BNA Standard Preparation

1 SCOPE AND APPLICATION

1.1 This SOP details the procedure for preparing standards used in the BNA sample extraction and analysis.

2 REAGENTS

NOTE: Record Lot Numbers of all the reagents and solvents used in the Note Book. For each new chemical standard received, enter all the information of standard into the Laboratory Information Management System (LIMS) and get the serial number, and then file the certificate of analysis in a certification folder. If no expiration date for the chemical received, call the company and if they cannot give any date then enter one (1) year from date of receipt. If any expired or expiring stock standard is re-certified, make sure the standard is still good by preparing stock, intermediate and working standard and check against valid standards. Response should agree within +/- 15%. Keep all the documents of re-certification in the certification folder. Re-certification should be limited to stable standards and do not re-certify ICAL standards, and always use un-expired ICAL standards.

2.1 Methylene Chloride, Methanol and Acetone, Optima or HPLC grade-Fisher Scientific

2.2 Commercial Stock Standards and neat standards are available from Ultra Scientific, Fisher, Accu Standard, Chem Service, Restek, O_2Si and other suppliers. Generally, one-milliliter vials of standards are purchased for making calibration curve and check standard solutions. However, larger vials (5 mL) of higher concentration standards (up to 10,000 ppm) may be used for surrogate spike solutions and matrix spike solutions since these are used up so quickly.

3 EQUIPMENT

3.1 Volumetric Flasks- 1, 2, 5, 10, 25, 50, 100, and 500 mL

3.2 Volumetric pipettes- 0.5, 1, 2, 5, and 10 mL

3.3 Micro syringes- 5, 10, 25, 50, 100, 250, 500 and 1000 µL (Required from the manufacturer, the certificate stating that the volume is accurate to < 1%, otherwise calibrate and keep the record of these gas-tight micro-syringes or volumetric pipets quarterly)

3.4 2 mL screw cap amber glass auto sampler vials (or 1.8 mL crimp top vials) with colored cap for easy identification.

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3.5 Amber glass bottle with Teflon lined screw cap - 25, 50 and 100 mL

4 STANDARDS QUALITY ASSURANCE

4.1 New standards must be checked for correctness and condition upon receipt. Information for each new standard is entered into the LIMS Electronic Standard Preparation Log which includes all pertinent information such as date of receipt, compound list, concentrations, lot number, solvent, expiration date for the standard preparation. When preparing a standard make sure that all of the preparation information is entered into the Electronic Standard Preparation Log. The Preparation Log will create a serial number and barcode specific for the standard you prepare. Place the serial number or barcode onto the vial along with the standard name, concentration, solvent, date and your initials.

4.2 All prepared spike, surrogate and internal standard stock solutions must be re-made every 6-months or at the time of the standard expiration date, whichever comes first. All working standards should be re-made on a 3-month interval. Before making any standards from commercial sources, check to insure that the expiration date has not passed. Before putting any standard into use, verify that it is acceptable by comparing against the previously used standard or an external check standard. Responses should agree within +/- 15%. If not, check for instrument problems or re-make the new standard. **DISCARD ANY OLD STANDARDS AFTER NEW STANDARDS HAVE BEEN MADE AND FOUND TO BE ACCEPTABLE!**

4.3 Any standard remaining in an open ampoule should be transferred to a 2-mL vial and capped using a Teflon-lined rubber septum. (Make sure Teflon side of septum faces the standard solution!) Replace any pierced septa before returning the standard to storage. Draw a line on the vial at the meniscus and date the vial. Always check the meniscus when you use concentrate from a vial to make sure no evaporation has taken place. If it is below the line you drew, open a fresh ampoule. Store the vial in an upright position either in the box the concentrate came in or in the rack with the standards in the refrigerator. Record all standard preparations in the electronic logbook!!

5 STANDARDS PREPARATION

NOTICE: Review relevant SOPs and refer to the Material Safety Data Sheets (MSDS) for hazard and handling instructions before preparing standards.

The BNA standard in ampules may precipitate during storage. Visually inspect all standard ampules before use. Ultra Sonication of the sealed ampules prior to preparation usually insures complete dissolution of the compounds into the solvent and is a good standard practice. Do not use any vial with an un-dissolved precipitate.

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Always print labels from LIMS each time you make standard. Do not hand write!

5.1 **BNA Internal standard (50 µg/mL):** Prepare from the stock concentrate containing the following at 4000 µg/mL (Ultra Scientific - US-108N, Internal Standards Mixture, 12 x 1 mL of 4000 µg/mL)

1,4-Dichlorobenzene-d4	Phenanthrene-d10
Naphthalene-d8	Chrysene-d12
Acenaphthene-d10	Perylene-d12

Allow Internal Standard Stock (4000 µg/mL) to completely warm up to room temperature. The vial containing the solution should be sonicated for several minutes to insure complete dissolution of compounds into the solvent. Visually check the bottom of the vial for crystals of compound. The more heavily deuterated compounds may crystallize during cold storage and then require a warm water bath as well as sonication to re-dissolve. Pipette exactly 0.125 mL of the Internal Standard Stock into a 10-mL volumetric flask. Dilute to volume with methylene chloride. Transfer to a 15 mL centrifuge tube and store at –10 °C or less.

5.1.1 BNA Internal standard at 5 µg/mL: Take 1 mL of BNA Internal Standard (50 µg/mL) and place into a 10 mL volumetric flask. Dilute to volume with methylene chloride and mix well. Use this concentration for Instrument blank check and for sample dilutions.

5.1.2 BNA Internal standard at 1 µg/mL: Take 0.2 mL of BNA Internal Standard (50 µg/mL) and place into a 10 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.1.3 BNA Internal standard at 100 µg/L: Take 1 mL of BNA Internal Standard (1 µg/mL) and place into a 10 mL volumetric flask. Dilute to volume with methylene chloride and mix well. Use this concentration for Instrument blank check and for sample dilutions.

5.2 **BNA Surrogate Mix for Water/Sediments (200 µg/mL acids, 100 µg/mL base neutrals):**

5.2.1 Take 5 mL each of the Acid Surrogate Spike Mix (10,000µg/mL) (Restek Corporation – 31087; Acid Surrogate Mix) and the Base-Neutral Surrogate Spike Mix (5,000 µg/mL) (Restek Corporation – 31086; B/N Surrogate Mix) and place into a 250 mL volumetric flask. Dilute to volume with methanol and mix well. Alternatively, make only 100 mL of this mix by diluting 2 mL each in methanol and store rest of the concentrate carefully.

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5.2.2 Transfer to amber glass bottles with Teflon lined screw caps. Label as "BNA Surrogate Mix for Water/Sediments (200 µg/mL acids, 100 µg/mL base neutrals), in methanol " and store at 4 °C or less.

5.2.3 For water acid and base neutral extractions Tinted methanol indicator at 2000 µg/mL of 250 mL is purchased from O_2Si, catalog number 020328-99-250. Add 0.5 mL of this solution along with surrogate.

5.3 **BNA Matrix Spike Mix for Water/Sediments – 625/8270/OFR matrix spike mixes for water/sediments (50 µg/mL for all of the components):**

5.3.1 Follow sec. 5.4.2 to 5.4.5 to prepare each of the 625/8270/ matrix spike mixes from 1st source without the addition of surrogate spikes. Use this 50 µg/mL of 625/8270/OFR intermediates for spiking; add 0.5 mL for a final volume of 1 mL (For drinking water analysis add 0.2 mL of 625/8270 spike). For TCLP use 625 intermediate for spiking.

5.3.2 Transfer to 15 mL centrifuge tube with Teflon lined screw caps. Label as "625/8270/ Matrix Spike Mix for Water/Sediments (50 µg/mL), in methanol " and store at 4 °C or less.

5.4 **Mixed BNA Calibration (ICAL) & Second Source Continuing Calibration Verification (CCV) Stock Standards (for 625/8270 and OFR, GC-MS Analyses):**

5.4.1 Prepare the following mixed stock standards at 200 µg/mL (ICAL) and 100 µg/mL (CCV): The standards for ICAL were used from Ultra Scientific or Restek and Accu Standard or Supelco or O_2Si for CCV by mixing them separately. These mixes may come from sources other than Ultra Scientific and Accu Standard as deemed necessary. Store the prepared intermediate standards mix at -10 °C or less.

5.4.2 **625 ICAL Stock Mix at 200 µg/mL with Surrogates:** Add the appropriate aliquots of the following concentrated stocks to a 2 mL volumetric flask to make 200 µg/mL. Dilute to volume with methylene chloride. The usual aliquot is 0.4 mL for 1000 µg/mL and 0.2 mL for 2000 µg/mL.

5.4.3 **625 CCV at 25 µg/mL**: Add the appropriate aliquots of 100 µg/mL (sec. 5.4.1) from second source to a 2 mL volumetric flask to make 25 µg/mL. Also add appropriate aliquot of internal standard. Dilute to volume with methylene chloride.

625 CCV at 5 µg/mL: Add the appropriate aliquots of 100 µg/mL (sec. 5.4.1) from second source to a 2 mL volumetric flask to make 5 µg/mL. Also add appropriate aliquot of internal standard. Dilute to volume with methylene chloride.

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Std ID	**Catalog #**
ICAL:	
64 Compound 8270 Mega mix	31850 , Restek
2 Compound Benzidine Mix	31030, Restek
Acid Surrogate Mix	ISM 290N, US
Base Neutral Surrogate Mix	ISM 280N, US
CCV:	
64 Compound	110807-01, O_2Si
2 Compound Benzidine Mix	Z-014F, Accu Std. or US-105N, US

5.4.4 8270 ICAL Stock Mix at 200 µg/mL:

Add the appropriate aliquots of the following concentrated stocks to a 2 mL volumetric flask to make 200 µg/mL. Dilute to volume with methylene chloride. The usual aliquot is 0.4 mL for 1000 µg/mL and 0.2 mL for 2000 µg/mL.

5.4.5 **8270 CCV at 25 µg/mL:** Add the appropriate aliquots of 100 µg/mL (sec. 5.4.1) from second source to a 2 mL volumetric flask to make 25 µg/mL. Also add appropriate aliquot of internal standard. Dilute to volume with methylene chloride.

8270 CCV at 5 µg/mL: Add the appropriate aliquots of 100 µg/mL (sec. 5.4.1) from second source to a 2 mL volumetric flask to make 5 µg/mL. Also add appropriate aliquot of internal standard. Dilute to volume with methylene chloride.

Std ID	**Catalog #**
ICAL:	
35 Compound SVM-8271 Mix	SVM-8271, 1000 µg/mL, Supelco
CCV:	
31 Compound M-8270 Mix	SVM-8271, 1000 µg/mL, US

5.4.6 OIL FRAKING ANALYTES (OFR): Similarly ICAL standards and CCV were made as sec 5.4.2 and 5.4.3

List of analytes for OFR:

Benzaldehyde, 2-Butoxyethanol, 1-Butoxy-2-propanol, Benzoic acid, Alpha-Terpineol and Triethyl-2-acetylcitrate

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5.5 **DFTPP Tuning Standard Mixture (50 µg/mL):**

5.5.1 (Pentachlorophenol, DFTPP, Benzidine and 4, 4'-DDT) (Ultra Scientific - GCM-150; Semi-volatiles GC/MS Tuning Standard; 4 x 1 mL of 1000 µg/mL)

5.5.2 Pipette exactly 0.5 mL of DFTPP solution (1000 µg/mL) into a 10 mL volumetric flask. Dilute to volume with methylene chloride. Mix well and transfer to a bottle. Store at -10 °C or less.

5.6 **PAH/DPGBE Matrix Spike Mix and B/N Surrogate Spike for Water, Waste, Sediment (low level) and Puf (100, 50 and 5 µg/mL):**

5.6.1 PAH Matrix Spike Mix Intermediate at 50 µg/mL: Take 0.25 mL of PAH Mix from 1st source (2,000µg/mL) and place into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.6.2 DPGBE Matrix Spike Intermediate at 100 µg/mL: Take appropriate aliquot of DPGBE from stock standard (Sigma Aldrich) and place into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.6.3 PAH Matrix Spike Mix at 5 µg/mL: Take 1 mL of 5.6.1 (50 µg/mL) and placed into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

Note: For low level, PAH Matrix Spike Mix at 100 µg/L: Take 0.2 mL of 5.6.3 (5 µg/mL) and placed into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.6.4 DPGBE Matrix Spike at 5 µg/mL: Take 0.5 mL of 5.6.2 (100 µg/mL) and placed into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.6.5 B/N Surrogate Spike at 50 µg/mL: Take 0.5 mL of B/N Surrogate 1000 µg/mL and placed into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

B/N Surrogate Spike at 5 µg/mL: Take 1 mL of B/N Surrogate 50 µg/mL (sec 5.6.5) and placed into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.6.6 Field Surrogate Spike for Puff at 50 µg/mL: Take appropriate aliquot of field surrogate and placed into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

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5.6.7 Laboratory and Field Surrogate Mix Spike for puff at 50 µg/mL: Take appropriate aliquot of field surrogate, laboratory surrogate, B/N surrogate and placed into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.6.8 PAH Mix Intermediate for CCV at 50 µg/mL: Take 0.125 mL of PAH Mix from 2nd source (2,000µg/mL) and place into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

PAH Mix Intermediate for CCV at 5 µg/mL: Take 0.5 mL of PAH Mix from 5.6.8 (50µg/mL) and place into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.6.9 DPGBE Intermediate for CCV at 50 µg/mL: Take appropriate aliquot of DPGBE from stock standard (AccuStandard) and place into a 10 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.6.10 PAH CCV Mix for low level analysis at 5 µg/mL: Take 0.5 mL of 5.6.8 (50 µg/mL), 0.5 mL of 50 µg/mL (5.6.5) B/N Surrogate and 0.5 mL of BNA Internal standard of 100 µg/mL and placed into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

Note: For SIM mode, PAH CCV Mix for low level analysis at 100 µg/L: Take 0.1 mL of 5.6.8 (5 µg/mL), 0.1 mL of 5 µg/mL (5.6.5) B/N Surrogate and 0.5 mL of BNA Internal standard of 1 µg/mL and placed into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.6.11 DPGBE CCV for low level analysis at 5 µg/mL: Take 0.5 mL of 5.6.9 (50 µg/mL), 0.5 mL of 50 µg/mL (5.6.5) B/N Surrogate and 0.5 mL of BNA Internal standard of 100 µg/mL and placed into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.6.12 PAH CCV Mix for puff analysis at 0.5 µg/mL: Take 0.05 mL of 5.6.8 (50 µg/mL), 0.05 mL of 50 µg/mL (5.6.7) and 0.05 mL of BNA Internal standard of 50 µg/mL and placed into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.7 **PAH/DPGBE and Surrogates (Laboratory and Field) Calibration Intermediate Standard Mix (For Puf, 100 and 10 µg/mL, GC/MS analyses):**

5.7.1 PAH and Surrogate Calibration Intermediate Standard mix at 100 µg/mL: Add 0.5 mL of the PAH stock mix (2,000µg/mL) and 1 mL of Base Neutral surrogate stock mix (1,000µg/mL) to a 10 mL volumetric flask. Dilute to volume with methylene chloride.

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5.7.2 DPGBE Calibration Intermediate Standard at 100 µg/mL: Take appropriate aliquot of DPGBE from stock standard (Sigma Aldrich) to a 10 mL volumetric flask. Dilute to volume with methylene chloride.

5.7.3 PAH and Surrogate Calibration Intermediate Standard mix for puff at 10 µg/mL: Add 0.05 mL of the PAH stock mix (2,000µg/mL) and 2 mL of 5.6.7 to a 10 mL volumetric flask and dilute to volume with methylene chloride.

5.7.4 PAH 7 (analytes) stock standard of 1000 µg/mL purchased from two different sources, ultra scientific and O_2Si (used for ICAL and CCV).

5.8 **PCP Matrix Spike Mix and B/N Surrogate Spike for Water (50, 5 and 1 µg/mL):**

5.8.1 PCP Matrix Spike Mix Intermediate at 50-25 µg/mL: Take 0.0625 mL of Coprostanol (2,000µg/mL), 0.278 mL of Galaxolide (449µg/mL) and 0.142 mL of Tonalide (880 µg/mL) from 1st source and place into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.8.2 PCP Matrix Spike Mix at 1-0.5 µg/mL: Take 0.2 mL of 5.8.1 (50-25 µg/mL) and placed into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.8.3 B/N Surrogate Intermediate at 50 µg/mL: Take 0.5 mL of B/N Surrogate 1000 µg/mL and placed into a 10 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.8.4 B/N Surrogate spike at 5 µg/mL: Take 1 mL of B/N Surrogate intermediate sec. 5.8.3 and placed into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.8.5 PCP Calibration Standard: Prepared seven levels (20, 10, 5, 2, 1, 0.5 and 0.2 µg/mL of calibration standard using appropriate aliquot of sec. 5.8.1and 5.8.3. Also added aliquot of internal standard at 2 µg/mL concentration in methylene chloride.

5.8.6 PCP CCV Mix for low level analysis at 5 µg/mL: Take appropriate aliquot of Coprostanol, Galaxolide and Tonalide from second source. B/N surrogate from 5.8.3 (50 µg/mL), and BNA Internal standard at 2 µg/mL level and placed into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.9 **FL-PRO Standard Preparation:**

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5.9.1 **TRPH Standard:** The FL-PRO method uses a 17 component alkane mixture for calibration and spiking which covers the C_8 to C_{40} range and is available in a 1:1 methylene chloride/carbon disulfide solvent mixture. The carbon disulfide is needed because of the low solubility of many of the alkane compounds, particularly at the higher concentrations. The TRPH standards are currently acquired from Ultra Scientific (SFL-601) and AccuStandard (DRH-004S-5X).

5.9.2 **Surrogate Standards:** ortho-Terphenyl (OTP) and Nonatriacontane (C_{39}) are used as surrogates. The neat surrogate standards are available from Fluka. The stock surrogate standards are prepared at 5000 µg/mL in methanol for OTP and carbon disulfide for C_{39}. Prepare 100 mL of 100 µg/mL for OTP and C_{39} in 1:1 acetone/ hexane. Add 2 mL of FL-PRO Surrogate Standard to all the samples in the set to a final volume of 2 mL.

5.9.3 **Calibration Standard:** A 7 level calibration curve is prepared and analyzed at 5.0, 25, 50, 100, 150, 200 and 300 µg/mL for each of the 17 alkane components plus OTP and C_{39} in methylene chloride. This is equivalent to 85, 425, 850, 1700, 2550, 3400 and 5100 µg/mL, respectively, for the total alkane concentration and is defined as TOTAL PHS.

5.9.4 **Water and Soil Spike solution:** The first source TRPH stock standard containing 17 alkane mixture 500 µg/mL from Ultra Scientific is used directly from the manufacturer for spiking.

5.9.5 CCV Standard at 40 µg/mL: The second source TRPH stock standard containing 17 alkane mixture 1000 µg/mL from AccuStandard (DRH-004S-5X) is used to make CCV at 40 µg/mL, which is equivalent to 680 µg/mL.

5.10 **EPH Standard Preparation:**

5.10.1 **Alkane Standard Mix:** The EPH method uses a 14 component aliphatic mixture as well as the surrogate (Chloro-octadecane) for calibration.

5.10.2 **Aromatic Standard:** The EPH method uses the 17 component Aromatic mixture as well as the surrogate ortho-Terphenyl.

5.10.3 **Fractionation surrogates:** 2-Bromonaphthalene and 2-Fluorobiphenyl for calibration.

5.10.4 **Surrogates:** The compounds ortho-Terphenyl (OTP) and Chloro-octadecane (COD) are used as surrogates. The stock surrogate standards are diluted to give a spiking solution concentration of 40 µg/mL in acetone.

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5.10.5 **Fractionation Surrogates:** The compounds 2-Fluorobiphenyl and 2-Bromonaphthalene are used to track the fractionation process. The stock fractionation surrogate standards are diluted to give a spiking solution concentration of 40 µg/mL in hexane.

5.10.6 **Internal Standard:** 5-alpha-Androstane stock internal standard at 200 µg/mL. For samples, 100 µL of this solution in hexane is added to the aliphatic fraction and 100 µL in methylene chloride is added to the aromatic fraction resulting in both cases in a sample extract concentration of 20 µg/mL. Appropriate amounts of internal standard stock solution are added to the curve solutions to give each of them a 20-µg/mL concentration.

5.10.7 **Calibration Standard:** A 6 level calibration curve is prepared at 0.8, 2.4, 4, 8, 20 and 40 µg/mL for both the aliphatic curve and the aromatic curve. This is equivalent to 11.2, 33.6, 56, 112, 280 and 560 µg/mL, respectively, for the total alkane concentration and 13.6, 40.8, 68, 136, 340 and 680 µg/mL for the total aromatic concentration.

5.10.8 **Matrix Spiking Solution:** The EPH matrix spiking solution consists of C_9, C_{14}, C_{19}, C_{20} and C_{28} Aliphatic as well as Naphthalene, Acenaphthalene, Anthracene, Pyrene and Chrysene aromatics at 50 µg/mL each in acetone.

5.10.9 **Water and Soil Matrix Spikes:** A 1 mL aliquot of the EPH matrix spiking solution is added to 1.0 liter of water or 10 grams of soil. The final extract volume for both the water and soil samples is 2 mL, thus the (total) sample spike levels are 0.50 mg/L for water and 50 mg/kg for soil samples.

5.11 **1, 4- Dioxane Standard Preparation (5 µg/mL):**

5.11.1 **1, 4-Dioxane for ICAL and Matrix Spike Intermediate at 5 µg/mL**: Take 0.0357 mL of 1, 4-Dioxane (1400 µg/mL) and place into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.11.2 **Surrogate (1, 4-Dioxane-d8) spike at 5 µg/mL**: Take 0.25 mL of 1, 4-Dioxane-d8 (200 µg/mL) and place into a 10 mL volumetric flask. Dilute to volume with methanol and mix well.

5.11.3 **Internal Standard (THF-d8 at 5 µg/mL):** Take 0.0588 mL of THF-d8 (850 µg/mL) and place into a 10 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

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5.11.4 **Internal Standard and Surrogate Mix Intermediate for Calibration Curve and CCV (5 µg/mL):** Take 0.0588 mL of THF-d8 (850 µg/mL) and 0.25 mL of 1, 4-Dioxane-d8 (200 µg/mL), place into a 10 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.11.5 **1, 4-Dioxane Intermediate for CCV at 5 µg/mL:** Take 0.25 mL of 1, 4-dioxane (2^{nd} source, 100 µg/mL) and placed into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

5.11.6 **1, 4-Dioxne - CCV Mix at 50 µg/L:** Take 0.05 mL aliquot of 5.11.4, 5.11.5 and placed into a 5 mL volumetric flask. Dilute to volume with methylene chloride and mix well.

6 CALIBRATION STANDARDS

6.1 In general, five point calibration curves need to be made for every compound on the identification list. The behavior of some compounds such as thermally labile and active site sensitive may limit the curve for that particular compound to only three or so points. The upper limit to the calibration curve is usually determined by the column's capacity for that compound. A DB-5 or similar column will take a sample load of about 100 ng before column overloading occurs, but this phenomenon may occur at as little as 50 ng for some compounds. Therefore, a significant drop in response factors (RF) values at the high end of the curve will warrant a deletion of that point on the curve for that individual compound. The lower end of the curve is determined statistically as the PQL for that compound. For most compounds this is 2 ppm.

6.2 Calibration curve solution preparation: Prepare seven calibration levels, for details see the table. Follow this procedure for the 8270 calibration solution. Using a clean transfer pipette for each flask, transfer the contents of the flask to an amber screw top sample vial. Place printed label and with a permanent ink marker, mark the meniscus level on the side of the vial so that in the future, any gross loss of the contents will be evident. Store at -10 °C or less.

Calibration Level (µg/mL)	Final Volume (mL)	Internal Std. (50µg/mL) Aliquot (mL)	Stock Std. (200µg/mL) Aliquot (mL)
L7- 100	1	0.1	0.5
L6- 50	1	0.1	0.25
L5- 25	1	0.1	0.125
L4- 10	1	0.1	0.05
L3- 5	1	0.1	0.025
L2- 2	2	0.2	0.02
L1- 1	5	0.5	0.025
0.5	1	Diluted with IS 5ppm	0.1 mL of L3
0.1	1	Diluted with IS 5ppm	0.1 mL of L1

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6.3 **Calibration curve solution preparation for Puf analysis:** Using five 1 mL volumetric flasks, add 0.05 mL of 10 ppm BNA internal standard solution to each flask. To prepare the following calibration standard, 2.5, 1.25, 0.5, 0.25and 0.1, known aliquot of 5.7.2 (10 µg/mL) is added to each flask using appropriate syringe. Make up to the volume with methylene chloride. Mix the contents thoroughly. Label the flask and transfer to an amber screw top sample vial. With a permanent ink marker, mark the meniscus level on the side of the vial so that in the future, any gross loss of the contents will be evident.

6.4 **Calibration curve solution preparation for Low Levels PAH/DPGBE analysis (GC/MS):**

Using seven 1 mL volumetric flasks, add 0.1 mL of 100 ppm BNA internal standard solution to each flask. To prepare the following calibration standard, 50, 25, 10, 5, 2, 1, 0.2 and 0.05 µg/mL, known aliquot of 5.7.1 (100 µg/mL) is added to each flask using appropriate syringe. Make up to the volume with methylene chloride. Mix the contents thoroughly. Label the flask and transfer to an amber screw top sample vial. With a permanent ink marker, mark the meniscus level on the side of the vial so that in the future, any gross loss of the contents will be evident.

Using seven 1 mL volumetric flasks, add 0.1 mL of 100 ppm BNA internal standard solution to each flask. To prepare the following calibration standard, 50, 25, 10, 5, 2, 1 and 0.2 µg/mL, known aliquot of 5.7.2 (100 µg/mL) is added to each flask using appropriate syringe. Make up to the volume with methylene chloride. Mix the contents thoroughly. Label the flask and transfer to an amber screw top sample vial. With a permanent ink marker, mark the meniscus level on the side of the vial so that in the future, any gross loss of the contents will be evident.

Note: For low level of PAH's in SIM mode: Using seven 1 mL volumetric flasks, add 0.1 mL of 1 ppm BNA internal standard solution to each flask. To prepare the following calibration standard, 1000, 500, 100, 25, 10, 5 and 2 µg/L, known aliquot of 5.6.3 and 5.6.5 (5 µg/mL) is added to each flask using appropriate syringe. Make up to the volume with methylene chloride. Mix the contents thoroughly. Label the flask and transfer to an amber screw top sample vial. With a permanent ink marker, mark the meniscus level on the side of the vial so that in the future, any gross loss of the contents will be evident.

6.5 **Calibration curve solution preparation for 1, 4- Dioxane analysis (SIM Mode):** Prepare seven calibration levels, for details see the table. The concentration of Internal standard (THF_d8) and Surrogate (1, 4-Dioxane_d8) are the same at 50 µg/L in all the calibration levels. Using a clean transfer pipette for each flask, transfer the contents of the flask to an amber screw top sample vial. Place printed label and with a permanent ink marker, mark the meniscus level on

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the side of the vial so that in the future, any gross loss of the contents will be evident. Store at -10 °C or less.

Levels	Calibration Level (µg/L)	Final Volume (mL)	Internal Std. & Surrogate (5µg/mL) Aliquot (mL)	1,4-Dioxane Std. (5µg/mL) Aliquot (mL)
L7	500	1	0.01	0.1
L6	250	1	0.01	0.05
L5	50	1	0.01	0.01
L4	25	5	0.05	0.025
L3	10	10	0.1	0.02
L2	5	10	0.1	0.01
L1	2	5	Make final volume with 50µg/L of internal standard	0.2 mL of L5

7 SECOND SOURCE CALIBRATION MIX (CCV):

7.1 Prepare a CCV from second source Std. 625/8270 at 25 µg/mL. See details sec. 5.4.2 to 5.4.5.

7.2 Prepare a CCV from second source standard for 1, 4-dioxane see details sec. 5.11.6

Appendix of Changes

04/26/2010 Minor revisions to the text were made for format and clarity.

04/26/2010 Updated standards to reflect current use.

05/10/2011 Updated standards to reflect current use.

10/24/2013 Updated standards to reflect current use.

12/06/2013 Updated standards to reflect current use.

07/29/2015 Updated standards to reflect current use.

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