14,000ª (14,000)
2,4 Dichlorophenol	9,800ª (14,000)	10,000ª (16,000)	9,000ª (16,000)	13,000ª (14,000)
Phenol	150,000	160,000	160,000	150,000
3-Chlorophenol	83,000 JN(1)	68,000 JN(1)	64,000 JN(1)	ND
2,3,4,5-Tetrachlorophenol	ND	ND	42,000 JN(1)	ND
Chlorophenols	ND	ND[b]	ND	ND
Dichlorophenols	149,000 JN(2)	193,000 JN(2)	182,000 JN(2)	196,000 JN(2)
Trichlorophenols	77,000 JN(2)	100,000 JN(2)	96,000 JN(2)	92,000 JN(1)
Tetrachlorophenols	75,000 JN(2)	71,000 JN(2)	51,000 JN(1)	103,000 JN(2)

Notes :

ª - Detected at a concentration below the reporting limit shown in parentheses
ᵇ - Only Tentatively Identified Compounds (TIC's) that are chlorinated phenols are included in the table
CW - Condensed Scrubber Water
SL - Sample location number
G - Grab sample number
D - Field duplicate sample
ND - Analyte was not detected above the detection limit; the number shown in parentheses, when provided, is the reporting limit.
JN - The analysis indicates the presence of analyte for which there is presumptive evidence for a "tentative identification". The associated number is an estimated value. The number in parentheses identifies the number of compounds which sum to the listed estimated concentration

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TABLE 2

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BCD-KOPPERS DEMONSTRATION
MTTD TEST RUNS
ANALYTICAL RESULTS FOR PCDDs/Fs (METHOD 8280)
IN SCRUBBER WATER SAMPLES (ng/l)

Analyte	CW-SL9-G1		CW-SL9-G2		CW-SL9-G3		CW-SL9-G3D	
2,3,7,8-TCDD	2,460		1,840		1,880		1,750	
Total TCDD	90,200		67,000		65,400		62,600	
2,3,7,8-TCDF	280	U	318	U	79.6	U	117	U
Total TCDF	12,400	J	10,200	J	9,760	J	9,060	J
Total PeCDD	98,000		71,800		72,000		69,200	
Total PeCDF	11,900	J	8,820	J	9,220	J	7,880	J
Total HxCDD	144,000		109,000		112,000		101,000	
Total HxCDF	12,200	J	9,100	J	8,800	J	8,840	J
Total HpCDD	130,000	J	99,600	J	105,000	J	109,000	J
Total HpCDF	8,000		6,160		6,880		6,440	
OCDD	108,000	J	83,400	J	81,800	J	95,400	J
OCDF	2,720		2,100		2,060		1,890	

Notes :

TCDD	-	Tetrachlorinated dibenzo-p-dioxin	HxCDF	-	Hexachlorinated dibenzofuran
TCDF	-	Tetrachlorinated dibenzofuran	HpCDD	-	Heptachlorinated dibenzo-p-dioxin
PeCDD	-	Pentachlorinated dibenzo-p-dioxin	HpCDF	-	Heptachlorinated dibenzofuran
PeCDF	-	Pentachlorinated dibenzofuran	OCDD	-	Octachlorodibenzo-p-dioxin
HxCDD	-	Hexachlorinated dibenzo-p-dioxin	OCDF	-	Octachlorodibenzofuran
G	-	Grab sample number	D	-	Field duplicate sample
CW	-	Condensed scrubber water	SL	-	Sample location number

J - The analyte was positively identified. The associated number is an estimated value.
U - The analyte was analyzed for, but was not detected at the level reported.

CO1183

TABLE 10

BCD-KOPPERS DEMONSTRATION
MTTD TEST RUNS
ANALYTICAL RESULTS FOR
VOLATILE ORGANIC COMPOUNDS (METHOD 8240)
IN WATER SCRUBBER SAMPLES[b] (µg/l)

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Analyte	CW-SL9-G1	CW-SL9-G2	CW-SL9-G3	CW-SL9-G3D
Chloromethane	920	950	990[a] (1,000)	980
Acetone	11,000	11,000	12,000	12,000
2-Butanone	6,300	7,100	6,400	6,700
Benzene	3,500	4,900	4,800	5,200
4-Methyl-2-pentanone	220	ND (400)	ND (1,000)	ND (400)
2-Hexanone	1,300	1,300	630[a] (1,000)	1,500
Toluene	2,700	3,200	2,700	3,800
Ethylbenzene	540	460	320[a] (500)	670
Styrene	1,000	940	710	1,300
Total xylenes	1,900	1,500	1,100	2,400

Notes :

[a] - Detected at a concentration below the reporting limit shown in parentheses
[b] - Tentatively Identified Compounds (TIC's) are not included in this table
CW - Condensed Scrubber Water
SL - Sample location number
G - Grab sample number
D - Field duplicate sample
ND - Analyte was not detected above the detection limit; the number shown in parentheses is the reporting limit

TABLE 11

RCD-KOPPERS DEMONSTRATION
MTTD TEST RUNS
ANALYTICAL RESULTS FOR
GENERAL CHEMISTRY ANALYSES FOR
SCRUBBER WATER SAMPLES

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Analyte	CW-SL9-G1	CW-SL9-G2	CW-SL9-G3	CW-SL9-G3D
Chloride (mg/l), Method E325.3	2,100	2,130	2,040	2,120
pH, Method SW9040	2.26	2.20	2.23	2.23
TOC (mg/l), Method SW9060	1,100	983	990	916
TSS (mg/l), Method E160.2	630	586	464	623
Oil and Grease (mg/l), Method E413.2	3.79	4.26	3.45	2.97

Notes :

CW - Condensed Scrubber Water
SL - Sample location number
G - Grab sample number
D - Field duplicate sample

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TABLE 12

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BCD-KOPPERS DEMONSTRATION
LTR TEST RUNS
ANALYTICAL RESULTS FOR SEMIVOLATILE
ORGANIC COMPOUNDS (METHOD 8270)
LTR OIL SAMPLES[b] (µg/kg)

Analyte	TEST RUN 1						CRE (%)
	Input			Output			
	LTR1-SL6-G1	LTR1-SL6-G2	LTR1-SL6-G3	LTR1-SL7-G1	LTR1-SL7-G2	LTR1-SL7-G3	
Pentachlorophenol	170,000	170,000	180,000	15,000	320 J	1,600 U	96.92[a]
2,4,5-Trichlorophenol	3,700	4,100	4,600	2,000 U	1,600 U	1,600 U	
2,4,6-Trichlorophenol	1,600 U	1,600 U	1,600 U	2,000 U	1,600 U	1,600 U	
2,4-Dichlorophenol	660 J	680 J	790 J	2,000 U	1,600 U	1,600 U	
Phenol	820 J	870 J	930 J	5,300	7,500	5,700	
Tetrachlorophenols	26,000JN(2)	19,000 JN(1)	51,000 JN(2)	3,000 JN(1)	ND	ND	
Trichlorophenols	11,900 JN(2)	13,800 JN(2)	23,000 JN(2)	ND	ND	ND	
Dichlorophenols	12,000 JN(2)	27,700 JN (3)	23,200 JN(2)	ND	ND	ND	

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TABLE 13

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BCD-KOPPERS DEMONSTRATION
LTR TEST RUNS
ANALYTICAL RESULTS FOR
PCDDs/Fs (METHODS 8280, 8290)
IN LTR OIL SAMPLES (ng/g)

Analyte	TEST RUN 1						
	Input			Output			CRE (%)
	LTR1-SL6-G1	LTR1-SL6-G2	LTR1-SL6-G3	LTR1-SL7-G1	LTR1-SL7-G2	LTR1-SL7-G3	
2,3,7,8-TCDD	594 J	571 J	521 J	0.051 U	0.237 U	0 161 U	≥ 99.99
Total TCDD	17,500	18,200	17,500	0.227 U	0.237 U	0.161 U	≥ 99.99
2,3,7,8-TCDF	46.6 U	45.1 U	56.7 U	0 042 U	0 090 U	0.144 U	NA
Total TCDF	751 J	767 J	658 J	0 084 U	0 090 U	0 144 U	≥ 99.99
Total PeCDD	15,400	14,200	13,800	0.328 U	0.253 U	0.137 U	≥ 99.99
Total PeCDF	233	264 J	275 U	0 211 J	0 075 U	0.171 U	99.97
Total HxCDD	13,100	12,500	12,200	0 047 J	0 130 U	0.167 U	99 99
Total HxCDF	350 J	400 U	143	0 557 J	0 082 U	0 126 U	99.99
Total HpCDD	9,850	10,300	9380	1 540 U	0 330 U	0 222 U	≥ 99 98
Total HpCDF	1,440 J	1,070 J	1,460	0.402 U	0 081 U	0 093 U	≥ 99.99
OCDD	9,250	8,810	8,460	14	0 353 U	0 969 U	99.84
OCDF	166	331 U	314 U	0.489 U	0.059 U	0 208 U	≥ 99.96

TABLE 13 (CONTINUED)

Analyte	TEST RUN 2								
	Input				Output				CRE (%)
	LTR2-SL6-G1	LTR2-SL6-G2	LTR2-SL6-G3	LTR2-SL6-G3D	LTR2-SL7-G1	LTR2-SL7-G2	LTR2-SL7-G3	LTR2-SL7-G3D	
2,3,7,8-TCDD	536 J	716 J	608 J	679 J	0.155 U	0.245 U	0.142 U	0.163 U	≥ 99.98
Total TCDD	16,000	17,400	9,230	19,200	0.242 U	0.389 U	0.164 U	0.322 U	≥ 99.99
2,3,7,8-TCDF	106 U	141 U	81.8 U	93.7 U	0.097 U	0.139 U	0.088 U	0.133 U	NA
Total TCDF	315 J	575 J	816 J	1,290 J	0.097 U	0.139 U	0.088 U	0.133 U	≥ 99.99
Total PeCDD	20,000	20,900	20,600	22,900	0.308 U	0.262 U	0.144 U	0.086 U	≥ 99.99
Total PeCDF	1,060 J	372 J	1,200 J	602 J	0.146 U	0.151 U	0.09 U	0.103 U	≥ 99.99
Total HxCDD	20,300	24,500	21,100	28,300	0.195 U	0.488 U	0.295 U	0.372 U	≥ 99.99
Total HxCDF	1,400 J	841 J	741 J	1,590 J	0.126 U	0.09 U	0.139 U	0.095 U	≥ 99.99
Total HpCDD	17,200	19,300	17,200	19,500	0.556 U	1.12 U	0.509 U	0.659 U	≥ 99.99
Total HpCDF	1,090	1,160	1,150	1,400 J	0.098 U	0.128 U	0.117 U	0.17 U	≥ 99.99
OCDD	17,800	19,600	17,700	20,200	1.05 U	4.9 U	1.560 U	1.51 U	≥ 99.99
OCDF	280 J	415 J	311 J	411 J	0.137 U	0.273 U	0.081 U	0.189 U	≥ 99.99

Notes :

LTR - LTR test run number.
SL - Sample location number.
G - Grab sample number
D - Field Duplicate sample
TCDD - Tetrachlorinated dibenzo-p-dioxin.
HpCDD - Heptachlorinated dibenzo-p-dioxin
LD - Laborotory duplicate sample.
HxCDD - Hexachlorinated dibenzo-p-dioxin
PeCDD - Pentachlorinated dibenzo-p-dioxin
OCDD - Octachlorodibenzo-p-dioxin
TCDF - Tetrachlorinated dibenzofuran
HpCDF - Heptachlorinated dibenzofuran
HxCDF - Hexachlorinated dibenzofuran
PeCDF - Pentachlorinated dibenzofuran
OCDF - Octachlorodibenzofuran
J - The analyte was positively identified. The associated number is an estimated value.
U - The analyte was analyzed for, but was not detected at the level reported.

C03195

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TABLE 14

BCD-KOPPERS DEMONSTRATION
LTR TEST RUN 1
ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS
IN OFF-GAS SAMPLES, METHOD
(ppbv)

Analyte	LTR Test Run 1
1,1,1-Trichloroethane	8,700
1,2-Dichlorobenzene	ND (3,500)
1,2,4-Trichlorobenzene	ND (3,500)
1,2,4-Trimethylbenzene	14,000
1,3-Butadiene	ND (3,500)
1,3-Dichlorobenzene	ND (3,500)
1,3,5-Trimethylbenzene	6,900
Acetonitrile	ND (35,000)
Benzene	ND (3,500)
Bromomethane	ND (3,500)
Chlorobenzene	ND (3,500)
Chloroethane	ND (3,500)
Chloromethane	ND (3,500)
Ethyl benzene	56,000
Ethyl toluene	19,000
Methylene chloride	ND (3,500)
m,p-Xylene	120,000
n-Octane	180,000
o-Xylene	71,000
Propylene	1,100,000 E
Tetrachloroethene	ND (3,500)
Toluene	320,000
Vinyl chloride	ND (3,500)

Notes:

ppbv - parts per billion by volume
E - Result exceeds instrument calibration range
ND - Analyte was not detected above the detection/reporting limit shown in parentheses.

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TABLE 15

BCD-KOPPERS DEMONSTRATION
LTR TEST RUN 2
ANALYTICAL RESULTS FOR VOLATILE ORGANIC COMPOUNDS IN OFF-GAS SAMPLES, METHOD
(μG/dscm)

Analyte	LTR Test Run 2
1,2-Dichlorobenzene	ND (2,050)
1,2,4-Trichlorobenzene	ND (1,900)
1,3-Dichlorobenzene	ND (2,310)
1,4-Dichlorobenzene	ND (1,900)
2-Methylnapthalene	28,035
2-Methylphenol	ND (1,000)
2,4-Dichlorophenol	ND (1,830)
2,4-5-Trichlorophenol	ND (1,650)
2,4,6-Trichlorophenol	ND (1,650)
4-Methylphenol	ND (1,500)
Acenaphthylene	ND (1,350)
Anthracene	ND (1,745)
Benzoic acid	ND (12,400)
Benzo(b)fluoranthene	ND (2,920)
Benzo(k)fluoranthene	ND (3,220)
Benzel alcohol	ND (1,970)
Benz(a)anthracene	ND (1,450)
Benz(a)pyrene	ND (1,670)
bis(2-Ethylhexyl)phthalate	ND (1,870)
Butylbenzylphthalate	ND (2,000)
Chrysene	ND (1,750)
Dibenzofuran	ND (1,750)
Diethylphthalate	ND (1,660)
Dimethylphathalate	ND (1,080)
Di-n-butylphthalate	445 J
Di-n-octylphthalate	ND (1,140)
Fluoranthene	1,350 J
Fluorene	3,494
Hexachlorobenzene	ND (1,010)
Isophorone	ND (1,980)
Napthalene	68,740
Pentachlorophenol	ND (2,860)
Phenanthrene	10,830
Phenol	2,840
Pyrene	1,952

Notes:

J - Result is below sample-specific detection limit.
dscm - dry standard cubic meter
ND - Analyte was not detected above the detection/reporting limit shown in parentheses. Results for analytes detected below the detection/reporting limit are reported and J-flagged.

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TABLE 16

BCD-KOPPERS DEMONSTRATION
LTR TEST RUN 1
ANALYTCAL RESULTS FOR PCDD/Fs (METHOD 8280)
IN LTR CONDENSATE (ng/g)

Analyte	LTR1-COND-G1	
2,3,7,8-TCDD	75.4	U
Total TCDD	183	U
2,3,7,8-TCDF	23.1	U
Total TCDF	110	U
Total PeCDD	288	U
Total PeCDF	202	U
Total HxCDD	261	U
Total HxCDF	117	U
Total HpCDD	275	U
Total HpCDF	904	U
OCDD	433	U
OCDF	333	U

Notes :

LTR	-	LTR Test Run number
COND	-	Condensate from LTR Test Run 1
G	-	Grab sample number
TCDD	-	Tetrachlorinated dibenzo-p-dioxin
TCDF	-	Tetrachlorinated dibenzofuran
HpCDD	-	Heptachlorinated dibenzo-p-dioxin
HpCDF	-	Heptachlorinated dibenzofuran
HxCDD	-	Hexachlorinated dibenzo-p-dioxin
HxCDF	-	Hexachlorinated dibenzofuran
PeCDD	-	Pentachlorinated dibenzo-p-dioxin
PeCDF	-	Pentachlorinated dibenzofuran
OCDD	-	Octachlorodibenzo-p-dioxin
OCDF	-	Octachlorodibenzofuran
U	-	The analyte was analyzed for, but was not detected at the level reported.

TABLE 17

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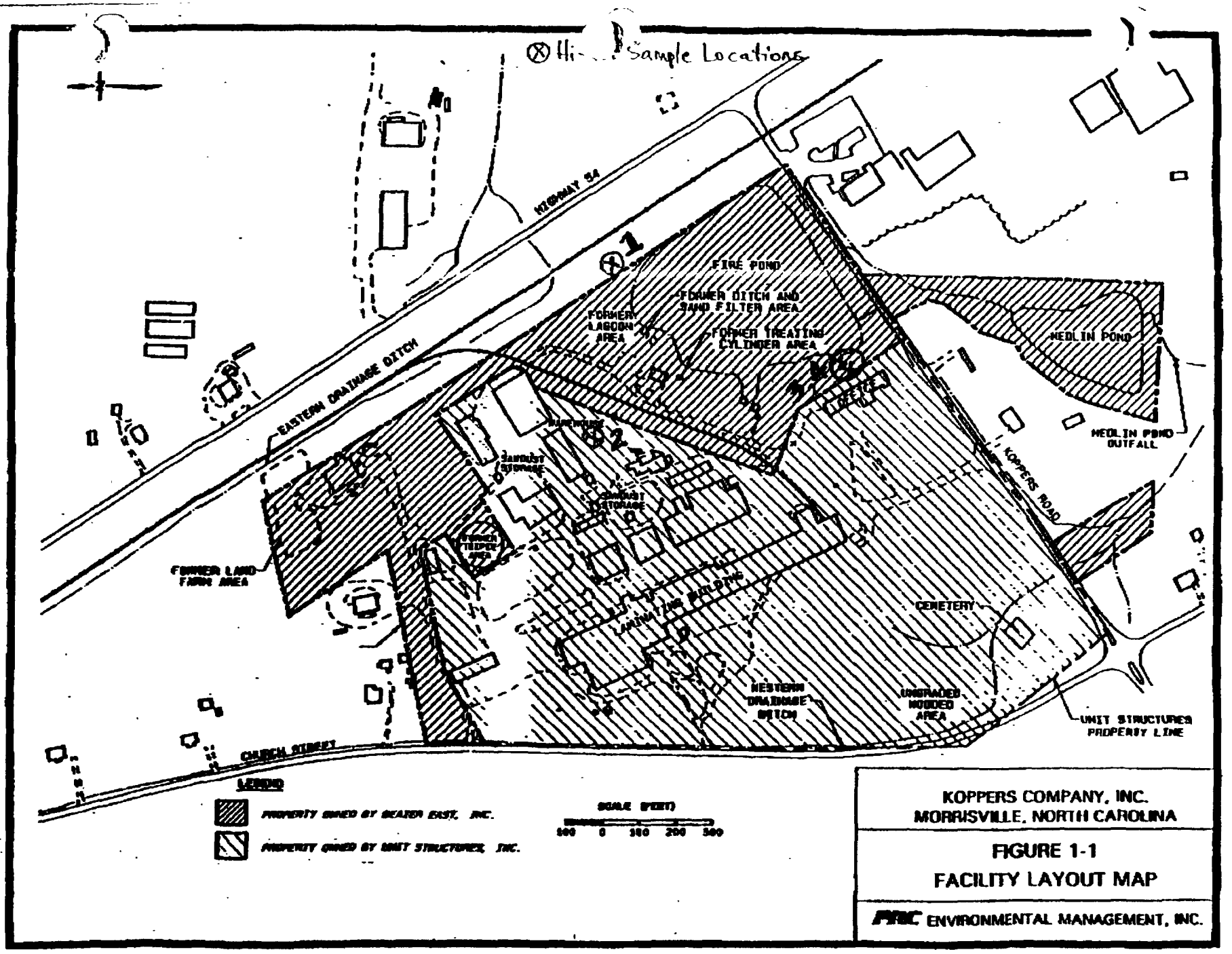
BCD-KOPPERS DEMONSTRATION
LTR TEST RUN 1
ANALYTCAL RESULTS FOR SEMIVOLATILE
ORGANIC COMPOUNDS (METHOD 8270*)
FOR LTR CONDENSATE (µg/kg)
ANALYSIS DATE :

Analyte	LTR1-COND-G1
Pentachlorophenol	ND (12,000,000)

Notes :

ND - Analyte was not detected above the detection limit; the number shown in parentheses is the reporting limit
LTR - LTR test run number
COND - Condensate from LTR Test Run 1
G - Grab sample number
* - Only Tentatively Identified Compounds (TIC's) that are chlorinated phenols are included in the table



KOPPERS COMPANY, INC.
MORRISVILLE, NORTH CAROLINA

FIGURE 1-1
FACILITY LAYOUT MAP

PRC ENVIRONMENTAL MANAGEMENT, INC.

001196

TOTAL MASS OF PCDDs AND PCDFs EMITTED TO THE ATMOSPHERE DURING OPERATION OF THE MTTD

Run Number and Sample Location	Average Volumetric Flow Rate (dscmm)	Duration of Run (min)	Total Gas Flow (dscm)	Sum of Total PCDD and PCDF Concentrations (ng/dscm)	Total Amount of PCDD and PCDF Emitted to Atmosphere (mg)
Run 1, Outlet	2.06	720	1,483	31,214	46.3
Run 2, Outlet	1.86	690	1,283	65,602	84.2
Run 3, Outlet	Assume 1.66 - Average of Other Runs (Outlet)	660	1,096	Assume 38,583 - Average of Other Runs (Outlet)	42.3
Run 4, Outlet	1.36	510	693.6	737.7	0.51
Run 5, Outlet	1.88	570	1,071.6	96,112	103.0
Run 6, Outlet	1.31	570	746.7	18,572.2	13.9
Run 7, Outlet	1.47	540	793.8	19,260.1	15.3

TOTAL MASS OF PCDDs AND PCDFs EMITTED TO ATMOSPHERE DURING OPERATION OF MTTD = 305.51mg ≈ 0.3g

BCD/047-1127/TOTALDXN.TBL

000506

DRAFT REPORT
AIR DISPERSION MODELLING RESULTS
BASE CATALYZED DECOMPOSITION
SITE DEMONSTRATION
KOPPERS, INC.
MORRISVILLE, NC

Prepared by PRC Environmental Management, Inc.
For Terrence Lyons
U.S. Environmental Protection Agency

DRAFT REPORT NOVEMBER 17, 1994

Prepared By: Andy Moser

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List of Tables and Figures

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1.0 Introduction

PRC Environmenta. Management Incorporated (PRC) conducted refined air modelling to determine the impact of stationary sources on air quality at the Superfund Innovative Technology Evaluation (SITE) demonstration of the Base Catalyzed Decomposition (BCD) and Thermo-Detox technologies. These technologies were developed by ETG Environmental, Inc. (ETG) and Separation and Recovery Systems, Inc. (SRS) and demonstrated during August and September , 1993, at Koppers Company in Morrisville, North Carolina. During this demonstration Radian Corporation collected gaseous samples to be analyzed for volatile and semivolatile organic compounds (VOC and SVOC), polychlorinated dibenzodioxins and dibenzofurans (PCDD/PCDF), hydrogen chloride (HCl) and chlorine (Cl_2), and particulate loading. PRC had previously conducted unrefined modelling of the SITE demonstration using SCREEN2, which showed a potential adverse impact of 2,3,7,8-TCDD (TEF Value).

This modelling analysis was conducted in accordance with the U.S. Environmental Protection Agency (EPA) Guideline on Air Quality Models (Revised), February 1993; User's Guide for the Industrial Source Complex (ISC2) Dispersion Models, March 1992; User's Guide to the Building Profile Input Program, October 1993; and PCRAMMET User's Guide, April 1993.This submittal represents five Industrial Source Complex Short-Term (ISCST2) modelling runs incorporating five years off-site surface meteorological data from the Raleigh-Durham National Weather Service Station and upper air meteorological data from the Greensboro-High Point National Weather Service Station.

This report is divided into four sections. The first section is an introduction to the study and section 2.0 discusses the development of the modelling study and the model inputs. Section 3.0 provides a review of the modelling results and section 4.0 presents the conclusion of the modelling analysis.

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2.0 Air Dispersion Model Preparation

The ISCST2 model requires an input file describing source emission parameters, receptor network design, surface and upper air meteorological data file, and other variables affecting processing options and desired output. The basic options set for this modelling analysis included the regulatory default option, rural dispersion coefficients, flat terrain, and concentration values. Deposition values were desired, but the lack of data on the particulate being emitted from the source; specifically the particulate size distribution and the density of the particulates emitted, precluded the calculation of deposition values. ISCST2 was set to calculate 1-hour, 24-hour, and period concentrations. The period concentration for this study is an annual concentration since one full year of meteorological data was used for each model run. The use of a short term model to develop a long term average is an acceptable practice as stated in the Guideline on Air Quality Models (Revised).

The source emission parameters were developed from the sampling data sheets contained in the draft report "Sampling and Analysis Results for Gaseous Samples from the Base Catalyzed Decomposition Technology Site Demonstration at Koppers Company, Inc. Morrisville, North Carolina" Volumes 1 and 2, November 1993, Radian Corporation. All of the required data could be obtained from this report with the exception of the stack height which was estimated at 10 meters based on direct observation and videotape. The temperature at exit was taken directly from the sampling data sheets as well as the exit velocity. The stack diameter was calculated from the area of the stack in square inches from the sampling data sheets. The sampling data sheet used for this modelling study is attached at the end of this report as Appendix A.

The emission rate was calculated from the sample concentrations for chlorinated dibenzo-p-dioxins (CDDs) and chlorinated dibenzo-p-furans (CDFs) on the outlet side of the carbon beds and the flow

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rate of the stack at the sampling point. These cogener concentrations were multiplied by the Toxicity Equivalency Factors (TEFs) to express the concentration in terms of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) equivalents (TEQs) The TEFs used for this calculation were the I-TEFs/89 that EPA has adopted as an interim procedure for assessing the risks associated with exposures to complex mixtures of CDDs and CDFs.

The nonzero TEFs, sample concentrations, and associated calculations performed to develop the TEQ are shown in Table 1. The units for the sample concentrations are nanograms per dry standard cubic meter (ng/dscm). This value was multiplied by the flow rate of 1.88 dry standard meters per minute divided by 60 to convert minutes to seconds and then converted from nanograms per second to grams per second for input to ISCST2.

Table 1. TEQ Determination and Calculation

Compound	TEF	Sample Concentration (ng/dscm)	Value
2,3,7,8-TCDD	1	447	447.00
2,3,7,8-PeCDD	0.5	1750	875.00
2,3,7,8-HxCDD	0.1	4470	447.00
2,3,7,8-HpCDD	0.01	5640	56.40
OCDD	0.001	12700	12.70
2,3,7,8-TCDF	0.1	29.3	2.93
1,2,3,7,8-PeCDF	0.05	125	6.25
2,3,4,7,8-PeCDF	0.5	46.9	23.45
2,3,7,8-HxCDF	0.1	196.18	19.62
2,3,7,8-HpCDF	0.01	172.2	1.72
OCDF	0.001	497	0.50
TEQ value (ng/dscm)			1,892.07

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The model was set to limit the emissions to only the month of August to simulate the time the demonstration actually occurred. The actual time of the demonstration was from August 28 thru September 3, but the ISCST2 model is able to limit emissions by month or hour of day, so one month of emissions was selected as best representative of the demonstration. The emission units of the model were changed to calculate concentrations in nanograms per cubic meter rather than the default units of micrograms per cubic meter, since ISCST2 reports concentrations out to five decimal places concentrations in micrograms per cubic meter would be reported as 0.00000.

ISCST2 was set to perform calculations on the effects of building downwash. The direction specific building heights and building widths were calculated using the Building Profile Input Program (BPIP) version 94074. Three buildings were input to this program with the source location using a cartesian coordinate system. The BPIP results showed that only one of the three buildings produced a Good Engineering Practice (GEP) 5L area of influence which contained the source stack. The output of the BPIP program was used as input for the ISCST2 model.

Three receptor networks were designed for the modelling study. A receptor network for the property boundary was developed using the BOUNDARY option of ISCST2. This option places a receptor every ten degrees at a user specified location for 360 degrees around the source. The user specified location is the distance measured from the source to the property boundary. The second receptor network was a polar grid centered on the source stack with six rings at 75, 100, 125, 150, 200 and 250 meters from the source and a receptor placed every ten degrees for 360 degrees. The third receptor network consisted of ten discrete cartesian coordinates placed on Highway 54 adjacent to the property boundary. These three receptor networks provided a total of 262 receptors around the source stack.

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The meteorological data chosen for this study included surface data from the Raleigh-Durham National Weather Service Station and upper air data from the Greensboro-High Point National Weather Service Station. The time period for the data used was 1986 thru 1991, excluding 1988. The upper air data from the Greensboro-High Point Station was missing for 1988. The meteorological data was downloaded from the Support Center for Regulatory Air Models (SCRAM) and processed first using MET144 to the expand the surface data to CD144 format and then with PCRAMMET to prepare the data for use by ISCST2.

3.0 Modelling Results

The modelling results for the five years of meteorological are presented in Table 2. This table reports the year processed, the maximum predicted concentration, the location of the maximum, and the date of occurrence for the one hour and twenty-four hour short term maximums. Since the period maximum is averaged over the duration of the meteorological data, there is no data of occurrence reported. The date of occurrence is in the form of YYMMDDHH, where YY is the year, MM is the month, DD is the day, and HH is the hour.

The results of the five ISCST2 model runs show that a predicted maximum period (annual) concentration of .00045 ng/m^3 occurs during the 1990 model year at receptor location -73.86, 13.02. This location of this receptor is shown in Figure 1. The North Carolina Toxic Air Pollutant Guidelines lists an annual guideline for tetrchlorodibenzo-p-dioxin of 3.0E-09 milligrams per cubic meter. The maximum predicted period (annual) concentration from ISCST2 is 4.5E-10 milligrams per cubic meter or 15 % of the annual Toxic Air Pollutant Guideline.

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does not mean

Table 2. Modelling Results of ISCST2.

	Maximum (ng/m^3)	'X' Location (meters)	'Y' Location (meters)	Date of Occurrence
1986				
1 Hour Max	.06401	70.48	25.65	86082802
24 Hour Max	.00752	-73.86	13.02	86080524
Period Max	.00018	-73.86	13.02	NA
1987				
1 Hour Max	.05469	73.86	13.02	87082907
24 Hour Max	.00935	-48.21	57.45	97080824
Period Max	.00019	-57.45	48.21	NA
1989				
1 Hour Max	.04729	70.48	25.65	89080408
24 Hour Max	.00930	-64.95	37.50	89081324
Period Max	.00018	-70.48	25.65	NA
1990				
1 Hour Max	.07132	70.48	25.65	90081503
24 Hour Max	.01620	-73.86	13.02	90082224
Period Max	.00045	-73.86	13.02	NA
1991				
1 Hour Max	.06151	70.48	25.65	91080308
24 Hour Max	.01243	-73.86	13.02	91082324
Period Max	.00029	-64.95	37.50	NA

4.0 Conclusions

The previous screening results showed that only Run 5 TEQs produced a potential adverse impact on Air Quality from the SITE BCD Demonstration. This refined modelling analysis using ISCST2 show

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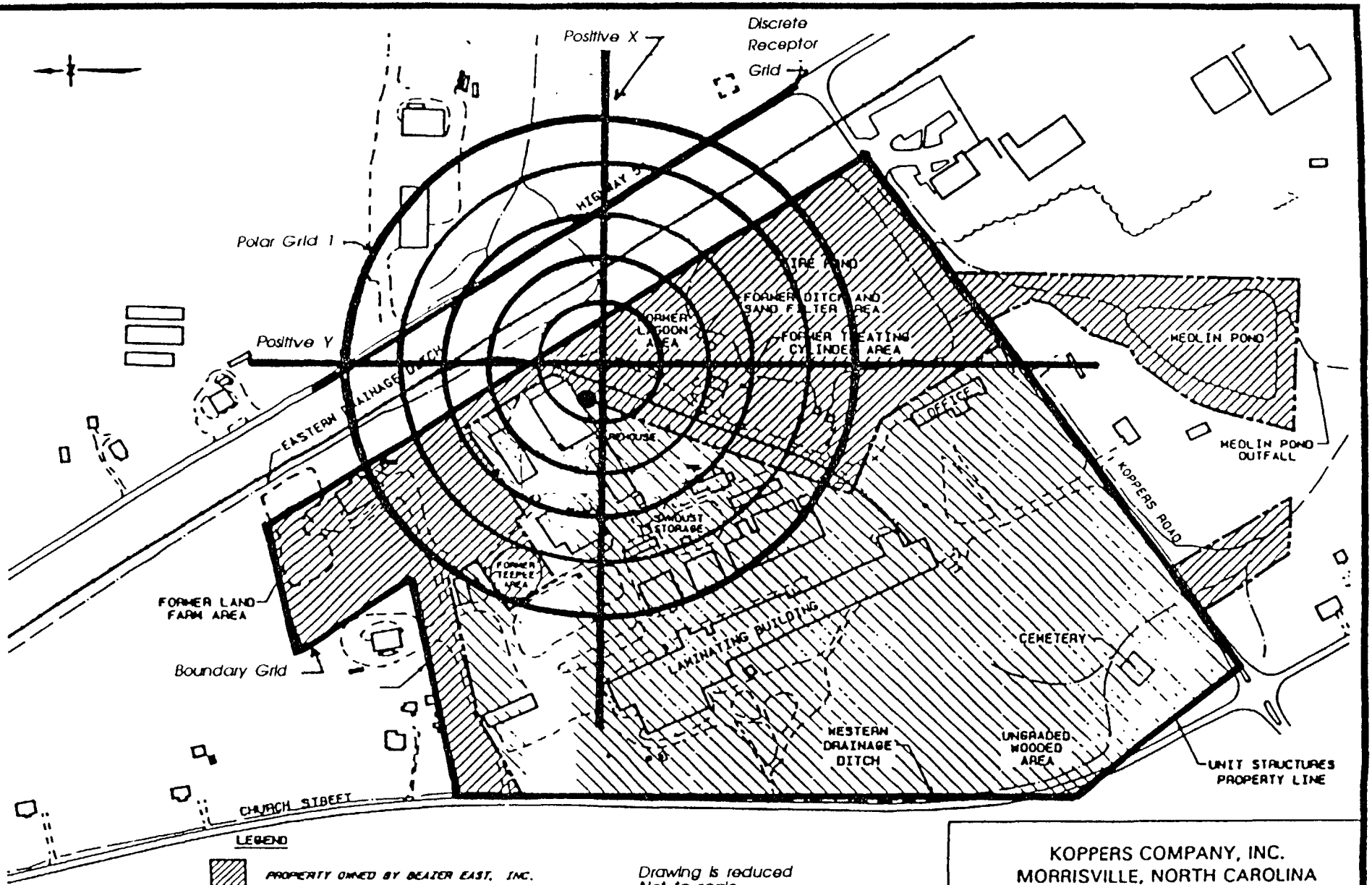

KOPPERS COMPANY, INC.
MORRISVILLE, NORTH CAROLINA

FIGURE 1-1
FACILITY LAYOUT MAP

PRC ENVIRONMENTAL MANAGEMENT, INC.

that the North Carolina Toxic Air Pollutant Annual Guideline for tertrachlorodibenzo-p-dioxin was not violated and Run 5 produced an average annual concentration that was 15 % of the annual guideline.

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Facility:	BCD
Date:	9/01/93
Location:	Outlet
Run Number:	5
Sample Type:	CDD/CDF

Total Sampling Time (min)	240.0
Corrected Barometric Pressure (in Hg)	29.69
Absolute Stack Pressure (in H2O)	29.71
Stack Static Pressure (in H2O)	0.24
Average Stack Temperature (°F)	100.81
Stack Area (sq in)	7.07
Actual Meter Volume (cu ft)	125.186
Average Meter Pressure (in H2O)	0.80
Average Meter Temperature (°F)	85.18
Moisture Collected (g)	82.50
Carbon Dioxide Concentration (%V)	1.0
Oxygen Concentration (%V)	20.0
Nitrogen Concentration (%V)	79.0
Dry Gas Meter Factor	0.9928
Nozzle Diameter (in)	0.257
Pitot Constant	0.84

Average Sampling Rate (dscfm)	0.499
Standard Metered Volume (dscf)	119.742
Standard Metered Volume (dscm)	3.391
Stack Moisture (%V)	3.15
Mole Fraction Dry Stack Gas	0.969
Dry Molecular Weight	28.96
Wet Molecular Weight	28.62
Stack Gas Velocity (fpm)	1497.00
Stack Gas Velocity (mpm)	456.29
Volumetric Flow Rate (acfm)	73.48
Volumetric Flow Rate (acmm)	2.08
Volumetric Flow Rate (dscfm)	66.53
Volumetric Flow Rate (dscmm)	1.88
Percent Isokinetic	102.19
Percent Excess Air	2294.10
Fuel Factor	0.900
Ultimate CO2	23.2

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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (8760 HRS) RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID	AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
ALL	1ST HIGHEST VALUE IS	.00018 AT (-73.86, 13.02, .00, .00)	GP	POLAR1
	2ND HIGHEST VALUE IS	.00018 AT (-75.00, .00, .00, .00)	GP	POLAR1
	3RD HIGHEST VALUE IS	.00018 AT (-70.48, 25.65, .00, .00)	GP	POLAR1
	4TH HIGHEST VALUE IS	.00016 AT (-64.95, 37.50, .00, .00)	GP	POLAR1
	5TH HIGHEST VALUE IS	.00016 AT (-73.86, -13.02, .00, .00)	GP	POLAR1
	6TH HIGHEST VALUE IS	.00015 AT (-57.45, 48.21, .00, .00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	.06401	ON 86082802: AT (	70.48,	25.65,	.00,	.00)	GP	POLAR1
	HIGH 2ND HIGH VALUE IS	.03963	ON 86082802: AT (	73.86,	13.02,	.00,	.00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

NOV-17-1994 15:52
0111404577 270
P.015
NOV 17 '94 05:48PM PRC EMI ATLANTA
P.15/28
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*** ISCST2 - VERSION 93109 *** *** BCD-Koppers, Inc. Demonstration Morrisville, NC *** 11/16/94
*** Sample Run Number 5 1986 MET DATA *** 10:51:25
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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID	AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
ALL HIGH 1ST HIGH VALUE IS	.00752c	ON 86080524:	AT (-73.86, 13.02, .00, .00)	GP	POLAR1
HIGH 2ND HIGH VALUE IS	.00728c	ON 86081524:	AT (-73.86, 13.02, .00, .00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (8760 HRS) RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
ALL	1ST HIGHEST VALUE IS	.00019 AT	-57.45,	48.21,	.00,	.00)	GP	POLAR1
	2ND HIGHEST VALUE IS	.00019 AT	-48.21,	57.45,	.00,	.00)	GP	POLAR1
	3RD HIGHEST VALUE IS	.00018 AT	-64.95,	37.50,	.00,	.00)	GP	POLAR1
	4TH HIGHEST VALUE IS	.00018 AT	-37.50,	64.95,	.00,	.00)	GP	POLAR1
	5TH HIGHEST VALUE IS	.00016 AT	-70.48,	25.65,	.00,	.00)	GP	POLAR1
	6TH HIGHEST VALUE IS	.00015 AT	-73.86,	13.02,	.00,	.00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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NOV 17 '94 05:48PM PRC EMI ATLANTA

C0435

*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID	AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
ALL HIGH 1ST HIGH VALUE IS	.05469	ON 87082907: AT (73.86, 13.02, .00, .00)		GP	POLAR1
HIGH 2ND HIGH VALUE IS	.04505	ON 87080810: AT (70.48, 25.65, .00, .00)		GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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NOV 17 '94 05:48PM PRC EMI ATLANTA
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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID	AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
ALL HIGH 1ST HIGH VALUE IS	.00935c	ON 87080824:	AT (-48.21, 57.45, .00, .00)	GP	POLAR1
HIGH 2ND HIGH VALUE IS	.00798c	ON 87080824:	AT (-57.45, 48.21, .00, .00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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*** ISCST2 - VERSION 93109 *** *** BCD-Koppers, Inc. Demonstration Morrisville, NC *** 11/16/94
*** Sample Run Number 5 1989 MET DATA *** 10:59:11
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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (8760 HRS) RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
ALL	1ST HIGHEST VALUE IS	.00018 AT (	-70.48,	25.65,	.00,	.00)	GP	POLAR1
	2ND HIGHEST VALUE IS	.00018 AT (	-73.86,	13.02,	.00,	.00)	GP	POLAR1
	3RD HIGHEST VALUE IS	.00016 AT (	-64.95,	37.50,	.00,	.00)	GP	POLAR1
	4TH HIGHEST VALUE IS	.00015 AT (	-75.00,	.00,	.00,	.00)	GP	POLAR1
	5TH HIGHEST VALUE IS	.00015 AT (	36.02,	-6.35,	.00,	.00)	BD	
	6TH HIGHEST VALUE IS	.00014 AT (	-57.45,	48.21,	.00,	.00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	.04729	ON 89080408: AT (	70.48,	25.65,	.00,	.00)	GP	POLAR1
	HIGH 2ND HIGH VALUE IS	.04488	ON 89080522: AT (	70.48,	25.65,	.00,	.00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	.00930c	ON 89082724: AT (	-64.95,	37.50,	.00,	.00)	GP	POLAR1
	HIGH 2ND HIGH VALUE IS	.00773	ON 89081324: AT (	-73.86,	13.02,	.00,	.00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (8760 HRS) RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	GRID-ID
ALL	1ST HIGHEST VALUE IS	.00045 AT (	-73.86, 13.02, .00, .00)	GP	POLAR1
	2ND HIGHEST VALUE IS	.00041 AT (	-75.00, .00, .00, .00)	GP	POLAR1
	3RD HIGHEST VALUE IS	.00038 AT (	-98.48, 17.36, .00, .00)	GP	POLAR1
	4TH HIGHEST VALUE IS	.00037 AT (	-70.48, 25.65, .00, .00)	GP	POLAR1
	5TH HIGHEST VALUE IS	.00033 AT (	-100.00, .00, .00, .00)	GP	POLAR1
	6TH HIGHEST VALUE IS	.00031 AT (	-123.10, 21.71, .00, .00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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NOV 17 '94 05:49PM PRC EMI ATLANTA
P.23/28

*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	DATE (YYMMODHR)	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	.07132	ON 90081503: AT (	70.48,	25.65,	.00,	.00)	GP	POLAR1
	HIGH 2ND HIGH VALUE IS	.05247	ON 90082605: AT (	70.48,	25.65,	.00,	.00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	.01620c	ON 90082224:	AT (-73.86, 13.02, .00, .00)	GP	POLAR1
	HIGH 2ND HIGH VALUE IS	.01317c	ON 90082224:	AT (-75.00, .00, .00, .00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

NOV-17-1994 16:54
2111404577407Q
P.025
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001523
P.25/28

*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (8760 HRS) RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
ALL	1ST HIGHEST VALUE IS	.00029 AT	-64.95,	37.50,	.00,	.00)	GP	POLAR1
	2ND HIGHEST VALUE IS	.00028 AT	-70.48,	25.65,	.00,	.00)	GP	POLAR1
	3RD HIGHEST VALUE IS	.00027 AT	-57.45,	48.21,	.00,	.00)	GP	POLAR1
	4TH HIGHEST VALUE IS	.00025 AT	-48.21,	57.45,	.00,	.00)	GP	POLAR1
	5TH HIGHEST VALUE IS	.00024 AT	-73.86,	13.02,	.00,	.00)	GP	POLAR1
	6TH HIGHEST VALUE IS	.00022 AT	-86.60,	58.00,	.00,	.00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
OC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	.06151	ON 91080308:	AT (70.48, 25.65, .00, .00)	GP	POLAR1
	HIGH 2ND HIGH VALUE IS	.05247	ON 91081523:	AT (70.48, 25.65, .00, .00)	GP	POLAR1

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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*** ISCST2 - VERSION 93109 *** *** BCD-Koppers, Inc. Demonstration Morrisville, NC *** 11/16/94
*** Sample Run Number 5 1991 MET DATA *** 11:06:47
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*** MODELING OPTIONS USED: CONC RURAL FLAT DFAULT

*** THE SUMMARY OF HIGHEST 24-HR RESULTS ***

** CONC OF TEFVALUE IN NANOGRAMS/M**3 **

GROUP ID		AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
ALL	HIGH 1ST HIGH VALUE IS	.01243c	ON 91082324: AT (	-73.86,	13.02,	.00,	.00)	GP	POLAR1
	HIGH 2ND HIGH VALUE IS	.01067c	ON 91082124: AT (	36.02,	-6.35,	.00,	.00)	BD	

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

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