ANL/EES-TM-21

ENVIRONMENTAL CONTROL TECHNOLOGY SURVEY OF SELECTED U. S. STRIP MINING SITES

Sampling and Sample Handling Procedures For Priority Pollutants In Surface Coal Mining Wastewaters

Prepared for the
U. S. Department of Energy's
Division of Environmental Control Technology

ENERGY & MINERAL RESOURCES PROGRAMS

ENERGY & ENVIRONMENTAL SYSTEMS DIVISION,
ARGONNE NATIONAL LABORATORY

OPERATED FOR
U. S. DEPARTMENT OF ENERGY
UNDER CONTRACT W-31-109-Eng-38

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SAMPLING AND SAMPLE HANDLING PROCEDURES FOR PRIORITY POLLUTANTS IN SURFACE COAL MINING WASTEWATERS

by

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March 1979

Sponsored by the U.S. Department of Energy's
Division of Environmental Control Technology

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FOREWORD

The Argonne National Laboratory program entitled "Environmental Control Technology Survey of Selected U.S. Strip Mining Sites" is funded by the U.S. Department of Energy (DOE). The program was established by an interagency agreement between the DOE's precursor -- the U.S. Energy Research and Development Administration -- and the U.S. Environmental Protection Agency (EPA).

This program has a twofold purpose which is related in part to the interests of its two federal sponsors. The overall issue addressed by both sponsors is the need to satisfy increased coal demand in an environmentally acceptable manner. Each sponsor, however, has particular interests: DOE is interested in the efficacy and practicability of coal mine effluent control options currently in use, identification of control technology problems and needs, and recommendations for research in these areas; the EPA is interested in an assessment of the validity of the recently promulgated effluent limitations guidelines and new source performance standards for the coal mining industry, with this assessment emphasizing seasonal and climatic variation impacts on effluent quantity and quality. A program plan was outlined to: (1) project future coal production levels to the year 2000 as a basis for selection of case-study sites; (2) gather data at surface mine case-study sites on effluent volumes and characteristics; (3) examine the efficacy and economics of current effluent-control systems (treatment facilities and settling ponds); (4) assess the validity of the effluent guidelines; and (5) evaluate potential environmental impacts related to increased surface mining through the end of the century.

Summaries of the program's various aspects are being published in a five-volume set. Volume I contains the projections of future coal production and the rationale behind the case-study site selections. Volume II is a series of reports in which water quality data gathered at the case-study sites are analyzed in terms of potential local impacts. In Volume III, the efficacy and economics of the various types of control technologies are presented, along with an assessment of the feasibility of alternate treatment methods which could offer less costly options and/or

reduce secondary impacts. Volume IV contains an assessment of the EPA and OSM effluent limitations guidelines for the coal mining industry relative to the data collected under this program. Volume V, the final report, assesses the potential environmental impacts related to increased surface mining by extrapolating the case-study-site point data of Volume II over areas where coal mining is likely to increase (Volume I), in light of engineering (Volume III), and legal constraints (Volume IV).

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ABSTRACT

The report describes the procedures used by Argonne National Laboratory to sample surface coal mine effluents in order to obtain field and laboratory data on 110 organic compounds or classes of compounds and 14 metals and minerals that are known as "priority pollutants," plus 5-day biochemical oxygen demand (BOD_5), total organic carbon (TOC), chemical oxygen demand (COD), total dissolved solids (TDS), and total suspended solids (TSS). Included are directions for preparation of sampling containers and equipment, methods of sampling and sample preservation, and field and laboratory protocols, including chain-of-custody procedures. Actual analytical procedures are not described, but their sources are referenced.

1 INTRODUCTION

The EPA/U.S. District Court consent decree of 9 June 1976 designated 110 organic compounds or classes of compounds, as well as 14 metals and minerals, as "Prospective Unambiguous Compounds." These substances have come to be known as "priority pollutants," and are listed in an appendix to this report. The coal mining and processing industry is among the 21 industries listed as possible sources of pollution by these toxic chemicals. To develop regulations for controlling the discharge of pollutants from the mining and processing of coal, the EPA must have information on occurrences and concentrations of each pollutant.

As part of the Environmental Control Technology (ECT) Program at Argonne National Laboratory, a project has been initiated to examine the effluents of a selected number of case-study mines for priority pollutants, and for an additional five environmentally sensitive parameters. The five are: 5-day biochemical oxygen demand (BOD_5); total organic carbon (TOC); chemical oxygen demand (COD); total dissolved solids (TDS); and total suspended solids (TSS). The data collected under this project will provide the information necessary to: (1) assess the need for research and development on methods to control pollution by organic compounds and other toxic

substances; (2) critically review and evaluate limitations to be proposed for these parameters; and (3) in conjunction with other effluent data gathered under the ECT program, provide a complete data base for characterizing effluent parameters in order to aid DOE in assessments of energy development and its impact.

This report describes how Argonne will sample the mine effluents and handle the samples prior to analysis. It includes: a description of, and procedures for preparing, reagents and equipment; effluent field sampling procedures; and custodial procedures for samples from the time they are taken until analysis is complete.

Analytical procedures used in the ECT program have been described in an EPA publication entitled Sampling and Analysis Procedures for Screening of Industrial Effluents for Priority Pollutants, published by the EPA's Environmental Monitoring and Support Laboratory, Cincinnati, Ohio, March, 1977 (revised April 1977). Analytical procedures for the remaining parameters have been described in the 1976 EPA manual Methods for Chemical Analyses of Water and Wastes.

2 REAGENTS AND EQUIPMENT

2.1 REAGENTS

Store all reagents in clean glass bottles with Teflon caps.

2.1.1 Blank Water

Use blank water for control samples and for washing all containers. Blank water is distilled water further purified by passing it through a triple deionizing filter consisting of an activated charcoal cell, a millipore cell, and a final membrane filter. This process provides water with minimal organic contamination.

2.1.2 Sulfuric Acid

Enough 50% sulfuric acid, of the highest purity available, to acidify the samples taken at each site for phenol determination.

2.1.3 Nitric Acid

Enough 35% Ultrapure nitric acid to acifidy the samples taken at each site for determination of metals.

2.1.4 Ascorbic Acid

Enough crystalline ascorbic acid, of the highest purity available, to reduce the chlorine in samples taken at each site for cyanide determination.

2.1.5 Sodium Hydroxide

Enough 10-normal (10N) sodium hydroxide, of the highest purity available, to preserve samples taken at each site for cyanide determination.

2.1.6 Sodium Thiosulfate

Enough of a 0.01N solution, of the highest purity available, to preserve extra samples taken for determination of volatile organics where chlorine is present. (Note: Sodium bisulfate may be used in place of sodium thiosulfate.)

2.2 EQUIPMENT

2.2.1 Glass

One-Liter Amber Glass Bottles

Screw caps - Teflon seals.

For samples taken to analyze for:

Organics
Phenols -- Total Organic Carbon (TOC)
-- Chemical Oxygen Demand (COD)
-- Biological Oxygen Demand (BOD)
Organics

500-mL Glass Bottles

Screw caps - Teflon seals.

For samples taken to analyze for asbestos.

50-mL Hypovials

Teflon disk seals - aluminum crimper caps.

For samples for volatile organics.

2.5-gallon Bottles

No caps.

For compositing samples.

4000-mL Beaker

For sampling.

1000-mL Beaker

For sampling.

250-mL Beakers

For filling hypovials.

50-mL Beakers

For acidifying and testing.

10-mL Glass Pipettes (disposable, if possible)

For acidifying and preserving samples.

2.2.2 Plastic

Use only new plastic sample containers.

500-mL Plastic Bottles

Screw caps.
For taking samples to analyze for cyanide.

250-mL Plastic Bottles

Screw caps.
For taking samples to analyze for total dissolved solids, total suspended solids, and metals.

2.2.3 Other

Crimping Tool

For sealing hypovials.

1 Pair Metal Tongs

For manipulating hypovials.

2 Pair Forceps

For handling seals and caps for hypovials and other containers.

Waterproof Labels and Markers

For labeling sample bottles.

In the field, pack all containers and other equipment for easy access, and protect them from possible contamination or breakage during transport.

3 PREPARATION OF CONTAINERS AND EQUIPMENT

3.1 GLASS BOTTLES, INCLUDING CAPS AND TEFLON SEALS (EXCEPT 50-mL HYPOVIALS, CAPS, AND SEALS) AND ALL BEAKERS AND PIPETTES

a. Wash with hot water and detergent and thoroughly rinse with tap water and blank water.

b. Further rinse with interference-free acetone and methylene chloride.

c. Air-dry in a contaminant-free area.

d. Place Teflon seals and caps on bottles.

e. Seal tops of capless beakers and bottles with prepared aluminum foil (see 3.2).

f. Wrap pipettes in prepared aluminum foil (see 3.2).

g. Affix a blank waterproof label to the side of each bottle and beaker.

3.2 FOIL WRAPPING

a. Rinse all foil wrapping with methylene chloride.

b. Air-dry in a contaminant-free area. (Note: To avoid possible contamination after rinsing with methylene chloride, the side of the foil in contact with a container or piece of equipment should not be touched.)

3.3 50-mL HYPOVIALS, SEALS, AND CAPS

a. Wash with hot water and detergent and thoroughly rinse with tap water and blank water.

b. Air-dry in a contaminant-free area.

c. Individually wrap each hypovial completely in prepared aluminum foil.

d. Wrap Teflon seals and caps in prepared aluminum foil. Wrap one seal and one cap to a package. (Note: To avoid possible organic contamination of samples through handling, the vials, seals, and caps must be untouched inside and outside until after the vial has been sealed with the sample in the field.)

3.4 PLASTIC CONTAINERS

a. Soak in 10% nitric acid.

b. Rinse thoroughly with blank water to remove all residual acid.

c. Air-dry and replace caps on containers.

d. Affix a blank waterproof label to the side of each bottle.

3.5 BLANK WATER

Draw blank water directly from the final filter into properly cleaned glass bottles.

3.6 OTHER EQUIPMENT

Tongs, forceps, and other instruments must be cleaned by following procedures for glassware (3.1 a, b, and c) and wrapping the instruments completely in prepared aluminum foil. (Note: Special preparations are not necessary with the crimper for the hypovials.)

4 FIELD PROTOCOL

4.1 GENERAL

Collect all samples in new containers that have been prepared as described in Sec. 3. Because an effluent sample can be contaminated with organic matter very easily by contact with, for example, fingers or even vehicle emissions, follow the procedures meticulously at every stage.

4.1.1 Logbook

Keep a careful record of all procedures and preparations, in field and laboratory sampling and in analysis, in a logbook with a stitched binding and consecutive numbered pages.

Make all log entries in permanent ink or permanent ballpoint pen.

Make no erasures.

Initial each entry made in the logbook.

Include complete information as to the source and sampling point for each sampling site.

Use separate page (or pages) for each sampling site.

Enter label code for the samples in the log.

4.1.2 Labeling Procedure

Label all samples with waterproof labels, using a waterproof pen. Attach labels to the bottles before going into the field (except for the hypovials). Each label must contain the following information:

a. Mine number
b. Logbook page
c. Date of sampling
d. Time of sampling
e. Site code
f. Purpose code
g. Preservative code

h. Icing code

i. Sampler's initials.

Code Symbols

Site Code

I	Influent site
IC	Influent, composited
E	Effluent
E_1, E_2, etc.	Effluent, if more than one site per mine
PR	Preparation plant.

If samples are taken at other sites, note the sites on the label with an appropriate code symbol; also note that symbol in the logbook.

Purpose Code

01	Organic chloride, PCB, Pesticides
02	Organics
03	Phenols, TOC, COD, BOD
04	Volatile Organics
04Cl	Volatile Organics - Chlorine Present
CY	Cyanide
DS	Total Dissolved, Total Suspended Solids
AS	Asbestos
MP	Metals - EPA
MA	Metals - ANL
BA	Blank - Ambient Air Organics

Preservative Code

N	None
HS	Sulfuric Acid
HN	Nitric Acid
HA	Ascorbic Acid
TS	Sodium Thiosulfate
BS	Sodium Bisulfate
OH	Sodium Hydroxide

Icing Code

C	Sample Iced
CN	Sample Not Iced

5 FIELD PROCEDURES

5.1 SAMPLE LOCATIONS

At each mine, take samples at the influent to the settling ponds, but composite if there is more than one influent; at the preparation plant, when there is one; and at each effluent location, where the water leaves the property. Collect samples at a turbulent, well-mixed section of the flow. If there is standing water in a settling pond, but no flow, collect samples from each pond. Take blank samples only at the effluent of each mine.

5.2 COMPOSITE SAMPLE

In mines having several settling ponds, or one pond fed by more than one influent, collect a composite sample consisting of equal amounts of the influent from each sample location in a clean 2.5-gal.jug.

5.3 USE OF REAGENTS

Pour enough of the reagent from its container into a clean 50-mL beaker. Rinse a clean pipette with reagent from the beaker, and discard the rinse before using the pipette to add reagent to a sample. After use, rinse the beaker and pipette with blank water to remove any remaining chemical.

5.4 ICING

Place samples that require icing in an insulated chest with sufficient ice to maintain sample temperature at 4°C. Maintain this temperature during transport and storage before analysis. Protect sample containers.

6 SAMPLING PROCEDURES

6.1 ORGANIC CHLORIDES, PCB, AND PESTICIDES

a. Withdraw a well-blended aliquot of at least 1000 mL from the composite sample (or take directly from the site), using a clean beaker that has been pre-rinsed with sample material.

b. Pour the sample into a clean, 1-liter amber glass bottle. Replace the Teflon seal and cap provided on the bottle.

c. Label the bottle.

d. Ice the sample.

6.2 ORGANICS FOR GC/MS ANALYSIS

a. Withdraw a well-blended aliquot of at least 1000 mL from the composite sample (or take directly from the site, using a clean beaker that has been pre-rinsed with sample material.

b. Pour the sample into a clean, 1-L amber glass bottle. Replace the Teflon seal and cap provided on the bottle.

c. Take a second sample using the same procedure.

d. Label the bottles.

e. Ice the samples.

6.3 PHENOL, TOC, COD, AND BOD_5

a. Withdraw a well-blended aliquot of at least 2000 mL from the composite sample (or take directly from the site), using a clean beaker that has been pre-rinsed with sample material.

b. Pour the sample into two clean, 1-L amber glass bottles.

c. Preserve the sample by acidifying with 50% H_2SO_4 to a pH 2.0. Test pH on a small amount of sample withdrawn into a clean beaker. Do not put pH testing device directly into the sample bottle.

d. Replace the Teflon seal and cap provided on the bottles.

e. Label the bottles.

f. Ice the samples.

6.4 VOLATILE ORGANICS

a. With tongs or forceps, unwrap and place a clean 50-mL hypovial inside a clean 250-mL beaker.

b. Withdraw a well-mixed aliquot of at least 250 mL from the composite sample (or take directly from the site), using a clean beaker that has been pre-rinsed with sample material.

c. Pour enough of the sample into the vial to completely fill the vial, and fill the beaker to a level at which the vial is completely submerged.

d. Tap the vial and beaker to make sure that all air bubbles have been expelled from the vial.

e. Dip the Teflon seal completely in the liquid and, making sure that no air bubbles cling to the seal, place it carefully, Teflon side down, on the mouth of the vial. Handle the seal with forceps at all times and never touch it with the fingers.

f. Place a fully submerged metal cap on the vial, making sure that all air has been eliminated from inside the cap.

g. Crimp the cap in place with the crimper while the vial and cap are still fully submerged.

h. Invert the sealed sample, and test for air bubbles by tapping. If there are any air bubbles in the vial, discard and repeat the procedure with a new vial, seal, and cap.

i. Take a second sample, using the same procedure.

j. Label the vials.

k. Ice the samples. (Note: The samples must be totally air-free.)

l. If chlorine is present in the sample water, as indicated in the cyanide sampling procedure:

   1. Take two additional samples in 50-mL hypovials using the above procedures.

   2. Before sealing, preserve the samples with sodium thiosulfate or sodium bisulfate.

   3. Seal, label, and ice the samples.

   Note: Cooling the sample to 4°C. in a large bottle prior to pouring it into the hypovials helps keep the sample bubble-free.

6.5 CYANIDE

a. Withdraw a well-blended aliquot of at least 50 mL from the composite sample (or take directly from the site), using a clean beaker that has been pre-rinsed with sample material.

b. Pour sample into a clean 500-mL plastic bottle.

c. Test a drop of the sample with KI-starch paper. A blue color on the paper indicates the presence of chlorine.

d. If chlorine is present, reduce it by adding ascorbic acid, a few crystals at a time, until a drop of the sample produces no color on KI-starch paper. Then add 0.6 g of ascorbic acid for each liter of sample volume.

e. Preserve the sample with 1 mL of 10N NaOH per liter.

f. Replace the cap provided on the bottle.

g. Label the bottle.

h. Ice the sample.

6.6 TOTAL DISSOLVED SOLIDS AND TOTAL SUSPENDED SOLIDS

a. Withdraw a well-blended aliquot of at least 250 mL from the composite sample (or take directly from the site), using a clean beaker that has been pre-rinsed with sample material.

b. Pour sample into a clean 250-mL plastic bottle.

c. Replace the cap provided on the bottle.

d. Label the bottle.

e. Store; icing is unnecessary.

6.7 ASBESTOS

a. Withdraw a well-blended aliquot of at least 500 mL from the composite sample (or take directly from the site), using a clean beaker that has been pre-rinsed with sample material.

b. Pour sample into a clean 500-mL glass bottle.

c. Replace the Teflon seal and cap provided on the bottle.

d. Label the bottle.

e. Store; icing is unnecessary.

6.8 METALS

a. Withdraw a well-blended aliquot of at least 500 mL from the composite sample (or take directly from the site), using a clean beaker that has been pre-rinsed with sample material.

b. Pour samples into two 250-mL plastic bottles.

c. Replace the cap provided on one sample without further treatment. (Sample for the EPA).

d. Preserve the second sample by acidifying with 2.5 mL of Ultrapure HNO_3.

e. Replace the cap provided on the second sample bottle. (Sample for ANL.)

f. Label each bottle.

g. Store; icing is unnecessary.

7 BLANKING PROCEDURES

7.1 LABORATORY BLANKS

In the laboratory, take samples, using blank water from the same source as that carried into the field, following the same procedures listed below for FIELD BLANKS. Take one set for each field trip. Place samples in a locked refrigerator to maintain chain of custody (See Sec. 8).

7.2 FIELD BLANKS

Take one set for each mine -- at the effluent sample site -- to be used as controls for the following:

7.2.1 Organics

Pour blank water from the container into three 1-L amber glass bottles; replace Teflon seals and caps provided with each bottle; label and ice the samples.

7.2.2 Volatile Organics

Pour blank water into one 50-mL hypovial and seal the vial, using the procedures described under Volatile Organics (Subsec. 6.4). Label and ice the sample.

7.2.3 Cyanide

Pour blank water from the container into a clear, 500-mL plastic bottle that has been pre-rinsed with blank water. Preserve the sample with 2 mL per L of 10N NaOH; replace the cap provided on the bottle; label and ice the sample.

7.2.4 Phenol

Pour blank water from the container into two clean 1-L amber glass bottles which have been pre-rinsed with blank water; preserve the samples by acidifying with 50% H_2SO_4 to a pH $<$ 2.0. Replace the Teflon seals and caps provided on the bottles; label and ice the sample.

8 CHAIN OF CUSTODY PROCEDURES

The Project Field Supervisor is responsible for preparation of all sample containers, and certifies them to be clean and free of contamination in accordance with the procedures listed in the manual.

The Project Field Supervisor is responsible for procurement of all chemicals and blank water, and certifies them to be pure and free from contamination.

In the field, only the Project Field Supervisor and qualified assistants handle equipment or samples.

At the sampling site, the samples are sealed as soon as practicable after collection, and entries are made in the log over the signature of the person sampling and sealing.

At the completion of each site's sampling, the Project Field Supervisor signs the log, certifying the sampling to be completed.

Upon return to ANL, secure all samples under lock and key until taken to appropriate locations for testing. The security of the samples is the responsibility of the Project Field Supervisor or other person or persons designated by ANL.

Maintain security during transportation to the testing facilities. The responsible person, upon receiving the samples for analysis, certifies in the logbook the samples received and their condition, together with the date and time received.

APPENDIX

PROSPECTIVE UNAMBIGUOUS COMPOUNDS TO BE ANALYZED FOR IN THE CONSENT DECREE*

*Ambiguous compounds or classes of compounds are underlined.

APPENDIX

PROSPECTIVE UNAMBIGUOUS COMPOUNDS TO BE ANALYZED FOR IN THE CONSENT DECREE

Compound Name

1. *acenaphthene
2. *acrolein
3. *acrylonitrile
4. *benzene
5. *benzidine
6. *carbon tetrachloride (tetrachloromethane)

**Chlorinated benzenes (other than dichlorobenzenes)

7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene

**Chlorinated ethanes (including 1,2-dichloroethane, 1,1,1-trichloroethane and hexachloroethane)

10. 1,2-dichloroethane
11. 1,1,1-trichloroethane
12. hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. chloroethane

**Chloroalkyl ethers (chloromethyl, chloroethyl, and mixed ethers)

17. bis (chloromethyl) ether
18. bis (2-chloroethyl) ether
19. 2-chloroethyl vinyl ether (mixed)

**Chlorinated naphthalene

20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. panachlormeta cresol
23. *chloroform (trichloromethane)
24. *2-chlorophenol

*Dichlorobenzenes

25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene

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*Specific compounds and chemical classes as listed in the consent decree.
**Chlorinated phenols (other than those listed elsewhere); includes trichlorophenols and chlorinated cresols.

*Dichlorobenzidine

28. 3,3'-dichlorobenzidine

*Dichloroethylene (1,1-dichloroethylene and 1,2-dichloroethylene)

29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. *2,4-dichlorophenol

*Dichloropropane and dichloropropene

32. 1,2-dichloropropane
33. 1,3-dichloropropylene (1,3-dichloropropene)
34. *2,4-dimethylphenol

*Dinitrotoluene

35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. *1,2-diphenylhydrazine
38. *ethylbenzene
39. *fluoroanthene

*Haloethers (other than those listed elsewhere)

40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis(2-chloroisopropyl) ether
43. bis(2-chloroethoxy) methane

*Halomethanes (other than those listed elsewhere)

44. methylene chloride (dichloromethane)
45. methyl chloride (chloromethane)
46. methyl bromide (bromomethane)
47. bromoform (tribromomethane)
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
51. chlorodibromomethane
52. *hexachlorobutadiene
53. *hexachlorocyclopentadiene
54. *isophorone
55. *naphthalene
56. *nitrobenzene

*Nitrophenols (including 2,4-dinitrophenol and dinitrocresol)

57. 2-nitrophenol
58. 4-nitrophenol
59. *2,4-dinitrophenol
60. 4,6-dinitro-o-cresol

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*Specific compounds and chemical classes as listed in the consent decree.

*Nitrosamines

61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. *pentachlorophenol
65. *phenol

*Phthalate esters

66. bis (2-ethylhexyl) phthalate
67. butyl benzyl phthalate
68. di-n-butyl phthalate
69. diethyl phthalate
70. dimethyl phthalate

*Polynuclear aromatic hydrocarbons

71. 1,2-benzathracene
72. benzo ( ) pyrene (3,4-benzopyrene)
73. 3,4-benzofluoranthene
74. 11,12-benzofluoranthene
75. chrysene
76. acenaphthylene
77. anthracene
78. 1,12-benzoperylene
79. fluorene
80. phenanthrene
81. 1,2:5,6-dibenzanthracene
82. indeno (1,2,3-C,D) pyrene
83. pyrene
84. *2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)
85. *tetrachloroethylene
86. *toluene
87. *trichloroethylene
88. *vinyl chloride (chloroethylene)

*Pesticides and metabolites

89. *aldrin
90. *dieldrin
91. *chlordane (technical mixture and metabolites)

*DDT and metabolites

92. 4,4'-DDT
93. 4,4'-DDE (p,p'-DDX)
94. 4,4'-DDD (p,p'-TDE)

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*Specific compounds and chemical classes as listed in the consent decree.

*Endosulfan and metabolites

95 -endosulfan
96. -endosulfan
97. endosulfan sulfate

*Endrin and metabolites

98. endrin
99. endrin aldehyde
100. endrin ketone (since deleted)

*Heptachlor and metabolites

101. heptachlor
102. heptachlor epoxide

*Hexachlorocyclohexane (all isomers)

103. -BHC
104. -BHC
105. -BHC (lindane)
106. -BHC

*Polychlorinated biphyenyls (PCB's)

107. PCB-1242 (Arochlor 1242)
108. PCB-1254 (Arochlor 1254)

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109. *toxaphene
110. *cyanide (Total)

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111. *antimony (Total)
112. *arsenic (Total)
113. *asbestos (Fibrous)
114. *beryllium (Total)
115. *cadmium (Total)
116. *chromium (Total)
117. *copper (Total)
118. *lead (Total)
119. *mercury (Total)
120. *nickel (Total)
121. *selenium (Total)
122. *silver (Total)
123. *thallium (Total)
124. *zinc (Total)

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*Specific compounds and chemical classes as listed in the consent decree.