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7 May 1996

Mr. Russell D. Hart (HSR6J)
U.S. Environmental Protection Agency
Region V
77 W. Jackson Blvd.
Chicago, IL 60604

Mr. Gary Edelstein
Wisconsin Department of Natural Resources
101 S. Webster Street
Box 7921
Madison, WI 53707

Work Order No. 02687-007-002

Re: 22 April 1996 Little Menomonee River Tour
Moss-American Site, Milwaukee, Wisconsin

Gentlemen:

This letter documents and clarifies observations made by Roy F. Weston, Inc. (WESTON®) and Kerr-McGee Chemical Corp. (KMCC) during the above-referenced river corridor walk with representatives of U.S. EPA, WDNR, Milwaukee County, WESTON, and KMCC. In addition, in some cases we have also presented a concise summary of findings and facts from past reports and studies on this subject. On what subject ?

Key Observations and Clarifications:

1. The river walk further confirmed WESTON's professional opinion that alternate, more practicable approaches to addressing sediment in the Little Menomonee River can be developed. There is no justifiable reason to reroute the Little Menomonee River.

2. During the river walk, several representatives of U.S. EPA were reviewing the river realignment Alternatives A, B, and C, as presented in a drawing excerpted from the Predesign Task 9 Technical Memorandum dated April 1994. KMCC/WESTON wish to clarify that while we were obligated to evaluate various alignment alternatives for the channel, we do not advocate selection of any alternative river alignments. We encourage the river management team to re-review the conclusions and recommendations of the Predesign Task 9 Technical Memorandum. The Technical Memorandum described the probability of significant adverse environmental impacts that would occur in realignment of the Little Menomonee River.

Goes beyond scope of what they were asked to do

3. The Little Menomonee River sediments have been visually examined and physically sampled extensively during the past 7 to 8 years. During this period over 400 samples have been collected and analyzed. In addition, the entire river has been visually examined by several entities. Through all of these activities, there has been no evidence of free-product creosote.

During the remedial investigation (RI) conducted by CH2M HILL in 1988 on behalf of U.S. EPA, over 290 sediment samples were collected and field screened for extractable organics. Over 60 sediment samples were analyzed for PAHs by GC/FID, and an additional 16 sediment samples were analyzed for PAHs by GC/MS. During the RI, river sediments were physically disturbed to check for oil sheens. When a sheen was observed, samples were collected. Lab results did not always confirm elevated PAH levels.

KMCC/WESTON have made similar observations regarding oil sheens in Little Menomonee River sediments. In 1990, WESTON conducted biological field investigations of the Little Menomonee River and reported its results to the Agency (Review Comments on Remedial Investigation and Feasibility Study Reports, August 1990, Appendix E). In the course of sampling for invertebrate fauna, no evidence of creosote deposits were observed anywhere in the river. During this sampling, scientists waded in the sediments along the entire five miles of the channel. Oil sheens were observed at some locations but were the result of natural anaerobic decay. No creosote odor was associated with any of the sediments.

KMCC/WESTON also conducted an extensive sampling of CPAH levels in the river sediments during 1994 under Predesign Task 4 (Technical Memorandum, Predesign Tasks 2(b), 3, 4, 5, 6, 7 and 19, November 1994). Approximately 110 sediment samples were collected from the river bed at intervals of 300 feet. All samples were analyzed for CPAHs using GC/MS or HPLC. Core samples were advanced from the top of the sediment layer to the hard pan river bed. Observations of sheens, when present, were also noted by the samplers. Comparison of field notes to analytical results indicated that oil sheens were not related to CPAH concentrations.

In our recent river tour with EPA and WDNR, we were again presented with evidence of oil sheens. Once again we confirmed that a sheen is not necessarily associated with elevated levels of CPAHs. During our walk with the Agencies, WDNR indicated that their previous field investigations had located two areas where "creosote" was observable in the river sediments and/or banks.

At the first such location (approximately ½ mile south of Good Hope Road and 2 ½ miles south of the former wood-treating facility) representatives of WDNR waded into the river and collected sediment samples with a spade. Oil sheens were visible when the sediments were disturbed. Approximately 10 to 15 minutes were spent by the samplers probing various nearby locations and various depths for a sample exhibiting the greatest "creosote" contamination. KMCC/WESTON provided a sample jar that was filled with sediment by WDNR. This sample was then shipped to Lancaster Laboratories, Inc. and analyzed for CPAHs by GC/MS (EPA method 8270). Analytical results indicate that the sample contained 19 mg/kg total CPAHs, a relatively low value that matches KMCC/WESTON's previous analytical results for this area of the river (see Table 1). Background sediment in adjacent tributaries reported values higher than 50 mg/kg. Clearly no evidence of "creosote" was found at this location.

The second area identified by WDNR as an area to observe "creosote" provided even less evidence of creosote. At this location (near the confluence with the Menomonee River, approximately 5 miles from the former wood-treating facility) representatives of WDNR waded into the river and spent approximately 15 to 25 minutes retrieving and examining sediment samples and bank samples for evidence of "creosote". In their opinion, no samples of "creosote" could be found at this location where they had previously observed it. KMCC/WESTON offered to have a sediment sample from this location analyzed for CPAHs, but no sample was deemed by WDNR to be "creosote", and therefore none was analyzed.

KMCC/WESTON emphasize that creosote is <u>not</u> present in sediment deposits throughout the Little Menomonee River. It has been 25 years since liquid wastes at the former wood-treating facility were redirected to the sanitary sewer and the settling ponds at the facility were dredged. During the 25 years since any significant creosote release to the Little Menomonee River, the most likely scenario is that any remaining creosote in the river has been covered by several inches to a few feet of sediment. This was evident on our 22 April 1996 river walk when WDNR demonstrated 2-2 ½ feet of sediment near the center of the river. As WDNR has previously noted (WDNR, February 1, 1995), only sediments near the sediment/surface water interface are biologically available and relevant when considering protection of aquatic organisms.

4. Overall, the Little Menomonee River can be characterized as a channelized drainage ditch, typical to the Midwestern landscape. The Little Menomonee River watershed is a surface drainage unit covering approximately 21.8 square miles in an urban/suburban setting. The Little Menomonee River is a series of straight runs, because it was channelized over 50 years ago to ensure the river could convey storm

water events and ensure flood control. Were it not for the fact that the adjoining properties are dedicated parkland, the Little Menomonee River would quite possibly have been converted to a sewer interceptor.

The water quality of the Little Menomonee River is defined by the quantity and character of contributions from the many drainage ditches and culverts that collect and feed stormwater runoff from the surrounding developed properties including roadways, parking lots, construction sites, tilled fields, and lawns. During flood conditions or following rainstorms, the Little Menomonee River is heavily loaded with silt and surface contaminants that are washed in from these various sources.

5. Even a carefully planned and executed realignment of the river will significantly impair the ecology, natural environment, and cultural resources along the Little Menomonee River. Resident species of birds, small mammals, reptiles, amphibians, insects, and microfauna would be lost in direct proportion to habitat loss. Regardless of the alternative alignment selected, about 40 percent of the study area (approximately 160 acres) will be impacted by site activities. A total of 95 acres will be impacted by dewatering and filling the existing channel. An additional 55 to 85 acres will be impacted by construction of the new channel, depending on the alignment selected. The County parkway will be off-limits to the public for several construction seasons during any realignment construction.

   The riparian habitat along the Little Menomonee River corridor, especially the forested wetland habitat, provides valuable terrestrial greenbelt in this typically urban/suburban area. This greenbelt generally corresponds with the 100-year floodplain and is owned by the Milwaukee County Department of Parks, Recreation, and Culture. The parkway is undeveloped open space and includes a scenic road and a bicycle/walking trail.

   The Little Menomonee River floodplain was used as farmland before urbanization of the area. The floodplain reverted to its present state because, as a designated floodplain, it could not be developed for homes or commercial purposes. The secondary growth of vegetation includes common species and habitat types that are widely distributed in a patchy mosaic over the length and width of the floodplain. The vegetation types distributed throughout the study area relate almost entirely to the amount of disturbance (e.g., the monotypic stands of reed canary grass on disturbed wetland areas) and the moisture regime (e.g., old field vegetation on the better-drained borders of the study area compared to marsh vegetation in wetter areas).

Seventeen habitat types were identified in the study area, including three woodland habitats, four scrub-shrub habitats, three field habitats, four ponded water habitats, and three river habitats. Twelve of the habitats cover less than 20 acres each; some habitats cover no more than a single acre. All woodlands in the Little Menomonee River study area are classified as wetland vegetation types.

Special natural resources in the study areas include wetlands, specimen trees (i.e., large diameter black willow and cottonwood trees that grow along the banks of the Little Menomonee River and within the Little Menomonee River corridor), and ponded water and close spaced shrub habitats that provide important habitat for a number of faunal species.

Local birders have observed 168 bird species (out of a total of 182 bird species potentially occurring in southeastern Wisconsin) during visits to the study area and similar adjacent habitats. Resident mammal population in the study area are composed of common and typical species for this type of setting. Top-level herbivores include whitetail deer and cottontail rabbits. High-level carnivores are largely limited by lack of habitat and prey. This niche is probably filled by raccoons and skunks. All of these herbivores and carnivores have been observed at the site.

Wetlands are present throughout most of the study area. These wetlands provide various functions. Several functional values (i.e., flood mitigation, erosion control, improving water quality, and groundwater recharge) of the wetlands along the Little Menomonee River are assumed to be more or less constant for all the wetlands (Beltman and Helmer, 1990). The U.S. EPA has stated that none of the wetlands along the Little Menomonee River currently have any significant value as fisheries (Beltman and Helmer, 1990). The value of the wetlands in providing plant and animal habitat is not constant throughout the study area. Wildlife habitats for segments of the Little Menomonee River from Brown Deer Road to Hampton Avenue have been classified as high value, medium value, and good value (Beltman and Helmer, 1990). These wildlife habitat classes are applied to areas that may include a variety of wetland plant communities. High wildlife habitat is present between Brown Deer and Bradley Roads and between Good Hope and Mill Roads. Medium value wildlife habitat is present between Brown Deer and Bradley Roads, Bradley and Good Hope Roads, Mill Road and Silver Spring Drive, and Silver Spring Drive and Hampton Avenue. Good value wildlife habitat is present between Bradley and Good Hope Roads.

The majority of the impact and the most severe adverse environmental impacts from river remediation and realignment will be to the forested wetlands. About one-half

of the total forested wetland acreage will be impacted by any of the river realignment alternatives. The forested wetlands have been assigned the highest value as a cover type by the U.S. EPA in their wetland survey (Beltman and Helmer, 1990). The U.S. EPA (Beltman and Helmer, 1990) recognizes that the selected remedy (i.e., remediation and realignment) will severely impact forested wetlands:

> *"... the Broad-leaved Deciduous Forest Wetlands along the LMR would take considerable time to recover. These forests provide valuable habitat to a variety of insects, amphibians, mammals and birds. For instance, the numerous ephemeral ponds that occur in these forests are unique habitats that provide important breeding areas for insects, which serve as important food sources for birds, amphibians, and reptiles. These fairly mature forests would take 50 to 60 years to recover following their removal for new channel construction. As this LMR corridor occurs in a highly urban area, mature forests like these are rare and valuable resources not only to the animals, insects and plants which inhabit them, but also to people in the area which use them for recreation. Superfund remedies are mandated to minimize impact on wetland areas, and construction through these Forest Wetlands should be minimized to minimize environmental impact.*
>
> *"Wetlands restoration has been proposed as a means of minimizing environmental impact along the LMR. However, wetlands restoration is far from an exact science. Much remains unknown about the intricacies of environmental and vegetation community factors involved in wetland restoration. Wetlands restoration should not be viewed as the equivalent to wetlands preservation, but as a "last resort" to mitigate wetlands destruction."*

6. The Little Menomonee River does not provide aquatic habitat to support a quality fishery. The habitat within the Little Menomonee River is extremely harsh. Factors that limit use/support of fish include.

- Extreme low summer flows.
- Extreme high temperatures and low dissolved oxygen.
- Severe episodic flows that scour the main channel.

- Monotonous benthic habitats that support little macroinvertebrate abundance or diversity.

- Poor water quality that is a result of urban runoff and non-point source discharges.

The Little Menomonee River is classified as INT-D, which means it is considered suitable for tolerant fish and aquatic life (ROD - U.S. EPA, 1990). The Little Menomonee River fishery is limited by habitat and water quality. There is little diversity in aquatic habitats, except at bridge crossings where the interaction of the river with the bridge structure has created pools, bends, and riffles. A macroinvertebrate community study of the Little Menomonee River by KMCC/ WESTON showed no discernible effects that could be attributed directly to PAHs discharges from the Moss American site. In addition, the data suggested that the Little Menomonee River is not adversely affecting the benthos of the Menomonee River (Review Comments on Remedial Investigation and Feasibility Study Reports, August, 1990, Appendix E).

7. It has been inferred that discharge of creosote from the Moss American site has adversely impacted the aquatic biota of the river (RI Report). Yet, biological investigations of the LMR do not confirm this. A macroinvertebrate community study of the LMR performed by KMCC/WESTON showed no discernible effects that could be attributed directly to PAH discharges from the Moss American site. *"Most biological investigations of the LMR have concluded that the lower river is ecologically impaired, with some effects attributed to the creosote contamination from the Moss-American site. These same studies have generally noted that the various effects of habitat loss, chemical pollution, soil erosion, and nonpoint source pollution cannot be readily distinguished" (RI Report).*

*"The chemicals of most concern at the Moss-American site and in the river are eight carcinogenic polycyclic aromatic hydrocarbons (CPAHs) that are part of the creosote mixture"* (CH2M Hill, 1990, RI Report). PAHs are ubiquitous in the environment, as a result of both natural and anthropogenic activities. In water, PAHs may evaporate, disperse in the water column, become incorporated in bottom sediments, concentrate in aquatic biota, or experience chemical oxidation and biodegradation (Suess, 1976, as presented in Eisler, 1987). The ultimate fate of PAHs that accumulate in sediments is believed to be biotransformation and biodegradation by benthic organisms (EPA, 1980, as presented in Eisler, 1987).

Information on the ecotoxicological effects of PAHs is limited. Unsubstituted, lower molecular weight compounds with 2 or 3 rings, exhibit acute toxicity and other adverse effects to some organisms. Higher molecular weight PAHs with 4 to 7 rings are less toxic, though they may be carcinogenic, mutagenic, or teratogenic to a wide variety of organisms. However, PAHs show little tendency to biomagnify in food chains, despite their high lipid solubility, probably because most PAHs are rapidly metabolized [Eisler, R. 1987. Polycyclic Aromatic Hydrocarbon Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish Wildl. Serv. Biol. Rep. 85(1.11)]. PAH levels in fish are usually low because fish rapidly metabolize PAHs. Higher molecular weight PAHs, which include the CPAHs, do not seem to accumulate in fish (Lawrence and Weber, 1984 and West et al., 1984, as presented in Eisler, 1987). PAHs are not listed as bioaccumulative chemicals of concern in the Great Lakes Water Quality Initiative (40 CR Parts 9, 122, 123, 131, and 132, Final Water Quality Guidance for the Great Lakes System).

The RI (CH2M Hill, 1990) indicated that "surface water in the LMR is not generally affected by the site" while "elevated PAH concentrations are present in varying amounts in the LMR sediment...". As noted by the WDNR, the biologically active zone of sediments can vary from a depth of approximately 2-15 cm below the sediment-overlying water interface (WDNR, February 1, 1995). Natural sediment transport processes have resulted in the natural "capping" or "armoring" of historically impacted sediments, limiting exposure of benthic organisms.

8. WDNR anticipates that dredging or excavating the river will create an unstable channel and therefore their preference is to reroute the river entirely to a newly excavated channel.

KMCC/WESTON pre-design data indicates that rerouting the river will require extensive loss of the existing tree canopy and will destroy established and emerging wetlands. Due to restricted space in the river corridor area and established invert elevations at bridge culverts, it will not be possible to reconstruct a meandering river, but rather a highly unstable, newly excavated channelized river would have to be constructed. To address WDNR's concern, KMCC/WESTON recommends that any remediation to the Little Menomonee River environment be limited to only sediments having elevated CPAH concentrations attributed to the former wood-treating operation using an excavation technique. This approach will result in a continued stable river corridor with much less disturbance to stabilizing features of the river such as wetlands, trees, vegetation, and other important habitats. Placing granular backfill in certain dredged areas of the river, utilizing temporary erosion controls, and re-establishing vegetative bank cover can be highly effective measures

for post-dredging stream stabilization. In fact, some of the sediment controls and post-dredged features of the river can be restored to create more favorable habitats or environmental settings.

9. WDNR stated that sediment as far as 3 to 5 miles downstream of the former wood-treating site contains higher concentrations of CPAHs than the sediment in the urbanized tributaries that flow into the Little Menomonee River. Extensive sampling of tributary sediments in the urbanized watershed of the Little Menomonee River was conducted by KMCC/WESTON. The study revealed that some very high concentrations of CPAHs are discharged via sediment and run-off transport from roads, commercial and residential developments, and other typical man-induced activities. Our study indicated that sediments in many areas of the Little Menomonee River have lower concentrations of CPAHs than adjoining tributaries.

In summary, KMCC/WESTON would like to reiterate the following key observations and clarifications that are crucial to making informed risk management decisions on this project:

- Even a carefully planned and executed realignment of the river will significantly impair the ecology, natural environment, and cultural resources along the Little Menomonee River.

- Creosote is <u>not</u> present in sediment deposits throughout the Little Menomonee River. Over 400 sediment samples have been collected from the river and chemically analyzed. Creosote has not been detected in any samples. Observations of oil sheens did not correlate with elevated CPAH levels.

- The riparian habitat along the Little Menomonee River corridor, especially the forested wetland habitat, provides a valuable terrestrial greenbelt in this typically urban/suburban area. Regardless of the alternative river alignment selected, about 40 percent of the Little Menomonee River corridor (160 acres) will be impacted by site activities. The majority of the impact and the most severe environmental impacts will be to the forested wetlands.

- The Little Menomonee River can be characterized as a channelized drainage ditch, whose primary purpose is sediment removal and flood control. The Little Menomonee River does not provide aquatic habitat to support a quality fishery. The potential of the fishery in the Little Menomonee River is limited by the fact that the river will always be subjected to regular urban/suburban runoff, sediment loading, and low flow episodes.

- Biological investigations in the Little Menomonee River do not confirm that only discharge of creosote from the Moss American site has adversely impacted the aquatic biota in the river. *"Most biological investigations of the LMR have concluded that the lower river is ecologically impaired, with some effects attributed to the creosote contamination from the Moss-American site. These same studies have generally noted that the various effects of habitat loss, chemical pollution, soil erosion, and nonpoint source pollution cannot be readily distinguished" (RI Report).*

We appreciated the opportunity to participate in the river tour and to offer our perspective on these important issues. We trust this follow-up letter also provides essential clarification, as we believe the government's river management team must be highly and accurately informed on this matter.

Very truly yours,

ROY F. WESTON, INC.

Gary J. Deigan
Principal Project Manager

Kurt S. Stimpson /slr

Kurt S. Stimpson
Project Director

GJD:KSS/slr

cc: K. Watson, KMCC
Members of the River Tour
(see attached Distribution List)
S. Baldwin, Director, Milwaukee County Parks,
Recreation & Culture

# Table 1

## CPAH Analytical Results — Sediments
## Moss-American Site
## Milwaukee, Wisconsin
## (All Concentrations in mg/kg)

| Sample Number | Distance from Confluence with Menomonee River (feet) | Distance from Most Upstream Sampling Location (feet) | Benzo(a)anthracene | Chrysene | Benzo(b)fluoranthene | Benzo(k)fluoranthene | Benzo(a)pyrene | Indeno(1,2,3-cd)pyrene | Dibenzo(a,h)anthracene | Benzo(g,h,i)perylene | CPAH Total[3] | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MA1-SD03-0010-01[a] | 15,300 | 15,300 | 6.1 | 6.4 | 0.9 U | 1.4 | 2.3 | 1.0 | 0.90 | 2.4 | 21 | Sheen |
| MA1-SD03-0011-01[a] | 15,600 | 15,000 | 1.7 | 1.9 | 0.2 U | 0.73 | 1.3 | 0.73 | 0.56 | 1.8 | 8.8 | Slight sheen |
| SD-1 | — | — | 4.3 | 4.6 | 3.7 | 1.3 | 2.4 | 1.3 | 0.35 J | 1.1 | 19 | Suggested location of creosote contamination. Sample collected 22 April 1996 and analyzed by Method 8270. Analysis concluded no creosote. |
| MA1-SD03-0012-01[a] | 15,900 | 14,700 | 13 | 17 | 2 U | 4.0 | 7.2 | 4.1 | 2.8 | 6.9 | 56 | Sheen |
| MA1-SD03-0013-01[a] | 16,200 | 14,400 | 4.9 | 5.6 | 0.9 U | 1.7 | 3.7 | 1.7 | 1.5 | 3.9 | 24 | |

[a] Sample results presented in Table 4-1, Technical Memorandum Predesign Tasks 2(b), 3, 4, 5, 6, 7, and 19, WESTON 1994.

# SITE TOUR - LITTLE MENOMONEE R.
# APRIL 22, 1996

| | | |
|---|---|---|
| RUSS HART - U.S EPA | | (312) 886-4814 |
| JESS LARSEN - KERR-McGEE | | (405) 270-2288 |
| Gary Deigan | WESTON | 847-918-4114 |
| Garet VanDe Steeg | Kerr-McGee | 405-270-3574 |
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| Jeni Chapman | USEPA | 312 886 7185 |
| JAMES MAYKA | USEPA | 312 353-9229 |
| Bonnie L. Eleder | USEPA | 312-886-4885 |
| Brenda K. Joyce | USEPA | 312 886-7938 |
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Lancaster Laboratories
A Thermo Analytical Laboratory



LLI Sample No. SW 2499260
Collected: 4/22/96 at 13:45 by TG

Submitted: 4/24/96 Reported: 4/30/96
Discard: 5/31/96

SD-1 Grab Sediment Sample
847-918-4000
Moss American Superfund Site
SSD-- SDG#: MOS01-01*

Account No: 07802
Kerr-McGee Corporation
Technology Center
PO Box 25861
Oklahoma City OK 73125

P.O. MOSS-AMERICAN
Rel.

| CAT NO. | ANALYSIS NAME | AS RECEIVED RESULTS | AS RECEIVED LIMIT OF QUANTITATION | AS RECEIVED UNITS | DRY WEIGHT RESULTS | DRY WEIGHT LIMIT OF QUANTITATION |
|---|---|---|---|---|---|---|
| 0893 | Semivolatile Library Search | | | See Page 4 | | |
| | The results from the semivolatile library search are listed on the attached FORM 1F - SV-TIC. The qualifiers appearing in the "Q" column are defined on the back of this form. An "X" indicates an isomer of the listed compound. | | | | | |
| | Pristane and phytane were not detected in the library search. | | | | | |
| 1199 | Base Neutrals (SW846/8270) | | | See Page 2 | | |
| 1200 | Base Neutral cont SW846/8270 | | | See Page 3 | | |
| 2111 | Moisture | 30.2 | 0.5 | % by wt. | | |
| | "Moisture" represents the loss in weight of the sample after drying with an infrared lamp at 150 degrees Celsius. | | | | | |

1 COPY TO Kerr-McGee Corporation ATTN: Garet Van de Steeg, PhD
1 COPY TO Roy F. Weston ATTN: Mr. Gary J. Deigan
1 COPY TO Data Package Group

Questions? Contact your Client Services Representative
F. Bradley Ayars at (717) 656-2300
04:00:22 D 0003 1 117437 513133
050 0.00 00060665 ASR000

Respectfully Submitted
Christine M. Ratcliff, B.S.
Group Leader, GC/MS

MEMBER ACIL
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2425 New Holland Pike
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Lancaster Laboratories
A Thermo Analytical Laboratory



LLI Sample No. SW 2499260
Collected: 4/22/96 at 13:45 by TG

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SD-1 Grab Sediment Sample
847-918-4000
Moss American Superfund Site
SSD-- SDG#: MOS01-01*

Account No: 07802
Kerr-McGee Corporation
Technology Center
PO Box 25861
Oklahoma City OK 73125

P.O. MOSS-AMERICAN
Rel.

| CAT NO. | ANALYSIS NAME | AS RECEIVED RESULTS | | AS RECEIVED LIMIT OF QUANTITATION | UNITS | DRY WEIGHT RESULTS | | DRY WEIGHT LIMIT OF QUANTITATION |
|---|---|---|---|---|---|---|---|---|
| Base Neutrals (SW846/8270) | | | | | | | | |
| 3761 | naphthalene | N.D. | | 330. | ug/kg | N.D. | | 480. |
| 3765 | acenaphthylene | 59. | J | 330. | ug/kg | 85. | J | 480. |
| 1191 | acenaphthene | 3,900. | | 330. | ug/kg | 5,500. | | 480. |
| 3768 | fluorene | 4,400. | | 330. | ug/kg | 6,300. | | 480. |
| 3775 | phenanthrene | 8,000. | | 670. | ug/kg | 11,000. | | 960. |

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F. Bradley Ayars at (717) 656-2300

Respectfully Submitted
Christine M. Ratcliff, B.S.
Group Leader, GC/MS

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Account No: 07802
Kerr-McGee Corporation
Technology Center
PO Box 25861
Oklahoma City OK 73125

P.O. MOSS-AMERICAN
Rel.

| CAT NO. | ANALYSIS NAME | AS RECEIVED RESULTS | | LIMIT OF QUANTITATION | UNITS | DRY WEIGHT RESULTS | | LIMIT OF QUANTITATION |
|---|---|---|---|---|---|---|---|---|
| Base Neutral cont SW846/8270 | | | | | | | | |
| 3776 | anthracene | 1,500. | | 330. | ug/kg | 2,200. | | 480. |
| 3778 | fluoranthene | 8,600. | | 670. | ug/kg | 12,000. | | 960. |
| 1195 | pyrene | 7,000. | | 670. | ug/kg | 10,000. | | 960. |
| 3781 | benzo (a) anthracene | 3,000. | | 330. | ug/kg | 4,300. | | 480. |
| 3782 | chrysene | 3,200. | | 330. | ug/kg | 4,600. | | 480. |
| 3786 | benzo (b) fluoranthene | 2,600. | | 330. | ug/kg | 3,700. | | 480. |
| 3787 | benzo (k) fluoranthene | 890. | | 330. | ug/kg | 1,300. | | 480. |
| 3788 | benzo (a) pyrene | 1,600. | | 330. | ug/kg | 2,400. | | 480. |
| 3789 | indeno (1,2,3-cd) pyrene | 910. | | 330. | ug/kg | 1,300. | | 480. |
| 3790 | dibenz (a,h) anthracene | 240. | J | 330. | ug/kg | 350. | J | 480. |
| 3791 | benzo (ghi) perylene | 760. | | 330. | ug/kg | 1,100. | | 480. |

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F. Bradley Ayars at (717) 656-2300

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Christine M. Ratcliff, B.S.
Group Leader, GC/MS

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