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ACTIONS TAKEN IN ISTANBUL TOWARDS THE AIM OF PREVENTING AIR POLLUTION

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ABSTRACT

In this study, the efforts performed in Istanbul as of the year 1984 until the year 2005 (the month of April) as regards the air pollution and the precautions taken for reducing the air pollutants are described. The point that has been reached concerning air pollutions as of the year 2005 is summarized.

Keywords: Sulfur Dioxide, Quality Fuel, Quality Burning Systems, Coal, Inversion

1. INTRODUCTION

In the year 1972, the United Nations General Assembly adopted the day 5, June as the 'World Environment Day' in order to 'engage in worldwide activities towards the aim of marking the interest of humanity in protecting and developing the environment with regards deepening the environmental awareness'. For that reason, every year on 5, June, special training programs at schools, parades, special cleaning campaigns, tree-planting activities are carried out throughout the world. The volunteers work in campaigns for using recycled paper as well as making efforts for increasing their effectiveness among workplaces and political circles.

In our country, there are many official and voluntary institutions and organizations taking actions in the issue of environment. The 'Environment Clubs' that are being set up or intended to be formed in schools can also be deemed voluntary environmental organizations.

Our subject matter being the environmental pollution, we can give a brief account of the information on air pollution as follows:

What is Air Pollution, What are its Sources?
Clean air is composed of 78% nitrogen, 21% oxygen and 1% other gases, substances like dust and vapor. These ratios are referred to as the natural components of the air. The presence in the air of foreign substances at such an intensiveness and duration that it might be harmful to the human health, organic life and ecological balance due to a disruption in these ratios leads to air pollution.

So, as for the question 'What are the sources are that lead to pollution?', these sources are:

Natural Sources
Examples for the natural sources which cause air pollution:

a) Volcanoes-Volcanic activities,
b) Fires in forests,
c) Deterioration of the flora and fauna in open country etc.

Synthetic Sources
The artificial sources that lead to air pollution are those sources which are formed as a result of human activities. These are:

a) Use of fuel in residences for heating purposes,
b) Industrial activities,
c) The use of motor road vehicles for transport, that is, traffic.

a. Air pollution due to the use of fuel in residences for heating purposes

There is a continuous flow of heat from an object or an environment with higher temperature to an object or an environment with lower temperature. Therefore, the temperature of the object or environment which has lower temperature decreases. If the temperature gap between two objects or environments is high, then the temperature transferred shall also be high. This basic rule also applies to human beings. People burn the food that they intake using oxygen and the body produces heat.
However, people lose heat and get cold in winter months when their environment is colder than themselves. To meet the need for establishing a balance between the heat produced by the human body and the heat lost by it, various heating devices (stoves, heaters etc.) are used.

The smoke that is exuded from the chimneys as these fuels are burned in our stoves and heaters also pollutes the air. The gases that emit from the stoves or heater furnace chimneys are called general pollutants.
These are;

- Carbon monoxide (CO)
- Sulfur dioxide (SO2)
- Nitrogen dioxides (NOx)
- Particulate substances (soot, lamp black and dust) are referred to as general pollutants.

b. Prevention of the Air Pollution due to Environmental Reasons

The fuels burned in factories to meet the need for energy as well as the pollutants occurring as a result of the operation in the factory are released into the air via chimneys and lead to environmental pollution.

So, how can both development and environmental protection be ensured at the same time?

The workplaces and factories must take the necessary measures in order not to pollute the environment. For example, clean fuel should be used, filtering systems ought to be set up, the raw materials that are able to be recycled should be used, the awareness of the staff concerning the environment should be raised, work should be performed to enhance green areas, technological innovations must be followed or implemented. Most importantly, the necessary permits absolutely have to be obtained from authorized institutions. Controlling institutions must also control such places very frequently.

Our Directorate controls the Non-Sanitary Enterprises based on the authority it derives from the laws. In cases where those enterprises which are detected to emit dirty smoke from their chimneys or releasing emissions, our directorate demands from the highest civilian authority in the Zone that judicial action to be taken against them according to the Environmental Code number 2872.

In order for the pollutants stemming from industrial zones and workplaces to be minimized, 2 teams generally resume their control every day, these controls are also performed at night when necessary.

The industry in our city has huge part in air pollution. Ranking the first among the pollutions stemming from the industry are fuels used for energy as well as non-fuel processes and various operations.

c. Air Pollution due to Traffic

The fact that a single vehicle turns the 15 m^3 of clean air that is the daily need of a human being into air which is harmful for inhalation can gives us enough idea about the extent of air pollution caused by hundreds of thousands of vehicles in cities.

Today in Istanbul, more than 2 million motor vehicles registered in traffic roam the streets and avenues of the city. These vehicles which might release pollutant gases and particulates in the air are increased another fold in their pollutant features due to poor maintenance, inattentive use and oldness in many of the cases, thus they constitute important sources for pollution.
Two types of engines are used in vehicles being and diesel. The sources in vehicles which lead to air pollution vary according to the type of the engine.

The primary pollutant sources in a vehicle that works with a gas engine are as follows:
Exhaust pipe (the actual source)
Fuel tank
Carter ventilation
Carburetor
Brake linings and Tires

As for the vehicles with diesel engines, the primary pollutant source is the exhaust pipe. Three types of smoke is emitted from the exhaust pipes of vehicles with diesel engines.

Black Smoke: It is the smoke formed by fuel granulates that are not entirely burned. It indicates that the viable conditions for burning do not exist.

Grey-White Smoke: It is the smoke formed by the substances which are wastes of full burning. It indicates that the viable conditions for burning do exist.

Blue Smoke: It is a mixture of unburned fuel and oil, it generally indicates that the engine needs maintenance.

The pollutants stemming from vehicles are divided into two as general and special pollutants. The gases carbon dioxide (CO_2), vapor (H_2O), hydrogen (H_2) and nitrogen (N_2) , which are found in the exhaust gases are not deemed to be pollutant

The carbon monoxides (CO), particulate substances (soot, dust, granulate etc.) and hydro carbons in the exhaust gas are deemed to be general pollutants.

The lead (Pb) compounds in gas vehicles is a significant pollutant.

2. EFFORTS FOR PROVIDING ISTANBUL WITH QUALITY COAL

The specifications and amounts of coals used in Istanbul before the year 1995
In Istanbul, air pollution started to manifest itself as of the year 1985 due to the rapid population increase and the use of low quality fuel.

Since the steam coals sold in Istanbul for heating purposes included more than 1% of sulfur on a dry basis, they had carcinogenic effects due to the poly-aromatic hydrocarbons that they contained and the air pollution levels increased the steps of II. warning, selling of steam coals was banned in Istanbul for heating purposes as of 1, March, 1993.
However, the air pollution continued to pose a problem since an effective fight could not be carried out as regards this ban. Furthermore, to recall those days, warnings were made in the newspapers regarding air pollution and people used to go out wearing masks in some regions (Figure 1).

Cumhuriyet

21 OCAK 1993

İstanbul'da 'kırmızı' alarm. Valilik, hava kirliliğinin yoğun olduğu akşam ve sabah saatlerinde çocukların sokağa çıkmamasını istedi.

06-10, 17-21 en tehlikeli saatler. Ancak bu saatlerde çocuklar ya okul yolunda ya da okul dönüşünde. Valilik, uyarmasına karşın okulları tatil etmiyor.

Bilim adamları, üst solunum yolları ve bağlı hastalıklara dikkat çekerek bugünlerde çocukların okula gönderilmemesini istiyor.

Hava kirliliği Denizli, Eskişehir, Konya, Samsun, Erzurum, Kayseri, Diyarbakır, Uşak, G. Antep ve Bursa'da da tehlikeli boyutlarda.

Çocukları evden çıkarmayın

İstanbul Valisi Kozakçıoğlu:' Hava kirliliği ciddi boyutlara varmıştır. Alınan önlemlere uyulmasını istiyorum'. Belediye Başkanı Sözen:'Kirliliğin nedeni egzoz. Kömürden kaynaklanan sorun doğalgaza geçilmesi halinde çözülecek. İstanbul'un şansı deniz.'

Figure 1. Extract from the newspaper Cumhuriyet issued on 21, January, 1993.

When it came to the year 1994, one of the most remarkable problems in Istanbul was air pollution. Since the resolution of the City Local Environmental Board dated 31.03.1993 and number 3 was previously taken concerning the coals to be used in Istanbul in order to prevent air pollution, it was necessary that the coals entering the city be controlled according to this Resolution.

In this resolution, the specifications for coals were specified as follows:

Humidity	: 18% Max. (for Coal Dry in the Air)
Ash	:14% Max.
Total Sulfur	:1.7% Max.
Burnable	:1.4% Max.
Calorific value	:4000 Kcal/Kg
Size	:200 mm Max.

According to these values, it was possible for coals with an original humidity rate of 30-40% to enter the city. Before, sample analyses were performed in the Ağaçlı Zone in Istanbul by getting samples from 50 coal quarries, however, it was possible for the coals obtained in those quarries to enter the city since the specifications to be observed in the coals to enter the city were kept on a broad spectrum.

That year, we could request the certificates of origin and make controls on sizes only at the points of entries for the coals entering the city. The size control could not be

totally possible, either. Because, larger pieces of coals would be placed on the lower parts and smaller pieces of coals would be placed on the higher parts of the lorries. Some efforts were made, however, there was also a problem of air pollution experienced in Istanbul in the mean time. Hence, our municipality engaged in a search and a scientific study was also commissioned by way of a resort.

In addition to the efforts made by our municipality, the study we commissioned to the Yıldız Technical University shows on the Table 1 that 10% of the emissions polluting the air (PM, SO_2, CO, NOx, HC) were caused by vehicles, 90% by fixed sources, conversely, the residences and the industry.

Also, the study indicates the condition of the liquid and coal fuels used in residences and the industry. While the consumption of coal was equal to that of fuel-oil during the years 1980-81-82, the consumption of coal increased nearly 9 times compared to fuel-oil and amounted to the level of 8-9 millions of tons/year. 80-90% of these coals were received from the Ağaçlı Zone in Istanbul. Coals that complied with the standards for burning were also received from the other coal-bearing zones in our country.

Table 1. Distribution of the pollutant emissions in Istanbul in the year 1990

Pollutant	Total Emission (%)	Fixed Sources (%)	Vehicles (%)
PM	48.10	47.5	0.65
SO2	29.4	29.1	0.26
CO	16.3	9.9	6.64
NOx	3.1	1.6	1.44
HC	3.0	1.6	1.40
TOTAL	100	90	~10

It could also be seen very clearly in the study conducted by Yıldız Technical University that the emission of sulfur dioxide (SO_2) increased in accordance with the rise in the use of coal.

Namely, while the emission of sulfur dioxide (SO_2) sorted by the fuels consumed during the 1980s was equal to the amounts of sulfur dioxide stemming from coal, the amount of sulfur dioxide also increased proportionately in the later years in parallel to the consumption of coal.
Comparing this increase with the sulfur dioxide stemming from fuel oil, the rate of sulfur dioxide due to coal in 1980s was 37%, and the rate of sulfur dioxide due to fuel-oil was 60%, these rates became 78% for sulfur dioxide due to coal and 20% for sulfur dioxide due to fuel-oil in 1993-1994.

Until the year 1994, the rate of sulfur dioxide emission stemming from fuel-oil fell from 60% to 20% within the last decade. It is natural in our city that there will be an increase in the air pollution at the same that as 8-9 millions of tons of low quality coal is used generally for heating.

Actions for increasing the quality of coal

Since the air pollution has assumed the dimensions mentioned above and this stems predominantly from the burning of low quality coal, actions have been taken in the direction of increasing the coal quality and making natural gas more rampant. As it is known, departing from the fact that it is not possible to take natural gas to the entirety of Istanbul in terms of both the amount of gas and technical terms and that the 30-40% of the need for fuel in the city can be met under any circumstances with coal, the quality of coal has been seriously dwelled upon.

Environment and Coal Analysis Laboratory

The samples taken from the entrances to the city, the points of sale in the city as well as the consumer domiciles in order to control whether the coals consigned to Istanbul with certificates of permission conform to the specifications determined by the Local Environmental Board Decision are analyzed in our coal analysis laboratories belonging to our municipality that started their activity in Yenibosna during the winter season in 1997-1998.

Thanks to this laboratory established within the body of our municipality, an increase rate of 30% has been ensured compared to the rate obtained by the university and the complaints by the citizens could be resolved more quickly since the coal analyses could be finalized in a shorter period of time. Thus, it has been also been ensured that the quality of coals be controlled in a more effective manner within a general structure.

As a result of this active work performed as of the year 1995 in order to reduce air pollution in Istanbul, the consumption rate of 8-9 millions of tons of coal marked during the years 1993-1994 fell to approximately 2-2.5 millions of tons in the winter season in 1997-1998 and down to 1-1.5 millions of tons during the winter season in 2004-2005. Even though the expansion of natural gas has had a share in this decrease in the amount, the actual factor was the raise in the quality of coals.

3. AIR POLLUTION MEASUREMENT ACTIONS

In Istanbul, the air pollution is one of the most significant problems brought about by modern life and it had assumed increasingly important dimensions in the past periods due to the rapid population increase, concentration of population caused by migration, faulty selection of locations in urbanization and industrialization, use of low quality fuel, lack of attention paid to heat isolation, non-conformity with standards in the burning devices (stoves and furnaces), use of old burning techniques in the industry, failure to perform the chimney cleansings as required, failure to take enough actions for reducing the emissions caused by traffic, overall lack of

knowledge of environmental problems and the inadequate attention paid to the issue in spite of everything.

As a result of these actions taken, the air pollution in Istanbul decreased as of the year 1995, the levels of warning reached before were not to be seen, furthermore, the limit values were not even reached.

Average Values In Winter Seasons
A rate of more than 400 mg/m^3 was generally observed during the years 1993-1004 and 3600 mg/m^3 was observed on some days.

	SO2	PM(TOZ)
1995-1996 Winter season (October-March) average	100	78
1996-1997 Winter season (October-March) average	81	60
1997-1998 Winter season (October-March) average	69	62
1999-2000 Winter season (October-March) average	43	57
2000-2001 Winter season (October-March) average	37	62
2001-2002 Winter season (October-March) average	33	71
2002-2003 Winter season (October-March) average	33	65
2003-2004 Winter season (October-March) average	23	61
2004-2005 Winter season (October-March) average	19	50

As a result, the air pollution was eliminated to a great extent as a problem in Istanbul. However, our efforts are underway to maintain this situation.

Our Metropolitan Municipality continues its activities briefly for providing quality coal (quality coal, quality fuel-oil), expansion of natural gas, improvement of burning devices (stoves and furnaces), implementing heat isolation in buildings and taking under control the emissions stemming from the industry taking and maintaining under control in order to eliminate these negativities and ensure that the effects leading to the negativities do not resurface.

Parameters taken into consideration for the selection of existing measurement locations
•Climatic conditions
•The topographic structure of Istanbul.
•Position of the industrial zones.
•Condition of the buildings in Istanbul and settlement.
•Vehicle traffic.
•Distribution of population.
•Distribution of natural gas.
•Historical meteorological data obtained from the Atatürk Airport.

Table 2. Location of the Air Quality Stations and Measurement Parameters

	AIR POLLUTANTS					
	SO2	**NOx**	**CO**	**O_3**	**HC**	**PM**
Yenibosna	X		X			X
Esenler	X	X	X		X	X
Saraçhane	X	X	X	X	X	X
Alibeyköy	X	X	X		X	X
Beşiktaş	X	X	X		X	X
Sarıyer	X		X			X
Üsküdar	X		X			X
Kadıköy	X	X	X	X	X	X
Ümraniye	X	X	X		X	X
Kartal	X		X			X

Table 3. Air Quality Analyzers/Samplers

	METHOD OF ANALYSIS
SO_2	UV Fluorescent Method (Automatic)
NOx	Chemi-luminescence Method (Automatic)
CO	IR Absorption Method (Automatic)
O_3	UV Photometry Method (Automatic)
HC	Gas Chromotography (FID) Method (Automatic)
PM10 (DUST)	Beta Beam Absorption (Beta Gauge) Method (Automatic)

Figure 2. Ümraniye, Kartal, Sariyer, Üsküdar, Esenler, Beşiktaş, Alibeyköy And Yenibosna, Kadiköy, Saraçhane Air Quality Measurement Stations In Kadıköy, Saraçhane Stations SO_2, PM 10, CO, NOx, THC, O_3 In Esenler, Beşiktaş, Alibeyköy, Ümraniye Stations: SO_2, PM 10, CO, NOx, THC, In Yenibosna, Kartal, Üsküdar, Sarıyer Stations: SO_2, PM 10, CO measurements are made.

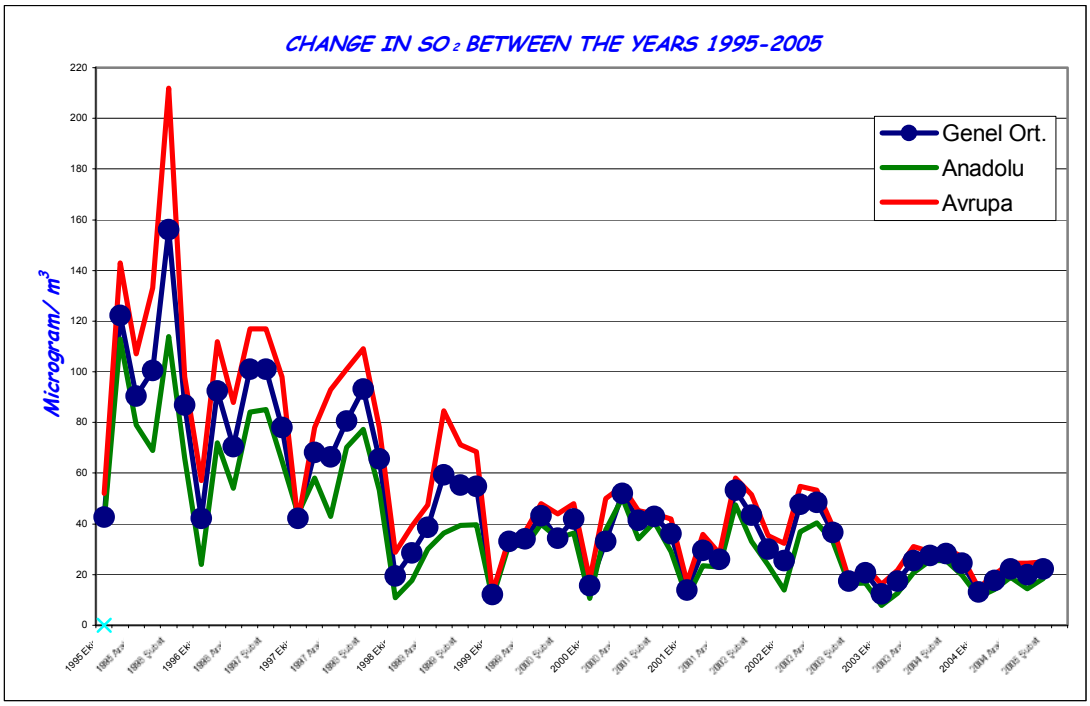

Figure 3: Change in the SO_2 between the years 1995-2005

An examination of the 2004-2005 Winter season (October-March) portrays that the daily threshold values specified in the Regulation for Air Quality Protection, World Health Organization, European Union, EPA and Benelux are not measured on average in the entirety of Istanbul; furthermore, the values are even below these thresholds.

The Measured Air Quality values are sent to the General Directorate of İGDAŞ (Istanbul Gas Distribution Corporation) and to the e-mail addresses of both the Provincial Directorate for Environment and Forest and the General Directorate of İGDAŞ as well as the Press Advisory Office of Istanbul Metropolitan Municipality.

Our measured air quality values are posted every day on our website "http://www.ibb.gov.tr/" \t "_parent", under the link **Air Quality.**

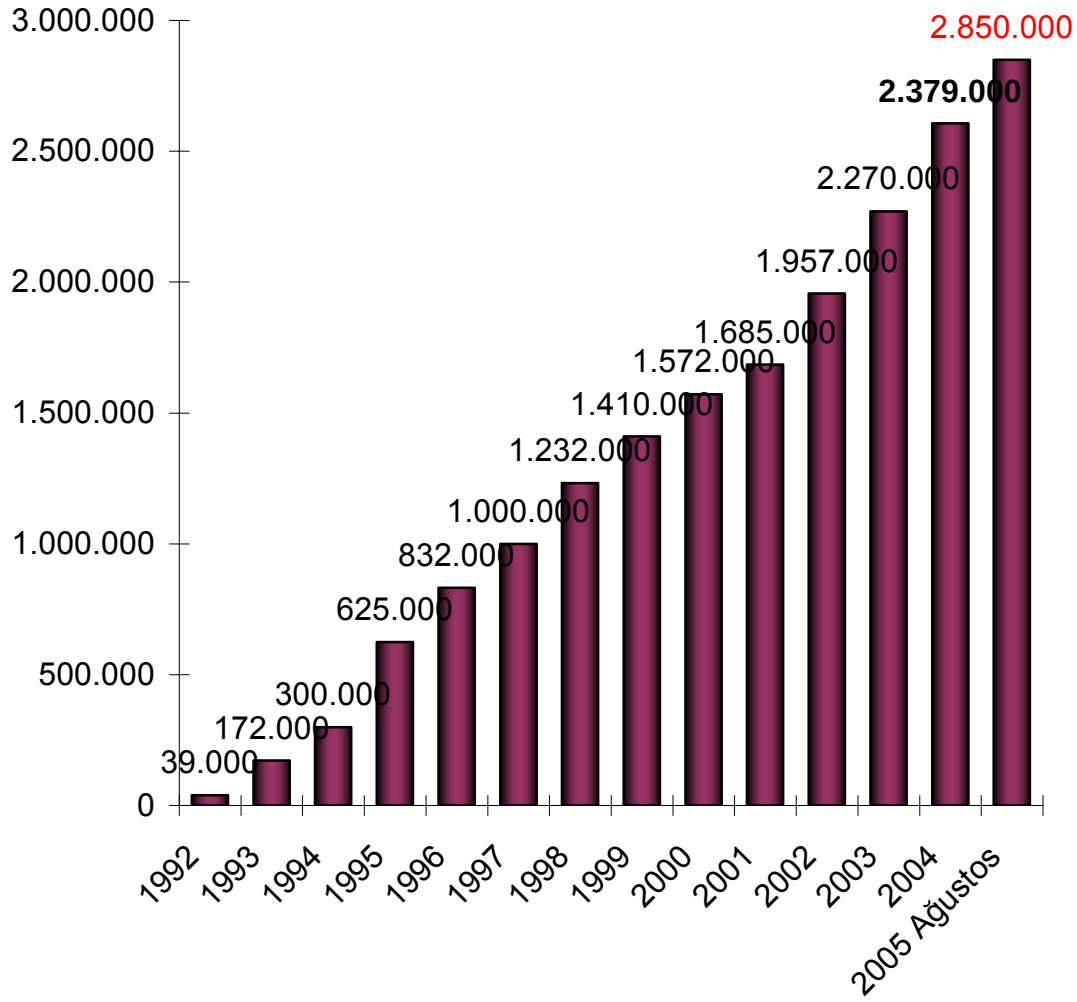

Figure 4. The number of subscribers of İGDAŞ sorted by years

4. RESULTS

We both have to provide heat for ourselves and to avoid polluting the air. Then, we should provide heating without polluting. For that reason, it is necessary that the principles below be obeyed in order to reduce air pollution stemming from heating or to prevent air pollution.

- There should be a fuel saving. The less fuel we consume, the less will be the air pollution.
- We should use clean fuel.
- The fuels should be burned in stoves and heaters in accordance with the technique.
- Heat isolation should be ensured in the buildings and in our houses.
- The furnace attendants should be commonly trained, the attendants who are not eligible should not be allowed to work in furnace rooms.
- The heater and stove chimneys should certainly be cleansed at the beginning of every season.
- The ventilation window of the furnace room should be kept open while the heaters are powered on.
- For the coal furnaces, a furnace cleaning should be performed twice a week; as for the furnaces that use liquid fuel, that is, fuel-oil, the cleaning should be done once a week.
- The faults in the heating installation should be overcome on time.
- The heaters shall be powered when the air temperature outside the building falls down to 12 ºC and below, when the temperature is between 12 ºC- 18 ºC, they shall be heated in a limited fashion and the heaters shall not be powered on once the temperature exceeds 18ºC.
- In the houses; heating ought to be ensured so that the temperature in the living rooms shall be around 22°C and it shall not exceed 15 °C in steps, kitchen and toilet, 20 °C in the bedroom and 26°C in the bathroom.
- If the area of heating of the heater installation is 3000 m^2 and above, a water filter is to be mounted on the furnace chimney.

5. REFERENCES

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