CONCLUSION

(A). Profile and PAHs in ambient atmosphere:

(I). PAH in TSPM:

1) The Annual average TSPM concentration ranged from 285.6 (at JNU) to 491.9 \( \mu \text{g/m}^3 \) (Daryaganj) and average is 398.33 \( \mu \text{g/m}^3 \)

2) Annual average concentration of ΣPAH in TSPM for Delhi ranged from 728.68-1277.79ng/m\(^3\), and average was 1048.6ng/m\(^3\).

3) Percentage distribution of ΣPAH in TSPM for Delhi were benzo(ghi)perylene -17.54%, benzo(b)fluoranthene 14.5%, indeno(1,2,3-cd)pyrene 14.4%, benzo(a)anthracene + chrysene 14.2%, fluoranthene 11.5%, pyrene 8.1%, benzo(k)fluoranthene 5.9%, benzo(a)pyrene 3.8%, phenanthrene 3.5%, dibenzo(ah)anthracene 3.4% and anthracene 3.2% respectively.

4) Average concentration of benzo(a)pyrene in TSPM varied from 20.39 at JNU to 47.21ng/m\(^3\) at Daryaganj and the average benzo(a)pyrene concentration for Delhi was found to be 39.12ng/m\(^3\) which is quite high than 10ng/m\(^3\) value which is recommended as a preventive guide by Pott and Dogner (1980).

(II). PAHs in RSPM:

5) The average concentration of RSPM (PM\(_{10}\)) ranged from 454.78\( \mu \text{g/m}^3 \) (JNU) to 658.45\( \mu \text{g/m}^3 \) (Daryaganj) and PM\(_{2.5}\) ranged from 175.3\( \mu \text{g/m}^3 \) at JNU to 294.70 \( \mu \text{g/m}^3 \) at Okhla

6) Average concentration ΣPAH in PM\(_{10}\) for four-month (Feb to May 1998) in Delhi was 852ng/m\(^3\). Maximum average concentration was found to be
964.6ng/m³ at site Daryaganj and minimum was observed at Moti Nagar 756ng/m³.

7) The average concentration of ΣPAH in PM$_{2.1}$ for four-month (Feb to May 1998) in Delhi was 677.8ng/m³. Maximum average concentration was found to 785.23ng/m³ at Daryaganj. While minimum average concentration was observed at Moti Nagar (604.55ng/m³).

8) Percentage distribution of ΣPAH in PM$_{2.1}$ for Delhi were benzo(ghi)perylene -18.1%, indeno(1,2,3-cd)pyrene 14.9%, benzofluoranthenes (BFs) 14.2%, fluoranthene 11.4%, pyrene 10.8%, chrysene 11.0%, benzo(a)anthracene 4.8%, dibenzo(ah)anthracene 4.0%, benzo(a)pyrene 3.5%, phenanthrene 4.1% each, and anthracene 3.3% respectively.

9) Average concentration of benzo(a)pyrene in PM$_{10}$ in Delhi was found to be 30.19ng/m³ while in fine fraction it was found to be 23.99ng/m³ i.e. 79.47% of total PM$_{10}$.

(III). PAHs at traffic intersections

10) The average concentration of RSPM (PM$_{10}$) was 545.92μg/m³ and 584.28μg/m³ and for PM$_{2.1}$ was 330.01μg/m³ and 333.02μg/m³ at Dhaulakuan and Daryaganj respectively.

11) Average concentration of ΣPAH in PM$_{10}$ for four-month (Jan to April 2000) at two-traffic intersection of Delhi was 3655.87ng/m³. At Daryaganj the average concentration was found to be 3688.34ng/m³ and at Dhaulakuan it was found to be 3623.39ng/m³.

12) Average concentration of ΣPAH in PM$_{2.1}$ for four-month (Jan to April 2000) at two-traffic intersection of Delhi was 3136.9ng/m³. At Dhaulakuan the
average concentration was found to be 3122.66ng/m³ and at Daryaganj it was found to be 3151.13ng/m³. Percentage distribution of PAHs in fine fraction of PM₁₀ was found to be 86.18% and 85.43% at Dhaulakuan and Daryaganj respectively.

13) Percentage distribution of ΣPAH in PM₂₅ for Delhi (average of two intersections) were phenanthrene 19.9%, pyrene 15.7%, chrysene 15.5%, benzo(ghi)perylene 13.8%, indeno(1,2,3-cd)pyrene 10.6%, benzofluoranthenes (BFS) 10.1%, fluoranthene 6.6%, benzo(a)anthracene 2.6%, benzo(a)pyrene 2.5%, dibenzo(ah)anthracene 1.5%, and anthracene 1.1% respectively.

14) Concentration of benzo(a)pyrene in PM₁₀ at traffic intersection was found to be 84.54 and 91.53ng/m³ at Dhaulakuan and Daryaganj, while in fine fraction it was found to be 76.46 and 83.24ng/m³ which is about 90% of total PM₁₀.

(B). PROFILE OF PAHS IN VEHICULAR EXHAUST:

15) Average concentration of ΣPAH form gasoline vehicles was 28566µg/g and from diesel vehicles it was 58872µg/g.

16) Percentage distribution of ΣPAH in gasoline vehicles exhaust was phenanthrene 52.4%, pyrene 16.1%, fluoranthene 10.4%, benzo(ghi)perylene 6.1%, chrysene 4.3%, benzo(a)anthracene 2.6%, benzo(a)pyrene and benzofluoranthenes (BFS) 1.9% each, indeno(1,2,3-cd)pyrene and anthracene 1.7% each and dibenzo(ah)anthracene 0.8% respectively.

17) Percentage distribution of ΣPAH for Diesel vehicles were phenanthrene 27.2%, pyrene 22.2%, fluoranthene 18.4%, benzo(ghi)perylene 2.9%,
benzofluoranthene (BFs) 4.9%, chrysene 7.6%, benzo(a)anthracene 7.3%, benzo(a)pyrene 1.4%, indeno(1,2,3-cd) pyrene 1.0% and anthracene 5.9% each and dibenzo(ah)anthracene 1.3% respectively.

18) Phenanthrene is the predominant PAH species in vehicular exhaust profile but not in ambient air profile. It is observed that the concentration of phenanthrene significantly decreases while it is being transported in the atmosphere.

19) Of all the PAH studied benzo(ghi)perylene was found to be highest in TSPM and RSPM of four different sites.

20) At traffic intersections and in vehicular exhausts phenanthrene was found to be the predominant PAH species.

21) Factor analysis of TSPM showed five factors indicating that 1) vehicular, 2) Industrial, 3) soil re-suspension and secondary aerosols, 4) Domestic combustion and 5) crustal as major sources of PAHs in ambient atmosphere of Delhi.

22) Factor analysis of fine fraction of PM$_{10}$ indicated three main factors contributing to PAHs, which were 1) diesel and gasoline exhausts, 2) industrial and 3) domestic burning.

23) Factor analysis of fine fraction of PM$_{10}$ at traffic intersections indicated four factors, which were, 1) soil resuspension, 2) diesel exhaust, 3) gasoline exhaust 4) other combustion sources.

24) Seasonal variation of PAH showed that the concentration of PAH was maximum during winters as compared to monsoon and summer seasons.
25) Average concentration of benzo(a)pyrene was found to have increased from 7.45ng/m³ in 1986 to 26.44ng/m³ in 1990 to the present levels of 39.67ng/m³ (2001).

26) 70 to 90% of particulate PAHs are found in fine fraction of PM₁₀

27) Overall trend shows that vehicular exhaust is the major contributor of PAH in Delhi.