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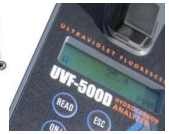


# UVF-500D TEST PROCEDURES FOR BaP IN ASPHALT

## Ultraviolet Fluorescence Method for Benzo[a]Pyrene Analysis Using Methanol Extraction



### Supplies & Equipment Required for Analysis:

**Sample Test Kit:**
**Part No. EXTR010-20-PAHS**

- Supplies for 20 samples.
- Use with methanol (solvent not included). Use with HPLC grade methanol, CAS #67-56-2.

**Sitelab UVF-500D Analyzer:**
**Part No. 50200**

- Use the 8mm Cuvette Adapter
- Use on Channel A optics only

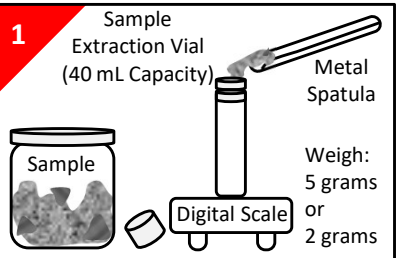
**Lab Equipment and Other Parts Needed, Sold Separately:**

- UVF-500D Starter Kit, Part No. 90300
- Soil Accessory Kit, Part No. 90300-SAK
- 8mm Round Glass Cuvettes, 400/Pack, Part No. 50957
- Benzo[a]Pyrene Standard, Part No. CAL-BAP-COALTAR

### Sample Extraction Procedure for Reclaimed Asphalts & Coal Tar Contaminates

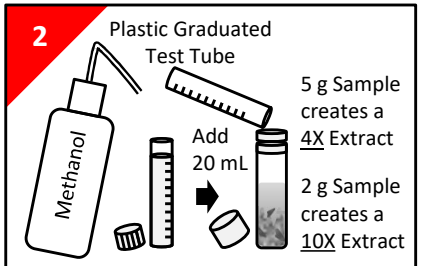
Samples prepared using materials supplied in EXTR010-20-PAHS test kit. Solvent dispenser bottle, digital scale, pipette and other tools needed are included in UVF-500D accessories.

**1**



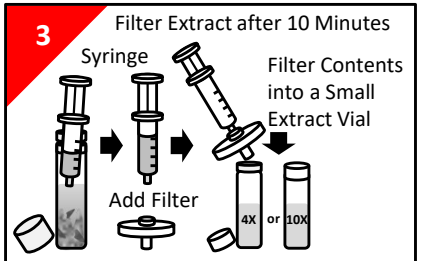

Asphalt samples should be crushed and sieved to 4 mm particle size prior to use following ADEPT (UK) guidelines. Using a glass sample extraction vial, remove the cap and place the vial onto the scale and tare the weight to zero. Scoop out and weigh 5.0 g of sample into the vial. Or use 2.0 g for highly contaminated samples. Be precise (within +/- 0.1 g).

**2**



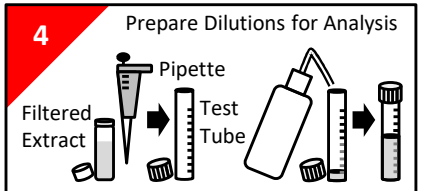

Add methanol to the solvent dispenser bottle. Squirt 10 mL of methanol into a plastic graduated test tube. Pour contents into the sample extraction vial. Add another 10 mL to vial for a total of 20 mL of solvent. Keep track of the dilution created in the extract (4X or 10X). Tighten cap and shake vial periodically for 10 minutes, no more than 20 minutes.

**3**




Once the sample has been extracted for 10 minutes, remove the cap, dip a syringe into the vial and suck up the Extract into the syringe. Screw on a filter, push down on the plunger and filter the Extract into a small glass extract vial. Label the vial with "4X" or "10X." Samples extracted for 24 hours will produce higher concentrations and is recommended more for coal tars.

**4**



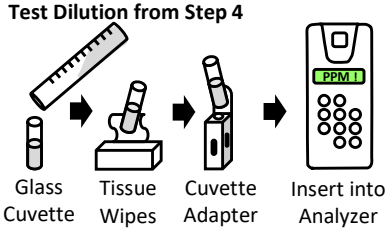

| Pipette Extract | Add Solvent To | 4X Extract Dilution | 10X Extract Dilution |
|---|---|---|---|
| 200 µL | 5 mL line | = 100X | = 250X |
| 100 µL | 5 mL line | = 200X | = 500X |
| 50 µL | 5 mL line | = 400X | **= 1,000X** |
| 40 µL | 10 mL line | **= 1,000X** | = 2,500X |

Attach a tip to the adjustable pipette, transfer aliquots of the Filtered Extract into a plastic graduated test tube and dilute with methanol using examples shown above. Prepare a 1,000X Dilution first, recommended for most samples.

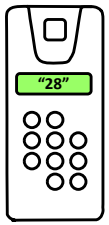
### Test Sample using UVF-500D Hydrocarbon Analyzer

Use with analyzer calibrated to 50 ppb Benzo[a]Pyrene using standard supplied in Sitelab CAL-BAP-COALTAR. Record results manually using a log book.

**Test Dilution from Step 4**




Fill glass cuvette about ½ full with the Dilution made in Step 4. Clean cuvette using a tissue to remove any liquids or fingerprints, place into the cuvette adapter, insert into analyzer and press the READ button. The UVF-500D displays PPM units only, but BaP is calibrated and analyzed at PPB concentrations. Divide readings by 1,000 to covert to PPB.




**Calculate BaP Concentration:**
Example: Test a 1,000X Dilution
28 ppb x 1,000X = 28,000 ppb
÷ 1,000 = 28 ppm (mg/Kg)

**Detection Range & Limits:**
Lower limit = 5 ppb (µg/Kg)
Upper limit = 100 ppb (µg/Kg)

Multiply the reading by dilution made to report final concentration. Divide result by 1,000 to convert back to PPM units. Press READ again to check repeatability. If the 1,000X dilution reads below 5 ppb, report sample as "Non-Detect <5 mg/Kg". Empty and rinse test tube with methanol to prepare and test higher or lower dilutions, as needed, using the Extract.

### Quality Control Tests

The UVF-500D does not need to be calibrated each time its used. The QC tests described below are recommended to help validate results and confirm analyzer performs properly.

**QC** **Check for Sample Quenching**

1,000X Dilution Result = 28 ppm
vs. 500X Dilution Result = 26 ppm
*Good, Similar Results! RPD = 7%*

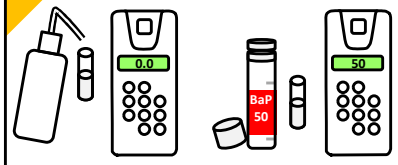
**Monitor Extraction Efficiency Over Time**

| *10 Minutes: | 24 Hours: |
|---|---|
| Result = 28 ppm | Result = 66 ppm |

**Performs best vs. Lab GC Methods*

"Quenching" can occur when the detector is swamped by too many hydrocarbons which can produce low or poor results. Test a sample at multiple dilutions to confirm readings are linear and results are <20% RPD. Reclaimed asphalts extracted for 24 hours can over quantify BaP, but the data generated may provide helpful information about the sample's contents.

**QC** **Test Your Solvent & Perform Calibration Checks**




Fill the cuvette ½ full with methanol and test a blank to make sure the solvent is clean. Readings in the blank should be close to zero ppm. If available, test the 50 ppb and 5 ppb BaP Standards to check the analyzer for accuracy or drift. Readings should be close to each standard's concentration, <20% RPD. See calibration instructions for more details.

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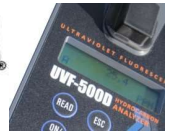


# UVF-500D TEST PROCEDURES FOR BaP IN ASPHALT

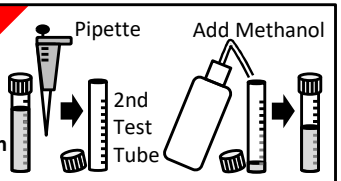
## Ultraviolet Fluorescence Method for Benzo[a]Pyrene Analysis Using Methanol Extraction



### Highly Contaminated Coal Tars Requiring 24 Hour Extraction

Prepare and analyze high dilutions. May not be practical for quick screening purposes.

**5**

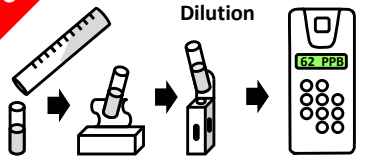



| Pipette Volume | Add Solvent To | New Dilution Created |
|---|---|---|
| 250 µL x2 | 5 mL line | = 10,000X |
| 250 µL | 5 mL line | = 20,000X |
| 100 µL | 5 mL line | = 50,000X |
| 50 µL | 5 mL line | = 100,000X |
| 50 µL | 10 mL line | = 200,000X |

Use the adjustable pipette and a second test tube to prepare very high dilutions, if necessary, using the dilution in Step 4 diluted further in methanol. Examples shown here uses the 1,000X Dilution with new dilutions created.

**6**

**Example Testing a 50,000X Dilution**




Glass Cuvette | Tissue Wipes | Cuvette Adapter | 0.062 x DIL = 3,100 ppm

Pour the dilution in Step 5 into a glass cuvette, place into the analyzer and press the READ button. Multiply the reading by the dilution factor to report the final concentration.

Use this protocol for coal tar driveway sealcoats, oily soil samples or DNAPL. The 24 hour extraction time performs best compared to BaP using lab GC methods.

### Additional Tests to Perform

Use this option for qualitative analysis

**Photograph Extract Colors**

Coal Tar Asphalt

**Interference in Coal Tar Free Asphalts**

Asphalt Bitumen:

10 Minute Extraction
UVF BaP = 5 ppm

24 Hour Extraction
UVF BaP = 20 ppm

Unfiltered extracts yellow in color indicate high concentrations of PAHs. This can be useful deciding which dilution to make or for observing the color change over time.

Clean asphalts, like binders with no BaP, will fluoresce due to other PAHs in the sample which are not detected by the lab GC/MS methods. Monitoring background levels can help with false positive results.

### Need to Test PAH Content?

Use STD VAL feature to estimate total PAHs

**Coal Tars Contain 4 to 6% Benzo[a]Pyrene**

1,000 ppb PAH Standard Response

*Fluoresces Same as*

50 ppb BaP Coal Tar Standard Response

PAH Calibration Kit CAL-061M-500D

The UVF-500D can measure PAHs, using Sitelab's PAH standards (EPA 16 PAHs) without the need to recalibrate.

Press the STD VAL button and use the arrow keys to increase the concentration from 50 to 1000. PAH sample readings will be about 20 times higher compared to BaP sample readings. Bap is 5% PAH.

**The DIAG %FS values do not change!**

### Benzo[a]Pyrene Standard

Part No. CAL-BAP-COALTAR

Compatible with UVF-500D and UVF-Trilogy analyzers. Certified reference product with 6-month expiration date.

**ADEPT, United Kingdom, Reclaimed Asphalt Regulations**

This product and procedure was developed to meet ADEPT UK specifications as a Rapid Monitoring Technique (RMT) screening method. Use UVF on-site to determine if asphalts contain Benzo[a]Pyrene above or below ADEPT's 50 ppm and 25 ppm action limits.

OBSTITECH WATER ANALYZERS

The UVF-500D, Part No. 50200, and supplies available are sold online with Sitelab's partner Obstitech ApS in Denmark.

Visit web shop: **UVF-500D.COM**
Phone: +45 20315771

## Key Features, Performance and Limitations Comparing UVF-500D and UVF-Trilogy Analyzers, both Suitable for BaP in Coal Tars

**UVF-500D**

**Key Features**

- Rugged, handheld, low-cost instrument
- Two optical channels
- Detects TPH and PAHs
- Detects <5 ppb Bap
- Solid Standard available, useful for extra QC test

**Performance & Limitations**

The analyzer uses a 375-nm light source and detects "Heavy PAHs". It has low detection limits and is very sensitive to Benzo[a]Pyrene, about the same as the UVF-Trilogy. PAH results in asphalts and coal tars are close, typically slightly lower compared to the UVF-Trilogy. It is not suitable for testing BaP or PAHs in diesel, gasoline, or other light-refined fuel oils. Lighter PAH compounds fluoresce poorly.

**Calibration Data Recorded**

Analyzer records the Fluorescence Scale (%FS) or voltage for the Blank and Calibration Standard.

**1-Point BaP Calibration Curve**

| Standard (PPB) | Response (%FS) | Calibration Factor | QC Test 50 PPB Reading |
|---|---|---|---|
| 0 (Blank) | 0.3% | | |
| 50 | 32.4% | 1.54 | 49.5 |

**Lower & Higher Calibrations are Linear**

| | | | |
|---|---|---|---|
| 5 | 3.2% | 1.56 | 49.9 |
| 25 | 16.2% | 1.54 | 48.5 |
| 100 | 64.5% | 1.55 | 49.0 |
| 150 | 93.0% | 1.61 | 50.3 |
| 200 | OVER | RSD = 1.7% | RSD = 1.3% |

OVER response indicates %FS exceeds 100% limit

**UVF-Trilogy**

**Key Features**

- Benchtop instrument
- Factory calibrated to both PAHs and BaP
- Performs multi-point calibration curves
- Detects <5 ppb BaP
- Computer connection

**Performance & Limitations**

The analyzer uses a 255-nm light source and detects "Target PAHs". It too has low detection limits. It is sensitive to PAHs in the C10 to C22 carbon range, including Benzo[a]Pyrene. It is suitable for testing a wider range of contaminants, including PAHs in gasoline, diesel and other refined fuel oils. When testing asphalts or coal tars, it's more susceptible to fluorescence quenching compared to the UVF-500D.

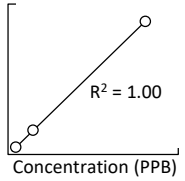
**Analyzer Uses 'Snap In' UV Modules**


Analyzer displays Raw Fluorescence Units (RFU) or voltage for the Blank and each Calibration Standard.

Modules for GRO, EDRO and TPH OIL are also available. All four modules are used for hydrocarbon fingerprinting analysis.

**Example Showing BaP Calibration Curve**

| Standard (PPB) | Response (RFU) |
|---|---|
| 0 (Blank) | 3.1 |
| 5 | 595 |
| 50 | 4,998 |




Analyzer is calibrated in PPB units (µg/Kg)

# UVF-500D CALIBRATION INSTRUCTIONS

## Using Sitelab CAL-BAP-COALTAR Standard for Testing Benzo[a]Pyrene

 Visit: UVF-500D.COM Need help? Call Toll Free 877-SITELAB or Dial (USA) 978-363-2299 CAL-BAP-COALTAR-500D-SOPV1

### Equipment Required

**Sitelab BaP Coal Tar Calibration Standard**
**Part No. CAL-BAP-COALTAR**

Use for measuring Benzo[a]Pyrene in reclaimed asphalts and other coal tar contaminants.

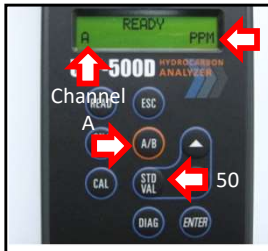
Includes 2 Standards, 30 mL each:
- 50 ppb Calibration Standard
- 5 ppb QC Check Standard
- Ready to use, supplied in methanol

WARNING! This product contains methanol solvent (highly flammable, CAS #67-56-2). Use in ventilated area, handle with care, store at room temperature.

**UVF-500D, Part No. 50200**
with 8mm Cuvette Adapter & Solvent Dispenser Squirt Bottle

**Other Items Needed:**
- 8mm Round Glass Cuvettes, Part No. 50957, 400/Pack
- Methanol, Use "HPLC" Grade

### 1. Set up Analyzer




The UVF-500D displays PPM units, used for TPH analysis.

Disregard PPM, enter BaP STD value in PPB!

Press the ON/OFF button to turn on. The READY screen – or home screen - appears and should display the "A" Channel is selected. If not, press the A/B button to switch from B to A. Next, press the STD VAL button to check and confirm the BaP standard's concentration is set to 50 ppb (shown as 50 ppm). If not, use the arrow keys to adjust the standard value and then press ENTER. Once the standard value and Channel are set, press the CAL button to begin the calibration process. Press ESC button to abort the calibration at any time.

### 2. Use Methanol for Solvent Blank



Always use clean solvent to blank or "zero" the analyzer during the calibration process. Use the same solvent used to extract samples. Fill the solvent dispenser bottle with methanol and squirt into a glass cuvette about half full. Wipe the outside glass with a tissue wipe to remove any liquids or fingerprints. Place the blank into the cuvette adapter, insert into the analyzer and press the ENTER button when ready to test the blank. The analyzer will read the blank for a few moments, settle and then prompt you to the next step. Remove the blank, empty contents into a waste jar or add a plug cap to cuvette to use later.

### 3. Use the 50 ppb BaP Standard

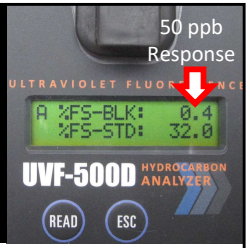


Pour the 50 ppb BaP Calibration Standard into a new cuvette about half full. Or use a pipette to transfer contents (less messy). Wipe the outside glass clean with a tissue wipe, place into the cuvette holder, insert into analyzer and press the ENTER button. The analyzer will read the standard for a few moments and will prompt you to press ENTER again when calibration is complete. When finished, remove the standard from the cuvette adapter. Add a plug cap to cuvette to save and reuse later or empty contents in a waste jar and discard cuvette. Avoid pouring contents back into the vial unless the calibration standard is fine.

### Check & Record Calibration Diagnostic Data


Record the %FS values of the blank and the standard.

%FS values should be close/similar each time the analyzer is calibrated to BaP.




After calibrating the analyzer, press the "DIAG" button to record the percent fluorescence scale (%FS or voltage) for the blank and the standard. These sensitivity values are very important and should be recorded. The %FS-BLK value should be below 1 and close to zero. The %FS-STD value using the Standard should be in the 24 to 40 range (each analyzer varies) and should produce similar %FS-STD values each time its used, within 10%, no more than 20% RPD. If not, a new standard using CAL-BAP-COALTAR should be used.

Once the UVF-500D is calibrated, it's stable for very long periods of time. The detector does not drift. Only recalibrate if necessary.

### Perform Quality Control Tests


Acceptance Criteria
- 50 ppb Standard: *Reads 45 to 55 ppb*
- 5 ppb Standard: *Reads 4 to 6 ppb*
- Methanol Check: *Reads 0 or <0.5 ppb*

Periodically check the analyzer for accuracy and precision by testing the 50 ppb Standard as if it were a sample. Readings should be close to 50 ppb. Press READ button again to check repeatability. Next, test the 5 ppb QC Check Standard to confirm the analyzer is linear at the lower end of the curve. Readings should be close, within 10%, no more than 20% off for best performance. If readings are outside the acceptance criteria, test new, fresh standards. Avoid testing standards past their 6-month expiration date. Test a blank to confirm the methanol is clean. This should be done on a more frequent basis, especially when new solvent is used.

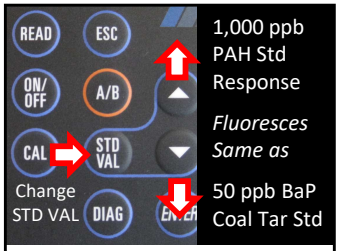
### Solid Standard Available


Includes Case with Wrenches

The UVF-500D includes a 100 ppm TPH Solid Standard. This device reads the same as the 100 ppm TPH standard used to factory calibrate the analyzer.

The Adjustable Solid Standard can be used and tuned to read "50 ppb", after the analyzer is calibrated to BaP using the 50 ppb Standard. Use the device for QC test or to calibrate analyzer. Once tightened, readings are always stable.

### Need to Test PAHs?




The UVF-500D can measure PAHs, using Sitelab PAH calibration kit CAL-061M-500D (EPA 16 PAHs) without the need to recalibrate. Press the STD VAL button and use the arrow keys to increase the concentration from 50 to 1000. PAH sample readings will be about 20 times higher compared to BaP sample readings. The DIAG %FS values do not change.