

CHAPTER III

A Radio Program to Reduce the Air Pollution in Kathmandu: A Health Promotion Strategy Targeting the Taxi Owners and Taxi Drivers

3.1 Introduction

As a result of a serious PM_{10} in Kathmandu valley more than 45 percent of the Valley's population is exposed to PM_{10} above the World Health Organization Air Quality Guidelines (WHO AQG). It is not only responsible for increasing the number of illness like chronic bronchitis, pediatric bronchitis and asthma in Kathmandu valley but also 85 excess deaths. Like wise PM_{10} is responsible for 18,863 cases of asthma and 4,847 bronchitis in children (Larssen et al., 1996). The health damage due to PM_{10} in monetary valuation is about 4 million US\$ dollar which is a significant loss for the one of the poorest countries in the world with per capita income of 210 US\$ (Larssen et al., 1996).

As the PM_{10} pollution is not only damaging to health but also is draining Nepal's very scarce economical resources it is very urgent to control the problem of PM_{10} and to reduce both the adverse health affects of PM_{10} pollution and monetary loss. Furthermore, the reduction of PM_{10} is cost effective; a reduction of 1 kg of PM_{10} emission leads to at least a monetary benefit of nearly one-dollar. Thus, considering both the health and monetary loss, it is absolutely necessary to control air pollution. In

an effort to bring down the PM₁₀ concentration for the sake of better health, this proposal puts forward a health promotion program adopting strategy of media inducing behavioral change in the target population of taxi drivers and taxi owners to bring about change in knowledge and practices of vehicle maintenance.

3.1.1 Background

This section gives a brief introduction of Kathmandu valley and attempts to analyze how traffics are responsible for PM₁₀ pollution and finally it also discusses what are the present legal methods to control air pollution. Kathmandu is one of the districts of Nepal, and Kathmandu valley refers to three districts namely: Kathmandu, Lalitpur and Bhaktapur. Being girdled by Mahabharat range, it is in the mid-mountain physiographic region. The valley is about 1325 meters above sea level. It covers around 900 square kilometers. It is inhabited by more than 1 million people. The valley, being the capital of the country, its major economical and political activities is centralized here. It provides opportunity for employment and education. As a result, the population of the valley is growing at a significant rate. Due to rapid urbanization in the last 20 years, the population has nearly doubled.

Beside the two-fold population growth, the valley is also going through industrial expansion. As a result of the population growth and industrial expansion, the number of vehicles in the past decade have also doubled (Larssen et al., 1996) with the present number of registered vehicle of 128,283 (16 June, 1999, The Kathmandu Posts). Consequently, the consumption of automotive fuel has also been increasing.

Over the period of 1980-93, there has been a 150 percent increase of gasoline, and 175 percent increase of diesel (Larssen et al., 1996).

In addition to the increase in number of vehicles, road conditions remain poor. The total road length within the valley is approximately 943 kilometers (DoR, 1995). Most of the roads are of two lanes and narrow with an average width of 4.6m. The length of road has not expanded with the growing number of vehicles. About 60 % of the city streets are tarred but even the tarred conditions are bad (Otaki, Sharma & Upadhy, 1995). As a result of the significant increase in the number of vehicles, the remarkable increase in the consumption of automotive fuel, and the narrow and poor condition of roads, along with industries and other sources of pollution has helped to aggravate the problem of particulate pollution .

Traffic emission is one of the four main causes of PM_{10} pollution and is responsible for 12% of total PM_{10} emissions in Kathmandu valley. Reduction of PM_{10} in traffic emission is the most cost effective among all the sources of PM_{10} pollution (Larssen et al. 1996). Therefore it is most beneficial to reduce traffic emissions. Fuel quality, condition of vehicle, type of vehicle i.e. (diesel or gasoline) are the major factors that play a crucial role in the emission of PM_{10} . In order to reduce traffic emissions, these factors have to be improved.

Fuel quality, here, refers to basically two problems 1) Fuel adulteration and 2) the sulfur content of fuel. Fuel adulteration is a common practice in Nepal. Adulterated fuels used in vehicles increase emissions. But the exact extent of this

practice and its environmental effects have not been quantified. Therefore, it is difficult to be certain whether any effort to control pollution by restricting the practice of adulteration will be effective or not.

In addition to adulteration, the sulfur content of diesel fuel available in Nepal is among the highest in the world. The high sulfur content not only increases the emission of sulfur but also increases the emission of PM_{10} in the form of sulfate (Adhiakri, 1998), which are fine particles size 2.5 micron and less. These fine particulates ($PM_{2.5}$) can easily penetrate deeply into the lungs causing damages to the lower respiratory systems. The reduction of sulfur content is not possible by only Nepal efforts as it does not have its own oil refinery and it depends on Indian Oil Corporation for its fuel supply.

Beside fuel quality, condition of vehicle also plays crucial role in emissions as old and not maintained cars pollute more than the maintained ones. A significant proportion of the vehicles plying the city is old. Awareness about the maintenance of vehicle, for clean air and awareness regarding the advantage of maintenance in better performance are lacking among the vehicle owners. Thus poor vehicle maintenance further compounds the problem (MoPE, 1998).

After the discussion on causes of traffic emission now it is time to discuss how the government of Nepal is trying to control the traffic emissions. The government has also taken some measures to address the problem of air pollution. These measures

include; an emissions test, and a ban on the most polluting diesel tempo (a three wheeler vehicle) plying the valley.

A vehicular color rating system with respect to the exhaust emission standards,-green stickers for vehicle which passed emission testing and red stickers for those which failed, has been implemented by the government of Nepal (MOPE,98). Only three wheel and four-wheel vehicles must undergo emissions tests in the past, but, presently, it is mandatory for motor cycles to undergo emissions testing. Of over more than 150,000 vehicles plying the city, only 30 percent are said to be within the prescribed standards to operate in the valley (Spotlight, September 24-30,1999).

The government of Nepal has set some areas in Kathmandu in which the emission-failed vehicles are not allowed to enter. Further, the government has planned to ban old and polluting vehicles within the ring road of Kathmandu valley in a phasewise manner (The Kathmandu Post, 17June, 1999). The government has restricted the diesel vehicles like trucks and tractors from entering the ring road of Kathmandu Valley during the daytime (The Kathmandu Post, 19 September, 1999).

In conclusion, the government of Nepal has implemented some regulatory measures to control PM_{10} pollution; however, these measures are not sufficient to control the air pollution. Thus, the existing situation also demands some additional measures to curb vehicular emissions other than the existing legal means. Realizing

this fact, this project proposes to reduce vehicular emissions by changing the vehicle maintenance behaviors of taxi drivers and taxi owners by a radio program.

3.2 Rationale

As this project is concerned with informing the taxi drivers and taxi owners to increase their knowledge and change their practices of car maintenance, as a strategy to reduce PM₁₀ pollution in Kathmandu valley, it is essential to justify some basic questions regarding the projects. Since this project suggests the use of radio program as a medium to increase the taxi drivers and taxi owner's knowledge and practices which poses the following questions. 1) What are the reasons behind choosing the use of radio as a medium for health promotion, then (2) what are the rationale behind choosing the taxi drivers and taxi owners as a target population. As the objective of the project is to reduce PM₁₀ (3) why choose maintenance among and (4) why this project is worthwhile endeavor. The following section tries to answer all the questions.

3.2.1 Why Vehicle maintenance?

The existing several options to reduce vehicular emissions, namely, are improving fuel quality, vehicle maintenance and improvement of traffic management. Each alternative has both weakness and strength, and in deciding the best options, these issues must be explored in detail.

As mentioned earlier, traffic congestion contributes a considerable amount of pollution in Kathmandu Valley. Traffic management is one way to reduce PM₁₀

emissions. Traffic management includes a variety of measure such as traffic lights, one-way streets, and construction of new road to address the problem of congestion. The measures like traffic control by traffic lights and one way –streets have already been adopted for better traffic a long time ago. However, traffic congestion in Kathmandu Valley is mainly caused by not having enough roads to accommodate the cars. Construction of new roads is a costly measure in a country where 40 % of population are under poverty line, thus this option may not be viable at present.

The second option is improving diesel fuel quality. As mentioned earlier, diesel fuel available in Nepal has a low centane number and high sulfur content (Larssen et al., 1996). The quality of diesel fuel needs to be improved. As Nepal does not have its own oil refinery it has to depend on the Indian Oil Corporation. Improvements of diesel fuel quality are possible only after India improves its diesel quality.

Checking the adulteration (i.e. mixing kerosene with diesel and diesel with gasoline) of fuel does help to reduce emissions, but the exact extent of adulteration practice and its adverse environmental affects have not been quantified in the country. This suggests that reducing adulteration, although good on its own but may not necessarily reduce PM_{10} pollution in any significant scale if the extent of practice is too low and its adverse environmental affects are also not very high. In such a case the cost involved for this intervention may exceed the benefit obtained from reducing PM_{10} pollution. Thus, any intervention to control air pollution by checking adulteration should be considered on the basis of a more careful cost benefit analysis.

The another choice, maintenance of vehicles, is also a feasible option as a properly maintained vehicle has not only increased fuel efficiency, but also reduced tail-pipe emissions, increased safety and resale value. The study conducted by Thapathali Camupus, suggested that simple maintenance leads to radical fuel efficiency and the smoke level can be reduced by 20 to 50 percent in a very cost effective manner (Larssen et al., 1996). A World Bank study also reported that maintenance can reduce tail pipe emission of PM_{10} by 35% of the total and estimated that the benefits of maintenance and inspection scheme may exceed 0.5 million US \$ (Larssen et al, 1996).

In conclusion, since traffic management involves costly measure like roads construction and improving fuel quality is not possible unless India improves its fuel quality and cost benefit analysis of checking adulteration is not known it is therefore most beneficial to choose vehicle maintenance for intervention as maintenance has a clear benefit as suggested by studies mentioned above.

3.2.2 Why Taxi Drivers and Taxi Owners as a Target Population?

The word taxi refers to both taxi and taxi-tempo-a three-wheel petrol vehicle. In choosing target group, there are several other options and these include jeep, trucks, motor cycles, tractors, buses. The major polluters of PM_{10} are taxi tempo (three wheeler), motorcycles and trucks. Total estimated annual emission of PM_{10} is 570 tons in kathmandu, but trucks and motorcycles are the major sources of emission. Estimated emissions of trucks and motorcycles are 114 and 107.5 tons of PM_{10} per

year respectively (Larssen et al., 1996). But government has recently implemented some measures to control emissions from both trucks and motorcycles. Trucks and other heavy vehicles have been restricted from plying inside the Ring Road from 7 a.m. to 8 p.m. Additionally, as mentioned earlier, the most polluting version of motorcycle –the two stroke motorcycle is currently banned from registration (The Kathmandu Post, September 19, 1999). Moreover, unlike the past, motorcycles nowadays also need to undergo the emission test. These two factors expectedly play crucial roles in reducing emission of PM_{10} from motorcycles. The other major polluter –the diesel three wheeler, with annual estimated emission of 85.5 tons of PM_{10} has been, has completely banned in the valley.

Second to motorcycles and trucks in emitting PM_{10} are taxi-tempos; the taxi –tempo’s estimated emission of PM_{10} is 68.4 tons per year (Larssen et al., 1996). Taxis along with cars, are responsible for the 38.4 tons of emission each year. Although separate figures for cars and taxis are not available (Larssen et al., 1996), but taxis in combination with taxi-tempos are the third largest sources of the emission of PM_{10} . Remaining PM_{10} , i.e, about 150 tons, are from scattered sources i.e., jeeps, buses, tractors. Thus, taxis and taxi-tempos need to be addressed to control PM_{10} pollution.

3.2.3 The need of Information

The need for information was clearly depicted when a study by Thapathali Campus in 1993 showed a lack of awareness of the environmental and economic effects of poor vehicle maintenance widely prevailed among both drivers and vehicle owners of the valley (Larssen et al., 1996). In other words, drivers and owners are still

not aware that appropriate maintenance of vehicle is beneficial both for fuel efficiencies and good environment. Therefore, increasing the knowledge and raising the awareness among the polluters may lead to a better practice in controlling PM₁₀ emission in Kathmandu.

3.2.4 Why mass media; not face to face communication?

As there are two conventional alternatives to education and information dissemination, namely (1) mass media and (2) face-to-face communication, there should be some basis for which approach is better than the other and why. Mass media, unlike face-to-face communication, can cover a mass audience where as information given in face- to- face communication is restricted to a limited number. The population of taxi divers is not less than a couple of thousands and this number can hardly be covered by any face to face communication in an cost effective manner. In addition, information given through mass media can go beyond the boundary of the target population. Similarly, in this context the message conveyed to taxi drivers and taxi owners can reach the general mass audience including all vehicle owners. This has a significant advantage especially in health education and in environmental awareness. Other vehicle owners can, in turn, improve their practice of maintaining their vehicles.

3.2.5 Why radio? Why not print media, or Television?

In the present age of communication, there are number of choices in the area of mass media; for example, television, radio, and printed materials to educate a fairly large population of taxi drivers and taxi owners, for which like training programs are

inappropriate in most cases. Since there is more than one alternative to educate or inform people, there should be some justification why the choice of radio is best.

Firstly, radio reaches wider audiences than other medium (Adam and Hardford, 1998). Radio is the only medium that reaches the entire Nepal in the sector of communication. Certainly radio has an advantage over all other forms of mass media in this aspect. Television and training involve time cost, whereas radio does not cost the time cost. The time cost means the opportunity cost, i.e., opportunity lost while attending training or watching Television. In other words, time cost, here translates to, work- time lost by a driver while attending a training program or watching television, in which, a driver loses income in not being available for passengers service.

Radios are cheap, portable, and convenient to listen. This gives advantage over television. For taxi or other vehicle drivers, price of radio costs an insignificant proportion of their income. Further, in most cases for the taxi drivers and taxi owners, the radio comes as an accessory of the car, which bears no additional costs to the owner and there is no operation cost since the car batteries operate it. In addition, in country like Nepal, with its poor literacy rate of 40 percent of total population, radio has become the main source of information for the majority of the people.

Studies undertaken in various parts of the world show that radio programs are cost effective in comparison to other methods like training (Robinson, 1993) Nielson and others in their review found that five out of seven radio education programs were

more cost-effective than conventional training programs (Nielson, Dean, Maria, and Kulratne, 1991). They found that radio education programs in Sri Lanka and Indonesia were significantly cheaper than training programs. Studies conducted in Nepal also showed similar findings (Holmes, Karmacharya and Mayo, 1993: Shreshtha 1988). Various studies undertaken both in Nepal and abroad have proven that information/instruction provided through radio is at least as effective in achieving specific communication objectives as other means (Spain, 1977). Consequently, radio as a means to disseminate information; it is highly desirable.

3.2.6 Why this project is a worthwhile endeavor?

As mentioned earlier, PM₁₀ pollution in Nepal caused not only 85 excess deaths and a number of respiratory diseases but also a loss of 4 million US\$ per annum. Furthermore, a World Bank study team assumed that Nepal is losing another 10 million US\$ in the tourism sector as a result of air pollution. All these monetary losses are huge for a country which is one of the poorest in the world with a per capita GNP US\$.210 and with more than forty percent of its population suffering the plight of absolute poverty (World Bank, 1999). Thus, it seems absolutely necessary to reduce pollution mainly for the reduction of the health care cost, if not for reducing suffering of the Nepalese population.

There are clear benefits of a program like this. Even if there is only 10 percent of reduction in PM₁₀ of the total emissions produced by vehicles, it will reduce mortality 6 percent and save 300,740 US\$ (Larsen et al., 1996). All of this evidence points to the need for intervention to save further health care expenditures and prevent

loss of more lives. Further a World Bank study estimated that vehicle maintenance can reduce tailpipe emissions by 35 percent of a vehicle in Kathmandu Valley, and the monetary benefit obtained from this reduction is about 0.5 million US\$.

Since tempos and taxis in combination with cars are responsible for 67.5 tons and 38.4 tons of PM₁₀ per year, respectively (Larssen et al.,1996.). If taxi is responsible for half of the 38.4 tons of PM₁₀, it can be assumed that total estimated emission of PM₁₀ by taxi and taxi tempo is roughly 85 tons per year even if 20 % of total emission is reduced it will reduce 17 tons of PM₁₀ annually (Larssen et al., 1996). As The World Bank study suggests reduction of one kg of PM₁₀ save 6.82 US\$, there will be gross monetary benefit of 115,940 US\$ (Larssen et al.,1996). In conclusion, if this project can reduce even 20 percent of emission exhausted from taxi and taxi tempo, there will be gross monetary benefit of 115,940 US\$.

3.2.7 Why Should They Change Behaviors

Adoption of new behaviors will take place only if costs involved in performing the new behaviors do not exceed benefits obtained from it. The following section attempts to suggest why benefits obtained from the maintenance of vehicle exceed costs involved, particularly, in Kathmandu.

The main advantage of vehicle maintenance is that it reduces vehicle tailpipe emission by 35%. Undoubtedly, one of the other benefits of the maintenance of the vehicle carried out for the purpose of the reduction of emission, is that it improves fuel efficiency (www.epa.gov , Larssen et al.,1996) In most cases, the cost of

maintenance is balanced by fuel efficiency (Larssen et al.,1996). Further, the reduction of emission helps the vehicle to pass the emission test imposed by the government, which allows the vehicle to travel on all roads in the city, whereas, vehicles that fail to pass emission tests are banned from restricted area. The government plans to increase the number of restricted areas gradually. Thus, reduction of emissions can serve as a business incentive to taxi where they can operate in any area in the city and, moreover, the emission test costs are inconsequential. In addition, maintenance gives other advantages these includes less repair, better safety, good performance, prolong vehicle life and good resale value (www.epa.gov).

The costs involved in the maintenance of vehicles are a) direct cost, i.e., monetary and b) opportunity cost i.e. time cost. Time cost, here, means operation time lost by a driver during maintenance in which a driver can produce income by availing taxi for passengers service. Whether the monetary cost exceeds the benefits obtained from fuel efficiency depends on mileage per unit of fuel, the cost of fuel, and the cost of maintenance. These both costs vary place to place; therefore no generalization can be made whether the maintenance is cost effective or not in its terms of fuel efficiency. But many studies agreed that cost of maintenance is balanced by the fuel efficiency in Kathmandu Valley (Larssen et al., 1996).

Therefore, it can be reasonably assumed that the benefit of car maintenance outweighs its cost. Moreover, as long as there is no additional cost involved in adopting this new behavior and there are clear social and individual advantages, i. e.

cleaner environment and safe vehicle, it is reasonable to believe that taxi drivers and taxi owners will change to new behaviors once they are aware of the advantages.

3.3 An Approach to Change Behaviors

Changing the behavior of taxi drivers and taxi owners is a complicated matter. It involves getting the taxi driver and taxi owner who needs change to first realize the need. After realizing the need and before they adopt new behaviors, they must understand the need to analyze the perceived benefit against the cost involved in performing that particular behavior. If the perceived benefit, in their mind, outweighs the cost involved, only then will the adoption, by taxi drivers and taxi owners, of new behaviors take place. A health behavior model may be used to understand the intricacies of the various factors involved in bringing about behavior change in the target population.

The theory of health belief model was developed initially in the 1950s by a group of social psychologists in the U.S Public Health Service. In general, this theory believed that

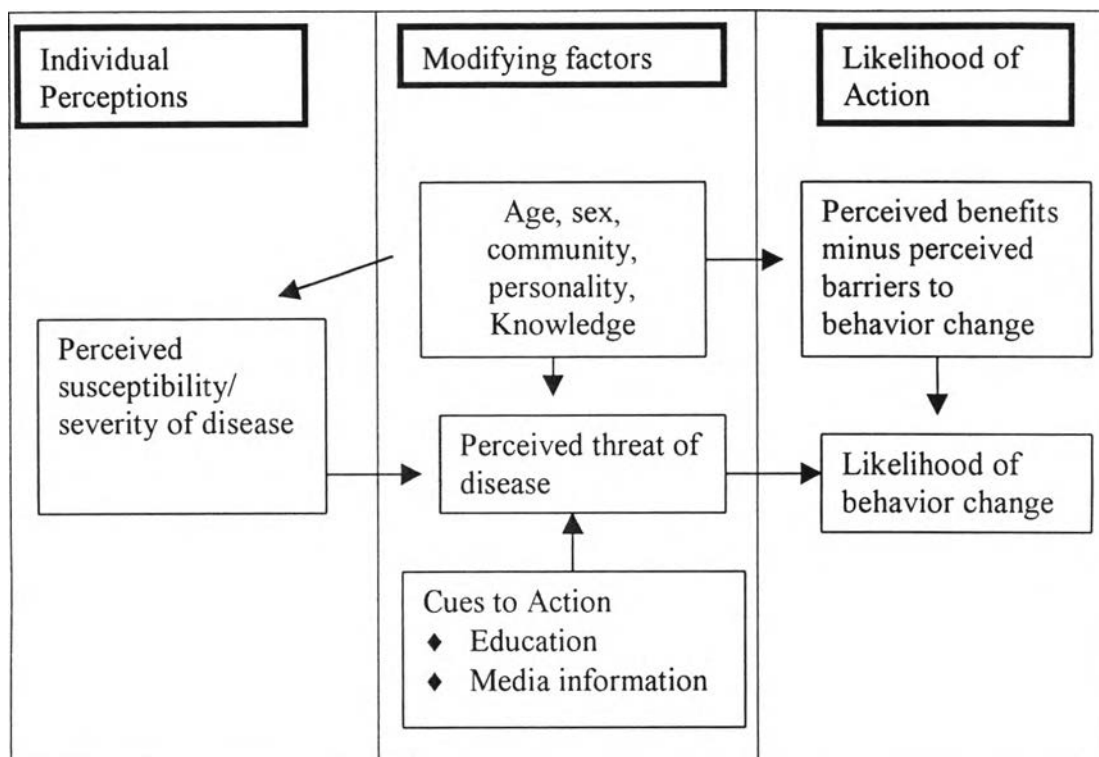
“ Individuals will take action to ward off, to screen for, or to control an ill-health condition if they regard themselves as susceptible to the condition, if they believe it to have potentially serious consequences, if they believe that a course of action available to them would be beneficial in reducing either susceptibility to or the severity of the condition, and if they believe that the anticipated barriers to (or costs of) taking the action are outweighed by its benefits” (Glanz, Lewis, & Rimer.,1997).

In other words taxi drivers and taxi owners are likely to change their behavior on maintaining vehicle for the following three conditions 1) if they feel that consequences of pollution are severe and susceptible to both; them and society they belong, 2) if they perceive that behavior of maintaining vehicles can avoid such consequences and 3) only if they perceive the benefit of this behavior is more than the cost involved in performing it.

The health behavior model, used here, is adapted from the health belief model of Becker, Drachman and Kirscht (1974). As illustrated in Figure 3.1, this model has three main components. These components are individual perceptions, modifying factors and likelihood of action. Individual perception refers to perceived susceptibility and perceived severity. Modifying factors include three factors namely: perceived threat, cues to action and various variables namely demographic, sociopsychological. Likelihood of action includes further include two issues: perceived benefit minus to perceived barrier to behavior change and likelihood of behavior change. How these factors are related with each other and work together to bring about behavioral change is discussed in the following sections.

The health belief model emphasizes the role of education and mass media within the concept of cue. According to the model, the role of the mass media or education is to trigger the action (McKenzie and Smeltzer, 1997). When someone the listening to the radio hears about air pollution, this is a cue to action that starts his/her thinking about pollution and its adverse health effects. Moreover, there are other variables (demographic and sociopsychological etc.) that cause him/her to think more

Figure 3.1, Health Belief Model



(Adapted from Health Belief Model of Becker , Drachman &. Kirscht (1974))

about air pollution. A taxi driver by his/her smoking habit and the nature of his/her job may consider s/he is more vulnerable than other normal person to adverse health affects of air pollution. It may help him/her to perceive that s/he is susceptible to respiratory diseases caused by air pollution. In other words, the role of radio in the health behavior model is to trigger his/her thinking and the role of the other variables is to make him/her think more about on the chosen issue so that it may influence to perceived susceptibility and severity that may in turn influence the perceived threat.

As depicted in the health belief model, the perceived susceptibility of a taxi driver is a subjective perception of his/her risk of contracting air pollution related diseases and the perceived severity includes evaluation of consequences like death,

disability and pain and possible social consequences (such as effects on his/ her work , family life, and social relation). This fact emphasizes that perceived severity is not confined to the individual only, rather it encompasses broader consequences at the societal level (Glanz & et al. 1997). These broader consequences highlight the fact, that driver's behaviors can be influenced by both the threat to individual and the threat to society. In the data exercise it was found that drivers considered threat to society not serious but on the other hand, one of the lessons of the data exercise is that most of the drivers considered that health effect of traffic emission is similar to smoking. Most of the drivers considered that it does not make any difference whether one smokes or not; in other words, they agreed that because of pollution from their vehicles, their infants were also inhaling air that is as bad as smoking even though they are not smoking. This, in turn, indicates that the success of the radio program is, at least partly, determined by the ability of program to convince the drivers community about how the individual and society, which includes him/her, are vulnerable to adverse effects of air pollution.

Perceived susceptibility and perceived severity, which have been labeled as perceived threat, though, unite to create a single factor to change the behaviors, but before switching on to new behavior one always analyzes the benefits or effectiveness of new behaviors. Thus drivers are likely to adopt to those behaviors that are not only beneficial in their perception and but also outweigh the perceived barrier (such as cost, time). Thus, a kind of subconscious cost- benefit analysis occur where the individual weighs a particular action's expected effectiveness against perceptions that it may be expensive and time consuming and so forth. Interestingly, it was found in

the data exercise that most of the vehicle owners perceived the cost of maintenance of new vehicles not as barrier to vehicle maintenance; but as the vehicle becomes older same owners perceived cost as a barrier to maintenance. This emphasizes the fact the radio program should highlight social and personal benefits (such as safety, fuel efficient vehicle and cleaner environment, fewer number of other major vehicle breakdowns) that result from maintenance, especially of old vehicles. Radio must stress costs on maintenance; both money and time are inconsequential and far less than the benefit obtained from maintenance.

In conclusion, a radio program can change the behavior of taxi drivers and taxi owners on maintaining vehicles by informing them that: the consequences of PM₁₀ pollution are susceptible, severe to both them and their society; maintenance of vehicles can help to get rid of such consequences; and benefits obtained from maintenance are much more than costs involved in maintaining the vehicle.

3.4 Operational Definition

Community of Taxi driver-All the taxi drivers (taxi and taxi tempo-three wheel vehicle) of Kathmandu who have been driving taxi as a major profession from the last one year in kathmandu Valley and will continue to drive, in the future, for at least next one year also.

Community of taxi owners-All the persons who have taxi/s registered in their name in Kathmandu valley and continue to possess taxi for at least one year.

Maintenance –Proper adjustment of those parts involved in ignition and combustion of fuel in Vehicle eg. Air filter, fuel filter, tappet settings and carburetor in petrol vehicle within the interval as recommend by owner manual.

3.5 The Purpose of this Project

The purpose of the project is to reduce adverse health affects by reducing vehicular emission. The reduction of vehicular emission can be achieved by informing the community of taxi drivers and taxi owners through a radio program. It is assumed that the information disseminated for the sake the project will not be narrowed down to taxi drivers and taxi owners only but broadcast will spread over to all the vehicle owners and drivers of Kathmandu. Hence, it is envisioned that benefits i.e. reduction of vehicular emission, as a result of this project will not be obtained from only the population of taxi drivers and taxi owners but also from a much larger population.

3.6 General Objective

The general objective of the project is to reduce the vehicular emissions particularly PM_{10} . The aim of project is to reduce the adverse health affects of pollution in Kathmandu valley by reducing the vehicular emissions. This will be done by educating the taxi drivers and taxi owners though radio broadcast about the role of maintenance of vehicle in reducing pollution.

3.7 Specific Objectives

This project is targeted toward the taxi drivers and taxi owners operating in Kathmandu with the following specific objectives:

- ◆ To increase the knowledge of air pollution and the adverse health affects of air pollution
- ◆ To increase the knowledge about how maintenance of a vehicle can reduce air pollution
- ◆ To increase the practice of maintenance of vehicle to reduce the vehicular emission.

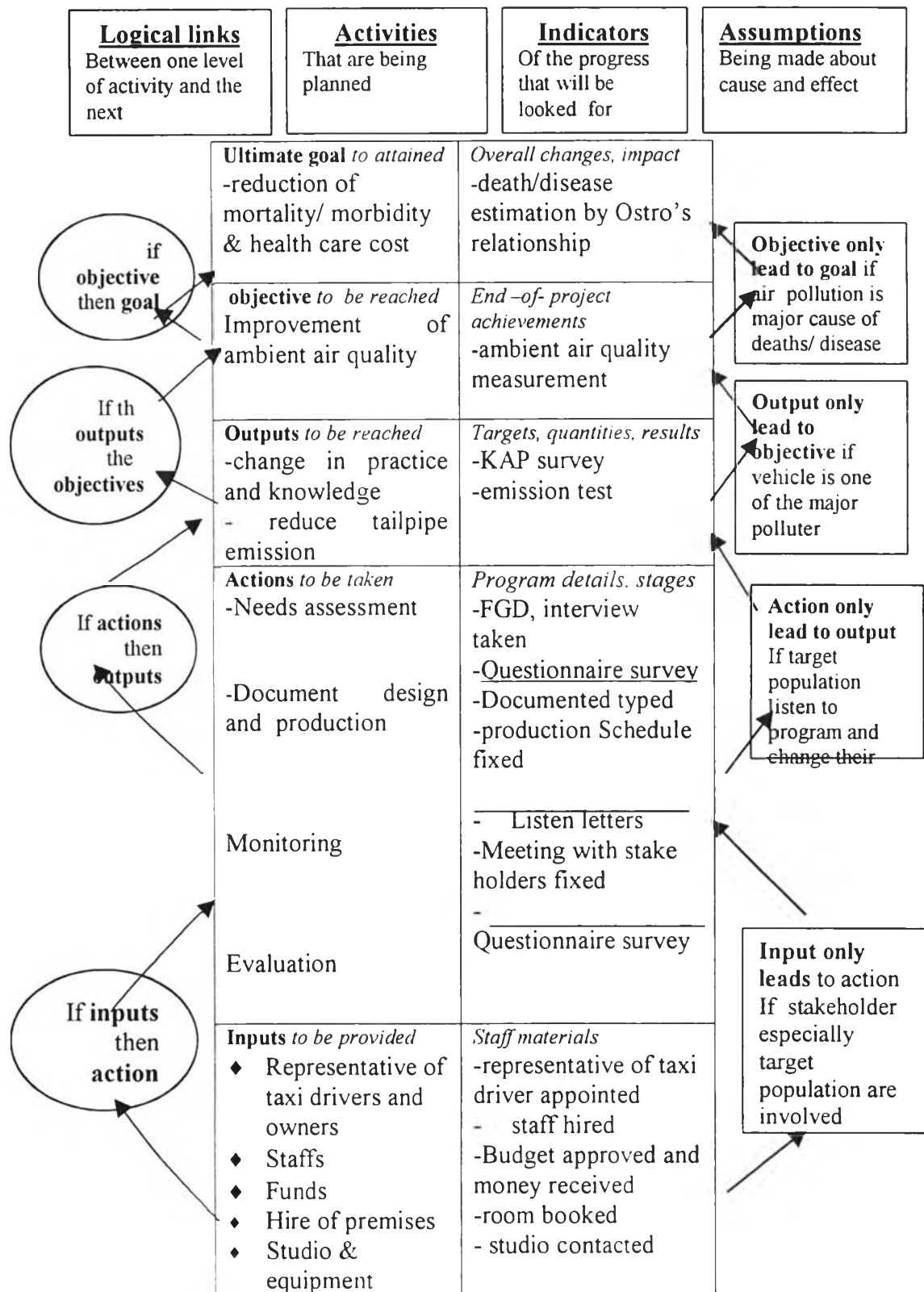
3.8 Overview of the Project

The general overview of the project is diagrammatically presented in the Figure 3.2. As referred in the logical frame work in Figure 3.2, this project requires input like representatives of taxi drivers and taxi owners, staffs, funds and so forth to carry out actions, i.e., needs assessment, document design, monitoring and evaluation. But it can carry these actions successfully only if taxi drivers and taxi owners are involved in these actions. Similarly these actions only lead to desirable outputs (i.e. increasing the knowledge and practice of taxi drivers and taxi owners; and reducing the tailpipe emission) only if taxi drivers and taxi owners listen to the radio program and adopt new behavior of vehicle maintenance. Likewise, desirable output can help achieve project's objective of improving ambient air quality of Kathmandu only if vehicles are one of the major polluters in Kathmandu. Finally, the project will reach its goal of reducing mortality, morbidity and health care cost only if air pollution is the major cause of health care cost.

As refereed in the framework, Ostro's relationship can be used to estimate deaths and diseases as an indicator to measure whether the project has received its

goal or not but, at present, realizing the limitation of the project, this project has no plan to use Ostro's relationship to estimate deaths and diseases. Similarly, this project will not determine change in ambient air quality of Kathmandu Valley to measure the whether the project has achieved its objective or not for the same areas on. Only, knowledge and practices (KP) survey will be an indicator of output measurement.

(Figure3.2) Logical Framework of the Project



3.9 Target Population

All the person who drives taxi as a major profession in Kathmandu valley will be the target population. All the person who possesses taxi will be also the target population. A secondary target group is all drivers owners in Kathmandu who will also hear radio broadcast and presumably adopt more responsible vehicle maintenance behavior. But the secondary target population will be excluded in the evaluation. Due to high variability of the number of taxi driver in Kathmandu, tentative number of the taxi drivers and taxi owners will be determined out from the consultation with taxi driver association.

3.10 Expected Outcome

Change in knowledge and practices among the target population are the outcome measurement of project. The change in the proportion of vehicle that passed the emission test after the implementation of the project (in comparison to before the project starts) is also the outcome measurement..

If every thing goes according to plan, net expected outcome should be not only increased knowledge and more practice but also increased number of maintained taxis with reduced tailpipe emissions in Kathmandu valley. This may eventually help to reduce the adverse health affect of air pollution particularly PM_{10} . Since only tempos taxis in combination with cars are responsible for 67.5 tons and 38.4 tons of PM_{10} per year respectively (Larssen et al., 1996.). Since there no separate data for taxis and cars, in that case it can be assumed that total estimated emission of PM_{10} by taxi and taxi tempo is 90 tons year even if 20 % of total emission is reduced it will reduce

18000kg of PM₁₀. As the World Bank study suggests reduction of one kg of PM₁₀ save 6.82 US\$, there will be gross monetary benefit of 122760 US\$.

3.11 Proposed Activities

The activities for radio program can be broadly divided into two phases

1. Base line survey
2. Consultation, production and implementation

3.11.1. Base line survey

The project will also conduct a base line survey (i.e. knowledge and practice) so that it can be compared with the final outcome of the project. For the purpose of knowledge-practice survey, a structured questionnaire (Appendix-4) will be used targeted at the taxi drivers and taxi owners community. Random sampling method will be used to select the respondents. The reason behind choosing the random sampling method is that the targeted populations are homogeneous in most of their characteristics. Most taxi drivers have roughly the same range of income and educational level. Although they may differ from one another in their caste and ethnicity, they have similar socio-cultural background that represents amalgamation of Hinduism and Buddhism. Since each taxi driver has his own registration number, computer generated random number will be used to select the participants. Sample size will be determined by using (WHO, 1992) following formula:

$$N = (Z_{\alpha} - Z_{\beta})^2 S^2 / d^2$$

Where N= number of sample required,

Z_{α} = 1.96 read from standardized normal variate table at α ,

$Z_B = -1.645$ read from standardized normal variate table at B ,

$\alpha =$ type I error = 0.005,

$B =$ type II error = 0.005,

$S^2 =$ Variance of sample population (degree of variability of observation of increased knowledge unit of the questionnaire)

$d =$ expected increase in knowledge unit of questionnaire

2 Consultation and implementation

The consultation and implementation activities for radio program can be divided into three phases.

1. Design Phase (Program planning and development)
2. Implementation Phase (Broadcasting and Monitoring)
3. Evaluation phase

3.11.2 Design Phase

Design Phase is the initial phase of the project There are mainly two activities

- 1) Needs assessment
- 2) Document design and Production

3.11.2.1 Needs assessment

Before planning a radio program it is essential to establish what the target group currently knows, believes and does about a chosen issue. Then it can be compared with the desired knowledge the target population needs to know and practice to make a positive difference. The objective of needs assessment is to identify the information gaps that exist. Beside this, as the project adopts health belief model, there are various requirement of this model that should be explored in the needs

assessment process. These requirements include information on the perceptions of target population on susceptibility and severity of diseases that air pollution can cause, their perception on the benefits and barrier of vehicle maintenance and demographic, sociopsychological and structural variables. In order to identify the gap of existing knowledge and behavior; and fulfill the requirements of health belief model the following information will be collected.

- ◆ Information about the air pollution and its adverse health affects
- ◆ Information about the target audience especially their knowledge, perception and behavior concerning the vehicle maintenance and role of maintenance on reduction of air pollution
- ◆ Information about the target audience especially the knowledge concerning the adverse health affect of air pollution
- ◆ Information about the listenership and the media
- ◆ Information about the target audience's preferences for program style
- ◆ Information about other institutions and organizations involved in health and environmental education.
- ◆ Information about the perception of target population on susceptibility and severity of adverse health affects of air pollution.
- ◆ Information about their perceptions on benefits and barrier of vehicle maintenance
- ◆ Information on various variables such demographic, sociopsychological and structural variables that target belongs to.

Following activities will be carried out for the need assessment.

1. Focus Group Discussion with Target Population

Rounds of focus group discussion will be done with the drivers and owners to assess all of the above mentioned information for needs assessment. Focus group discussion and in-depth interviews will be used to gather information about feelings and impressions from a small sample of the target population who is chosen purposively rather than randomly. Participants for the both focus group discussion and in-depth interviews will be chosen from the target population. For the focus group discussion, six to eight people will be chosen. These people will be chosen purposively to ensure that these people have necessary knowledge. Discussion will take place in the taxi driver association office. There will be monetary incentives for the participants to make up their time lost.(For focus group discussion interview guidelines see Appendix-3)

2. Secondary sources review

Secondary sources reviewing will be helpful to qualitative study on the health issues or target audience, radio listenership, broadcast schedules and KP survey results. Secondary sources review is necessary to find out air pollution and its adverse health affects for the accurate broadcasting for the radio programs.

3. Other Stakeholders Consultation

For the purpose of needs assessment, discussions will be held also with relevant organizations; these include (Ministry of Population and Environment (MoPE), Ministry of Health (MoH), Traffic Police. The purpose behind consulting MoPE, MoH, radio stations and Traffic police is to gain their experiences on other

environmental and health education. A workshop will be held involving these organizations. Health education programs, radio program style, appropriate time for broadcasting, monitoring of radio program and emission test will be the content of workshop.

3.11.2.2 Document Design and Production

Information obtained from needs assessment will be selected and incorporated in the radio program. Beside this, data obtained from needs assessment will be used to develop program so that it addresses both the interests and needs of the target population. The health belief model will also guide the selection of information as the project has adopted health belief model to bring about behavior change in the target population. In addition to this, during the data exercise it was found that people generally followed the maintenance guidelines as given in the manual when their vehicle are relatively new, but as the vehicle become older they maintain only after when their vehicles fail to run. Therefore, the content of the program that emphasizes the maintenance of an old vehicle is essential and beneficial. (details of the content and the specific objectives of the radio program- Appendix-5)

Beside the content, program format is also an important matter. Most of the present program, aired in Nepal and targeted to vehicle owners and drivers, were mixed with entertainment and advertisement. This factor will be also considered while designing the format. But basically, program formatting will be done according to both the liking of the target population and expert views. There will be pretests of the program before the sample of target population to ensure that the audience understand

the message and make the target population feel more involved in the program making process. An inter-disciplinary team of IEC specialists, producer, scriptwriters, directors will be formed who will develop a program.

The s production process includes script writing, script editing, translation, reviewing, final revision, rehearsal, recording. A schedule will be developed to specify completion dates for these tasks.

3.11.3 Implementation Phase

3.11.3.1 Project Site

The project is Kathmandu valley. It is chosen on the basis of the fact Kathmandu Valley has the largest number of vehicles in Nepal. The problem of air pollution is the most severe among all the cities of Nepal. Other reasons for choosing Kathmandu are: 1)it has three FM stations and one government station for the national broadcast 2) one of the radio stations is a community radio and its area of concern includes environment and public health.

3.11.3.2 Project Period

The project will be one year but the program broadcasting will take place only six months. Other six months are for other activities, i.e., program production, evaluation and so forth.

3.11.3.3 Monitoring

The objective of monitoring is to assess the progress of program during its lifetime. During the broadcasting period it is necessary to check who is listening to the program and when, what they think of the program and provide some feedback. Thus monitoring will be done to find out whether target audiences are listening to the program or not, to collect their feed back and to check the reception quality is good enough for the target audience to listen easily.

Following methods will be used for monitoring:

A)Listeners' Letters: Listeners letter can be a rich sources of evidence of listener's views on the content , timing and reception quality of programs. To attract letter there will be small prizes.

B) Regular consultation with taxi driver association and taxi association: In addition to listeners letter, regular consultation with key persons of these organization will be done to obtain information the content, timing , reception , and popularity of the program. The key person will be chosen on the basis of their educational level.

3.11.4 Evaluation

Evaluation means measuring changes in the target population's knowledge and behavior that came about as the result of the radio program. The basic objectives behind the evaluations are as follows:

- ◆ to find out whether the program is changing the target population's knowledge and behavior?
- ◆ To share experience with others
- ◆ To report to donors and seek on-going funding

- ◆ To make necessary adjustment on future projects designs

3.11.4.1 How the evaluation will be done

As mentioned earlier, knowledge and practice will be assessed during the base line survey by using the structured questionnaire. After the completion of this radio program there will be a similar questionnaire survey. The difference between pre and post test will be an indication of the amount of knowledge and understanding imparted by program. The sampling method and sample size of evaluation will be the same as discussed for the base line survey. Further, the practices of maintenance can be, even though, roughly measured with the help from the mechanics. During the evaluation if it is found that person with increased knowledge and also shows improved maintenance behavior then it is ensured that the project is successful enough to increase both knowledge and practice.

The record of the mechanics will tell whether supply of maintenance service is increasing or decreasing. Major auto-work shops will be contacted to determine the supply of maintenance during the six months of broadcasting and this will be compared with the supply of the previous six months of without broadcasting. The change in the proportion of vehicle that passed emission test after the implementation of the project will be the other measurement of the project.

3.11.4.2 Who will do the evaluation?

It is customary that evaluations are carried out as a part of any project to assess whether the program has reached its objective. Beside this internal evaluation,

the external evaluators can evaluate a performance of program. External evaluators can be the funding agency itself or any evaluators assigned by the funding agency. Thus, beside the internal evaluation as a part of the project, funding agency will be highly recommended to perform external evaluations.

3.12 Activity Plan , Manpower And Budget

Project will start in February of 2000. During the first month, i.e., February, of the project, a series of consultations with all the stake holders will take place. During the next month, needs assessments will be done with the help of four interviewers. These interviewers will be employed on a contract basis for a one-month period. During the third and fourth months, document design will take place. For the document designing, an IEC expert will be hired for a two-month period. Program production will start May 2000 and will be carried out to the end of the broadcasting. The purpose behind this is to adjust the feedback in incoming programs obtained from monitoring. For the program production, a producer and scriptwriter will be hired for the eight months. The broadcasting of the program will start July, 2000 and continue for the period of six months. Monitoring will start from July, 2000 at the same time with broadcasting. Program producer will do monitoring, and evaluation will be done after the completion of the broadcasting. For the purpose of the evaluation, four interviewers will be hired for one month. The project manager will be responsible for the entire project.

Table (3.1): Project Flowchart

	Year/month (number denotes the month-Nov-11, Apr-4)											
	2000											200
	2	3	4	5	6	7	8	9	10	11	12	1
Consultation With Stake holder												
Needs Assessment												
Document Design												
Production												
Broadcast												
Monitoring												
Evaluation												

(Table 3.2) Budget of the Proposed Project		Total cost
<u>Air time cost</u>		
Thirty minutes per week	Rs. 3000/ week	Rs.78000
	(Rs.3000@ 26 week)	
<u>Staff cost:</u>		
Project manager	Rs. 15,000/month	Rs.180,000
	(Rs. 15,000@ 12months)	
Producer, 1 post (part time)	Rs. 1500/ week	Rs.51,000
	(Rs. 1500@ 34 weeks)	
Script writer, 1 post (part time)	Rs. 500/week	Rs.17,000
	(Rs. 500@ 34 weeks)	
IEC experts, 1 post	Rs10,000/month	Rs.20,000
	(Rs. 10,000@ 2months)	
Interviewer, 4 posts	(Rs.4000 /person/month)	Rs. 32000
	(Rs 4000*4@ 2 months)	
<u>Logistics:</u>		
Over head Supplies	Rs.500/week	Rs. 26,000
	(Rs.500@ 52week)	
Publicity/Communication	Rs.500/week	Rs. 26,000
	(Rs.500@ 52week)	
Contingency	20%	Rs.80,600
Total - Nepalese RS. 510,600		
1 US\$=N Rs. 69	Total- 7400.66 US \$	

3.13 Requirement of Technical Equipment

The main technical equipment requirement of this project is a studio for recording and broadcasting. The studio to be used for this purpose will be paid. The studio will also provide all the necessary requirements for recording.

3.14 Potential Problems

There is a wide variety of potential problems that could affect this project. However, in order to achieve maximum impact, this project will focus on the major primary potential problem as described below. Any other problems that arise during the course of the project and their affect will be noted and included in the final results.

This project constitutes stakeholder teamwork and its success does not depend on only one but on the commitment and performance of the entire team of stakeholders. Any project of vehicle maintenance will be most effective if it is equally supported by the traffic police emission tests. Thus, it is desirable to have meetings with stakeholders on a regular basis both to monitor the situation or progress of the project and keep the team spirit intact. If necessary, representatives of stakeholders will be provided with monetary incentives to keep their real interest in the project.

As there are many radio stations in the Kathmandu valley, the success of a radio program, however good on its own, depends also on performances and credibility of the particular station. Thus it is desirable to broadcast the program through the most credible radio station, which may not be possible in some cases due

to lack of appropriate time, funds and so forth. Success of a radio program largely depends on the appropriate broadcast time for the target population, but broadcast time depends on the station also. Thus, a desirable time- schedule for the target population may not be available despite the best of efforts. As there are a number of stations, if appropriate time is not available on one station, the program will be aired on the other credible station.

The prime need of a radio program is that it should be understandable and acceptable to the target population. To make program understandable and acceptable, it is absolutely necessary to consider the culture and education of the target population in the program. Thus, to best accomplish this task, the script writer and IEC experts need to be oriented thoroughly and given enough time and need to visit to the field to get the first hand knowledge of the target populations daily lives. All these issues will be carefully considered during the course of the project.

3.15 Continuity and Sustainability of the Project

As the broadcasting period of six months may be relatively short time to bring about behavioral changes on the target population, further continuation of this project is highly desirable. But the continuity and sustainability of the project will depend on the outcome of the project. Outcome of the project will dictate how it should be continued. The evaluation will provide information leading to necessary changes that may be required to achieve the overall objective of this project.

If the project needs to be continued, then for the initial period (until the program enjoys popularity within target population), donor agencies will be approached for its funding but for the long-term sustainability, advertisements in the program and sponsorship of the program will be the more viable options.

3.16 Ethical Issues Involved in the Project

The main ethical issue involved in a radio health program is the accuracy of the information. Broadcasting health related information imposes a special responsibility on a broadcaster because it is providing information that people may act on to improve their health (Adam and Harford, 1998). If the information is not correct, the consequences could be serious or fatal. This ethical issue can be considered by carefully selecting information from reliable sources with the help of IEC experts. In addition to this, some health related behavior and diseases are subject to socially and culturally determined perceptions, and if the radio program is not based on the proper understanding of attitudes and beliefs of the target population, there is a danger that the audience will regard the health education advice as irrelevant (Adam and Harford, 98). This ethical concern can be solved with a needs assessment process which involves exploring the knowledge, attitudes and behavior of the target population on the chosen issue.

3.17 Limitation of the Project

First and foremost limitation of this project is that it relies on information to bring about behavioral changes and information alone is not sufficient to bring about desirable behavioral changes, rather an integration of multiple approaches is needed for this purpose. Thus, development and effective enforcement of regulation will also assist to meet the objectives of the project. Similarly, interventions to reduce pollution through market based approach will also complement the success of the project. Coordination among various responsible organizations will be a crucial factor to the success of the project

Although radios are widely used as a medium to disseminate information, a radio is a transitory medium and information and may not be retained by listeners who cannot ask for the information to be repeated or clarified. The careful scheduling and repetition of the program can minimize this pitfall. However, radio as one way - medium, unlike face- to-face communication, cannot offer immediate opportunity to ask people questions about what they know or to check if they have understood what they heard. Listeners cannot respond instantly too. This might hinder the increase of the audience's knowledge and consequently reducing the ability to change their behaviors. The listener's letters can minimize this limitation which may be used as a communication channel with the audience.

This project tries to reduce air pollution by reducing vehicular emissions as a result of media induced behavioral modification. The impact of this project may not be observable in spite of reduction of vehicular emission if other sources are

increasing their emissions. As described in the evaluation section, a variety of methods will be used to measure the impact so that if emission measurements are not conclusive, others will be more effective.

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