

**NON-INDUSTRIAL PERSONAL BENZENE EXPOSURE
IN A MEDITERRANEAN CLIMATE**

THIS THESIS IS PRESENTED FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY OF MURDOCH UNIVERSITY

by

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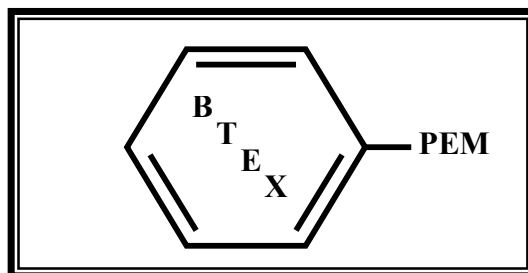
I declare that this thesis is my own account of my research except where duly acknowledged, and contains as its main content work which has not been previously submitted for a degree at any tertiary education institution

Anthony Horton



APPENDIX A
MURDOCH
UNIVERSITY
PERTH, WESTERN AUSTRALIA

PARTICIPANT QUESTIONNAIRE



This questionnaire is part of a study funded by Environment Australia (Commonwealth Department of Heritage and the Environment). The study is being conducted to characterise personal exposure to benzene, toluene, ethylbenzene and xylene in Perth, Adelaide, Melbourne and Sydney.

THE INFORMATION REQUESTED IN THIS QUESTIONNAIRE WILL BE TREATED WITH THE STRICTEST CONFIDENCE.

DIRECTIONS

1. PLEASE READ EACH QUESTION CAREFULLY
2. PLEASE TICK THE BOX THAT CORRESPONDS TO YOUR ANSWER

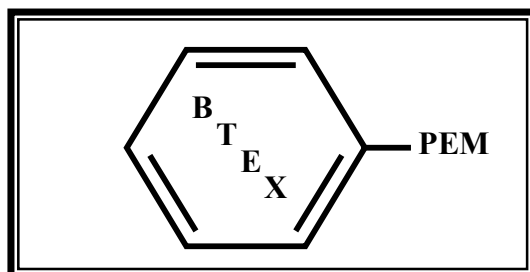
PARTICIPANT IDENTIFICATION NUMBER

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DATE

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TIME/ ACTIVITY DIARY



This time/activity diary is part of a study funded by Environment Australia (Commonwealth Department of Heritage and the Environment). The study is being conducted to characterise personal exposure to airborne benzene, toluene, ethylbenzene and xylene in Perth, Adelaide, Melbourne and Sydney.

An essential part of the study involves examining the length of time people spend in a range of different locations whilst simultaneously monitoring personal exposure to BTEX.

DIRECTIONS

To complete the time/ activity diary, please follow these steps:

- complete the time/activity diary for each 24-hour period each time a BTEX sampler is worn.
- briefly describe the activities undertaken during the 24-hours
- specify each commuting mode used during the 24 hours (ie. car, bus, train).
- please indicate whether someone was smoking in the room (if indoors) or nearby (if outdoors) for each location and activity during the 24 hours.
- indicate whether any of the “key activities” took place during the 24-hour monitoring period.

PART A: PERSONAL INFORMATION

OFFICE USE ONLY

1. What is your age in years? _____

1.

2. What is your sex?

Male 1 Female 2

2.

3. Does anybody in your household smoke?

yes 1 no 2

3.

4. Are you employed?

yes 1 no 2

4.

If no, go to Part B

4.1 If yes, in which industry are you employed? _____

4.1

4.2 What is your job description? _____

4.2

PART B: INFORMATION RELATING TO TRANSPORT

5. During an average weekday (Monday to Friday), how long (to the nearest quarter of an hour) would you spend using the following modes of transport? (If you do not spend any time in these modes write 0).

hours (per day)

5.1 motor car/ ute _____

5.1

5.2 truck, van or minibus _____

5.2

5.3 motorcycle _____

5.3

5.4 bus _____

5.4

5.5 train _____

5.5

5.6 tram _____

5.6

5.7 ferry _____

5.7

5.8 bicycle _____

5.8

5.9 walk/ run/ jog _____

5.9

5.10 other (please specify) _____

5.10

6. During an average weekend day (Saturday or Sunday), how long (to the nearest quarter of an hour) would you spend in the following modes of transport? (If you do not spend any time in these modes write 0).

	hours per day	
6.1 motor car/ ute	_____	6.1 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6.2 truck, van or minibus	_____	6.2 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6.3 motorcycle	_____	6.3 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6.4 bus	_____	6.4 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6.5 train	_____	6.5 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6.6 tram	_____	6.6 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6.7 ferry	_____	6.7 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6.8 bicycle	_____	6.8 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6.9 walk/ run/ jog	_____	6.9 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
6.10 other (please specify)	_____	6.10 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

7. Do you ever park a vehicle in an underground/multistorey car park?

yes 1 no 2 7

If no, go to PART C

8. If yes, how often do you park a vehicle in an underground/ multi-storey car park?

infrequently throughout the year 1 once per fortnight 2 3

once per week 3 3-5 times per week 4

daily 5

PART C: INFORMATION RELATING TO BEHAVIOURS

OFFICE USE ONLY

9. Do you ever purchase food/ beverages (including take- away) from drive- through outlets?

yes 1 no 2

9.

If no, go to Question 11.

10. If yes, how often do you purchase food/ beverages from drive- through outlets?

less than once per month 1 once per month 2
once per fortnight 3 once per week 4
two- three times per week 5 daily 6

10.

11. Do you ever have your clothes dry cleaned?

yes 1 no 2

11.

If no, go to Question 13.

12. If yes, approximately how many items per month do you have dry cleaned?

less than 5 1 5-10 2 more than 10 3

12.

13. Do you drive a motor vehicle?

yes 1 no 2

13.

If no, go to Question 15.

14. If yes, approximately how old is the motor vehicle you drive most often?

Less than 2 years old 1
More than 2, but less than 5 years old 2
More than 5, but less than 10 years old 3
More than 10, but less than 20 years old 4
More than 20 years old 5

14.

15. Do you ever refuel a motor vehicle?

yes 1 no 2

15.

If no, go to Question 18.

16. If yes, how many times per week do you refuel (on average)?

- less than once per week 1 once per week 2
twice per week 3 more than twice per week 4
every day 5

OFFICE USE ONLY

16.

17. Which of the following does the vehicle you refuel most often use?

- 17.1 Petrol
17.2 diesel
17.3 LPG

17.1

17.2

17.3

18. Do you ever carry out mechanical repairs on a vehicle or other motorized equipment? (eg, outboard motor, pumps, etc)

- yes 1 no 2

18.

19. How often do you use any of the products listed below in and around your home?

- | | never/
infrequently | once per
month | once per
week | more than
once per week | every
day |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 19.1 glues/ adhesives | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 19.2 stain remover | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 19.3 varnishes/
lacquers | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 19.4 paints | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 19.5 solvents/
degreasers (kero, turps, white spirit, acetone, etc) | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 19.6 methanol | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 19.7 oven cleaner | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 19.8 nail polish/
remover | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 19.9 insect sprays/
aerosols | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 19.10 WD-40/RP-7 | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |

19.1

19.2

19.3

19.4

19.5

19.6

19.7

19.8

19.9

19.10

PART D: INFORMATION RELATING TO YOUR HOME

OFFICE USE ONLY

20. How far is your home from the nearest highway or arterial road?
 (Please indicate approximate distance in metres.) _____ m

20

21. Is your home located within 300m of light industry or heavy industry?

yes 1 no 2

21

If yes, please describe the nearest type of industrial activity; for example, spray painter, hospital incinerator, service station, etc _____

22. What is the main floor covering in each of the following rooms in your home?
 carpet tiles/slate floorboards linoleum Other (specify)
 /vinyl

22.1 bedrooms 1 2 3 4 5 _____
 22.2 living room 1 2 3 4 5 _____
 22.3 kitchen 1 2 3 4 5 _____
 22.4 dining room 1 2 3 4 5 _____

22.1
 22.2
 22.3
 22.4

23. Does your home have an enclosed attached garage with a door into your home?

yes 1 no 2

23

24. Are you currently renovating (eg. new carpet, new kitchen) or have you done any renovations in the last 12 months?

yes 1 no 2

24

25. Have you painted indoors recently (within the last 12 months)?

yes 1 no 2

25.

26. If yes, how long ago in months (please specify) _____

26.

27. Have you painted outdoors recently (within the last 12 months)?

yes 1 no 2

27.

28. If yes, how long ago in months (please specify) _____

28.

29. Do you use a lawnmower at home?

yes 1 no 2

If no, go to Question 31.

30. If yes, which one of the following types is it?

- 30.1 2- stroke petrol 1
30.2 4- stroke petrol 2
30.3 electric 3
30.4 push mower 4
30.5 other 5
(please specify) _____

31. Do you use a heater at home in winter ?

yes 1 no 2

If no, go to Question 34.

32. If yes, how many of each type of heating do you use?

- | | 0 | 1 | 2 | 3 |
|---------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 32.1 unflued gas | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
| 32.2 flued gas (with a chimney) | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
| 32.3 pot belly stove | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
| 32.4 open fire | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
| 32.5 electric | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
| 32.6 oil/ column | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
| 32.7 kerosene | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |

33. In winter, for how many hours per day do you operate your main heater?

33.1 < 1 hour 1 1-2 hours 2 2 - 5 hours 3 >5 hours 4

33.2 What type of heater is it? (specify) _____

34. In winter, do you ever notice the smell of wood smoke in your home ?

yes 1 no 2

OFFICE USE ONLY

26.

30.1

30.2

30.3

30.4

30.5

31.

32.1

32.2

32.3

32.4

32.5

32.6

32.7

33.1

33.2

34.

35. In summer, do you use an air-conditioner in your home?

yes 1 no 2

35.

If no, go to Question 37.

36. If you use an air-conditioner, when would you be likely to have it turned on?

36.1 During the day

36.1.

36.2 During the night

36.2.

36.3 During both day and night

36.3.

36.4 Any time, if the temperature is over ____ °C (please indicate)

36.4.

36.5 Other (please specify) _____

36.5.

37. How often do you burn candles in your home?

never/ infrequently 1 once per month 2

37.

once per week 3 every day 4

38. How often do you burn essential/ aromatherapy oils in your home?

never/infrequently 1 once per month 2

38.

once per week 3 every day 4

39. What type of fuel/energy do you use to operate your Hot-plate?

Gas 1 Electric 2 Wood 3

39.

Do not know 4 Other (specify) 5 _____

40. Is a range hood (with external flue) or ventilation fan normally used when the hot-plate is used?

yes 1 no 2

40.

41. What type of fuel/energy do you use to operate your Oven?

Gas 1 Electric 2 Wood 3

41.

Do not know 4 Other (specify) 5 _____

EXAMPLE: Sample time/ activity diary (weekday)

Did you do any of the following “key activities” today? (Y/N)				
Refuel car? N				
Use home air-conditioner or heater? Y (A/C)				
Go to underground carpark? Y				
Go to drive-through fast food outlet or similar drive-through service (eg bottle shop)? N				
Begin	End	Location	Activity	Someone smoking nearby? Y/N
11:00 pm	7:00 am	Home – bedroom	Sleeping	N
7:00 am	7:30 am	Bathroom	Showering, dressing	N
7:30 am	8:00 am	Kitchen	Preparing breakfast, eating	N
8:00 am	8:45 am	Car – Commodore sedan, unleaded fuel	Driving to work – used air conditioner (re-circulating)* *Traffic jam in tunnel – approx 10 min	N
8:45 am	9:00 am	Underground Car park, elevator	Park car	N
9:00 am	12:30 pm	Office	Write reports, attend meetings	N
12:30 pm	1:00 pm	Park	Eat lunch, read paper	Y
5:30 pm	5:45 pm	Central business district	Walk to gym	Y
5:45 pm	6:45 pm	Gym	Aerobics class	N
6:45 pm	7:30 pm	Car (same car as AM)	Get car from carpark, drive home –windows down	N
7:30 pm	8:00 pm	Home – living room	Watch television, talk with partner (indoors)	N
8:00 pm	9:00 pm	Home – kitchen	Eat dinner, wash dishes	N
9:00 pm	10:00 pm	Home – living room	Listen to music, talk with partner* * Spent 15 minutes applying nail polish	N
10:00 pm	10:15 pm	Home - bedroom	Prepare for bed, remove sampler and fill in diary.	N

EXAMPLE: Sample time/ activity diary (weekend)

Did you do any of the following “key activities” today? (Y/N)				
Refuel car? Y				
Use home air-conditioner or heater? Y (A/C)				
Go to underground carpark? N				
Go to drive-through fast food outlet or similar drive-through service (eg bottle shop)? Y				
Begin	End	Location	Activity	Someone smoking nearby? Y/N
1:00 am	9:00 am	Home – bedroom	Sleeping	N
9:00 am	9:30 am	Home - kitchen	Preparing breakfast, eating	N
9:30 am	9:45 am	Home - bathroom	Showering, dressing	N
9:45 am	10:45 am	Home – garden	Water pot plants, mow lawn* *Used 2-stroke fuel in law mower for 30 min	N
10:45 am	11:00 am	Car – Pajero 4WD (diesel)	Drive to supermarket, windows down	N
11:00 am	11:45 am	Shopping centre	Grocery shopping	N
11:45 am	12:15 pm	Car - Pajero	Drive home from shops via servo – refuel car (diesel) – windows down	N
12:15 pm	4:45 pm	Home - indoors	Eat lunch, put away groceries, vacuum, do laundry, read newspaper. (A/C on).	N
4:45 pm	5:15 pm	Home - bathroom	Shower and get ready to go out	N
5:15 pm	6:15 pm	Car (same car as AM)	Drive to friend’s house – stopped at drive-through bottle shop. Did not use A/C in car, windows up	N
6:15 pm	10:15 pm	Friend’s house - backyard	Barbeque*, socialising. * Very smoky fire during first 15 minutes!	Y
10:15 pm	10:30 pm	Car	Drive home.	N
10:30 pm	11:30 pm	Home	Watch television	N
11:30 pm	11:45 pm	Home - bedroom	Prepare for bed.	N

TIME/ ACTIVITY DIARY

- please print clearly
- record times spent for each location/ activity *to the nearest 15 minutes* for each 24 hour period

Participant Identification Number

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Day 1

Day of week sample tube opened: _____

Date sample tube opened: ____/____/____ **day/month/year)**

Did you do any of the following “key activities” today? (Y/N)

- Refuel car?
 Use home air-conditioner or heater?
 Go to underground carpark?
 Go to drive-through fast food outlet or similar drive-through service (eg bottle shop)?

Begin	End	Location	Activity	Someone smoking nearby? Y/N

(over page)

TIME/ ACTIVITY DIARY

- please print clearly
- record times spent for each location/ activity *to the nearest 15 minutes* for each 24 hour period

Participant Identification Number

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Day 2

Day of week sample tube opened: _____

Date sample tube opened: ____/____/____ **day/month/year)**

Did you do any of the following “key activities” today? (Y/N)

- Refuel car?
- Use home air-conditioner or heater?
- Go to underground carpark?
- Go to drive-through fast food outlet or similar drive-through service (eg bottle shop)?

Begin	End	Location	Activity	Someone smoking nearby? Y/N

(over page)

TIME/ ACTIVITY DIARY

- please print clearly
- record times spent for each location/ activity *to the nearest 15 minutes* for each 24 hour period

Participant Identification Number

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Day 3

Day of week sample tube opened: _____

Date sample tube opened: ____/____/____ **day/month/year)**

Did you do any of the following “key activities” today? (Y/N)

- Refuel car?
- Use home air-conditioner or heater?
- Go to underground carpark?
- Go to drive-through fast food outlet or similar drive-through service (eg bottle shop)?

Begin	End	Location	Activity	Someone smoking nearby? Y/N

(over page)

TIME/ ACTIVITY DIARY

- please print clearly
- record times spent for each location/ activity *to the nearest 15 minutes* for each 24 hour period

Participant Identification Number

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Day 4

Day of week sample tube opened: _____

Date sample tube opened: ____/____/____ **day/month/year)**

Did you do any of the following “key activities” today? (Y/N)				
Refuel car?				
Use home air-conditioner or heater?				
Go to underground carpark?				
Go to drive-through fast food outlet or similar drive-through service (eg bottle shop)?				
Begin	End	Location	Activity	Someone smoking nearby? Y/N

(over page)

TIME/ ACTIVITY DIARY

- please print clearly
- record times spent for each location/ activity *to the nearest 15 minutes* for each 24 hour period

Participant Identification Number

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Day 5

Day of week sample tube opened: _____

Date sample tube opened: ____/____/____ **day/month/year)**

Did you do any of the following “key activities” today? (Y/N)

- Refuel car?
- Use home air-conditioner or heater?
- Go to underground carpark?
- Go to drive-through fast food outlet or similar drive-through service (eg bottle shop)?

Begin	End	Location	Activity	Someone smoking nearby? Y/N

(over page)

