Environmental impact on health has gained great significance in recent times. In case of the present study, the cytogenetic end points were evaluated for the exposures of control and traffic policemen exposed in different age groups. The various endpoints that have been studied includes chromosomal aberrations (CA), micronuclei (MN) and Single-cell Agarose Gel Electrophoresis (SAGE) or popularly called as comet assay. CA assays the double strand breaks, MN the clastogenic and mutagenic effects of the assay candidate and the comet assay the single strand breaks, thus forming a closed triad of cytogenetic endpoints, leading to a comprehensive evaluation of the environmental agent namely air pollution in Tiruchirappalli city.

An analysis of air pollution from personal air samplers demonstrated that traffic policemen were exposed up to three times higher levels of pollutants than normal people. The present study reports results from the genetic monitoring of chromosomal aberrations as a measure of genotoxic damage with correlation to air pollution. The present study demonstrates a genotoxic effect of ambient air pollution, mostly attributable to traffic, in traffic policemen posted to look after the transportation, in the center of a major city. An increased risk of cancer has been reported in occupationally exposed persons to air pollution, and our results further support the view that genotoxic exposure is partly responsible for this finding. Inter-
individual differences in susceptibility are becoming an increasingly important issue in environmental related diseases and their initiation processes such as SSBs and DSBs. As in the present study, correlations between genotypes effect biomarkers are usually observed at the group level, and such information can be used, e.g., in assessing risks associated with exposure to urban air pollution. However, the existing knowledge is not enough to justify screening of risk genotypes at the individual level, because many scientific, social, and ethical questions are still unanswered. Studies like the present one enable prospective follow-up of the predictive value of biomarkers and metabolic genotypes/phenotypes. The predictivity may concern cancer risk, risk of cardiovascular diseases, or other diseases accessible in national registries. Such prospective follow-up studies have already been designed and performed by Nordic and Italian researchers and by the European Study Group of Cytogenetic Biomarkers and Health. An association has been observed between high levels of chromosomal aberrations and increased levels exposure (age and service of the traffic policemen) related to air pollutants.

Even though the chromosomal aberrations like DC are very specific to radiation exposures and very rare chemicals, it has been reported that particulate air pollution was associated with lung cancer mortality and cardiopulmonary, and in particular, exposure to fine particles in air pollutants resulted in increased mortality and an increase in respiratory
symptoms and respiratory hospitalizations. Of the various mutagens present in fine particles, nitrated ABP and its N-oxides may play an important role in mutagenesis in lung cells and also may be associated with declines of lung function because the chemicals are more mutagenic and genotoxic than other nitroarenes, that could very well lead to the development of CA.

Oxygen radicals are generated by environmental agents and by endogenous processes. These oxygen radicals cause extensive damage to DNA, including 8-dihydro-2’-deoxyguanosine (8-oxodG) in both leukocytes and potential target tissues such as lung. The damaged DNA is repaired, and the repair product can be detected in the urine. Smokers do have a higher level of 8-oxodG in urine than nonsmokers. Diesel exhaust particles, the main contributor of carcinogenic compounds in ambient air, do induce oxidative damage to DNA in experimental animals. The 8-oxodG level did not correlate with other markers for damage to DNA, e.g., chromosomal aberrations and bulky carcinogen-DNA adducts, although some of the compounds responsible for the latter DNA damage are expected to produce oxygen radicals during biotransformation processes. The nature of formation of 8-oxodG is more complex, involving a number of endogenous factors and modifying factors in the diet. Nevertheless, a number of occupational exposures, including benzene, reportedly increase 8-oxodG ROS produces irreversible modifications in DNA.
As seen in several studies in the past with regard to medical, industrial and environmental cytogenetic assays, there has been an age dependent increase in the aberrations across all the assayed techniques as well as the two study groups, namely control and traffic policemen. This is seen in several other studies even without any genotoxic exposures such as disease states like cancers etc.,. Thus the role of age, as an important factor is proved yet again for cytogenetic deterioration.

The subtle response of the genotoxic exposure to air pollution is well documented from the fact that there are more aberrations in the traffic policemen for every endpoint and every age group than that of the controls. These increase reveals that the exposure to several air borne pollutants result in actual degradation of human genome.

Concordance in correlation is only among the first or few of the age groups which indicate that the role of duration of exposure plays a very vital in the increase of cytogenetic aberrations. This underlines the dose effect in the damage induction.

Another aspect that emerges from the study is that the slight increase in the exposure results in drastic increase in the aberration frequencies as seen in the higher age groups.

Chromatid type of aberrations are also indicative of breaks and gaps that the air pollutants cause in the exposed group, which shows that the
rather peculiar type of such aberrations which represent neither clastogenic (as represented by MN) nor mutagenic (as seen by CA) also occur due to air pollution. They also represent the nature of misrepair taking place after exposure to such environmental toxicants.

Double minutes (DM) are indicators of attempt to repair and misrepair of double stranded breaks as well as can also be a result of direct action of pollutants. The decrease of DM compared to the sum of both DC and ExAC at older age groups cause suspicion that the DM are more of DNA repair than due to direct action of pollutants.

Micronuclei frequency increase more than total chromosomal aberrations indicating that there are other causes other than mutagenic mechanisms in play and also indicate clastogenic action of such air pollutants. This is important because the nature of air pollutants especially that of vehicular exhaust can cause more clastogenic damage than that of mutagenic, leading to more germline / gonadal defects than somatic / body damages. This is significant as these pollutants have capacity not only to affect mitosis but also meiosis.

Rare types of aberrations like centric and acentric rings also occur indicating that the pollutants have capacity to inflect different types of complex aberrations that lead to the formation of these aberrations. Under dispersion of these aberrations highlight their rarity.
Excessive acentric fragments are more indicating that the formation of DC can be expected to increase if there is misrepair of these into DC. Thus there is a tendency to get even higher levels of DC in these type of environmental exposures. Another interesting feature is that the frequency of DM and EXACs are not significantly different from each other indicating to the possibility of events in DNA damage similar in both the instants.

Combination of acentric rings, centric rings and dicentrics near the frequency level of excess acentric fragments frequency showing that there is correlation among these aberrations. This reflects the interrelation between these aberrations and the general linking between the chromosomal aberrations.

Finally the overall view between the DSBs represented by the chromosomal aberrations like DC, EXAC, AR, CR, CG, GB and DM; and micronuclei follow of pattern of increasing complexity and general trend towards exposure related occurrence.

The recommendations of the present study lead to the conclusion that the traffic policemen have to be well equipped both in terms of safety equipments for air pollution as well as physiological stress related to air pollution causing free radical formation leading to formation of such chromosomal aberrations.