

# Control of Output Pollutants Emission from the Incinerators in Iran for Decreasing Air Pollution

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**Abstract.** Formulating the control of emissions from the incinerators in order to properly apply the incinerators in Iran and reaching a good level of standard of air pollution is the main purpose of the present paper. So, an industrialized city like Tehran was selected and different factors of meteorology and air pollution were studied in that city. Then the information about the standard and control of emissions from the incinerators in other countries like US, India and Turkey was studied and finally, by considering those standards and controls of other countries and based on comparing those factors and conditions with those in Iran, a schema has been offered for controlling the emissions of incinerators.

**Keywords:** incinerator, pollutants, emission control, air pollution

## 1. Introduction

In order to control air pollution and emissions from the incinerators and based on the sustainable development, it is necessary to pay attention to control of incinerators' emissions along with development of industries. So, applying a pollution control system with specific criteria and regulations was under consideration. Therefore, formulating incinerators' emissions control is an important and main necessity in regard to different geographic conditions of Iran and air pollution in different areas. [1]

In Iran, local standards for incinerators have not been formulated so far and international standards are used and the only case that is applied practically in Iran Department of Environment is the directives and specifications of hospital incinerators. [2]

In developed countries, there are special directives and standards for incinerating waste materials and depended on the type of waste material there are different standards for emissions from incinerators and some of them are mentioned in this paper.[1]

## 2. Methods

### 2.1. Introducing the territory under study (Iran)

Iran is located in Asia and in western part of Iran plateau and is one of the countries of Middle East. In general, five climates have been recognized in Iran based on De Martin system: arid, semi-arid, Mediterranean, humid and semi-humid. [3]

### 2.2. Natural features of Iran in view of climatology

Climatic factors such as air temperature, rain falling, storm, dust storm, lightening, fog, vision lower than 2 km, number of calm days, wind speed and direction, air pressure, saturated vapor pressure, relative humidity and sunny hours are among the cases that should be studied.

### 2.3. Critical regions of Iran in view of air pollution

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Based on the studies performed in Iran, seven big cities of Iran are faced with air pollution: Tehran, Mashad, Isfahan, Tabriz, Shiraz, Ahvaz, Karaj and Arak.

Pollutants such as HC, CO, Sox, Nox, and Pm10 in cities are beyond the allowable amounts and automobiles and motor vehicles constitute 70% of these pollutions and home cooling and heating systems are in the second place. [4]

## **2.4. Main city pollutants**

### **2.4.1. Hydrocarbons (HC)**

Hydrocarbons are important in two ways: 1-They are prerequisites for photochemical oxides. 2- Some types of them are carcinogen.

### **2.4.2. Carbon monoxide (CO)**

A colorless and odorless gas that is produced as a result of incomplete combustion of coal and fossil fuels. In Tehran and in time of heavy traffic its concentration reaches 50 ppm.

### **2.4.3. Sulfur dioxide (Sox)**

It is a colorless gas that goes into reaction with most of solid materials and air particles. It is produced as a result of combustion of fossil fuels.

### **2.4.4. Nitrogen oxides (Nox)**

It is a colorless and odorless gas. Initially, it is in form of NO and is produced as a result of combustion when nitrogen and oxygen are combined in high temperatures especially in internal combustion engines and after entering free air it converts to NO<sub>2</sub> and its main source is urban transportation. [1]

## **2.5. Control of solid waste materials in Iran**

To know the sources and types of solid waste materials, their compounds and rate of production is necessary in designing and performance of components of controlling solid waste materials. System of controlling urban solid waste materials has eight components: 1- decrease at origin, 2- production, 3- Storage, processing and administering at the place, 4- recollection, 5- transportation, 6- recycle, 7- disposal, 8- cares after disposal. [2]

Among the eight components, the final disposal of solid waste materials is one of the important components studied in this research. To this aim, the incinerators as appropriate option for disposal and as a tool for converting wastes to energy in Iran have been studied.

## **2.6. Incineration and incinerators in Iran**

We must determine the position of incineration within the framework of different disposal systems for solid waste materials. There has not been an incineration factory in Iran so far. Incineration is a process for disposing and decreasing the wastes in high temperatures. In other word, incineration is healthy disposal of wastes. The main products of incineration in high temperatures are carbon dioxide, water and inorganic ash. Incinerators are equipment for disposing any combustible material. The energy produced from burning wastes may be very useful and can be converted to other forms of energies. There are various kinds of incinerators including fluidized bed, moving grate, fixed grate, and rotary-kiln.

## **2.7. Emissions from incinerators**

There are three courses for emissions from incinerators:

- 1-Emission through the stack
- 2-Discharge of sewage of air pollution control machines
- 3-Unburned wastes or ash

The following products are emitted through the stacks: smog, metal particles and vapors such as lead, nickel, mercury, cadmium and etc and gases such as carbon monoxide, nitrogen oxides and in some cases sulfur dioxide. [5]

## **2.8. Effective factors in emissions from incinerators**

The following are among the effective factors in measuring emission factors:

- 1-Type of incinerator
- 2-Wastes specifications
- 3-Air pollution control equipment

The emitted pollutants include suspended particles, carbon monoxide, hydrogen chloride, sulfur oxides, nitrogen oxides, different metals and also volatile organic compounds. [6]

### 3. Emission Coefficients

Emission coefficients are used for evaluating the quantity of pollutants resulted from different sources and determining the share of each source. Emission coefficients are usually given based on pollution amount to the unit of product and/or pollution amount to the unit of used raw materials. [7]

#### 3.1. Emissions from incinerators in Iran

In respect to the studies and comparing the status quo in Iran with the conditions and standards of emissions in other countries and also by analyzing the status quo in cities of Iran like Tehran, the pollutants including HC, CO, Sox, Nox, and Pm10 in Tehran are out of the allowable limits. Since municipal incineration operation aggravates the air pollution, so we should offer some methods for controlling the emissions from the incinerators in cities. [7]

### 4. Conclusions

-To control the emissions from the incinerators in Iran

1-Operational standard of incinerators including using double chamber incinerators with a stack with minimum height of 25 m above the ground level. The temperature in initial combustion chamber should be 50-800 °C.

Of course, some factors such as technology level, economic conditions, pollution standard, and in Iran are effective in formulating the operational standards.

Standards for Emissions from municipal incinerators were formulated with considering the operational conditions of incinerators and also with respect to the climatic conditions, allowable limits for pollution in the region, individual waste production, and type of waste materials and also the standards of other countries that are as following:

Table1: Controlling the emissions from municipal incinerators

Parameter	Allowable limits of pollutants in polluted cities	Allowable limits of pollutants in non-polluted cities
Nox	400 Mg/Nm <sup>3</sup> (12% Co <sub>2</sub> )	450 Mg/Nm <sup>3</sup> (12% Co <sub>2</sub> )
CO	350 Mg/Rm <sup>3</sup>	400 Mg/Rm <sup>3</sup>
So <sub>2</sub>	50 Mg/Rm <sup>3</sup>	55 Mg/Rm <sup>3</sup>
Particles	200 Mg/Rm <sup>3</sup>	250 Mg/Rm <sup>3</sup>
Metals	1 µg/Rm <sup>3</sup>	0 µg/Rm <sup>3</sup>

Mg/Nm<sup>3</sup>: Milligrams per Newton cubic meter

Mg/Rm<sup>3</sup>: Milligrams per cubic meter in standard conditions

µg/Rm<sup>3</sup>: Micrograms per cubic meter in standard conditions

Controlling the emissions from industrial incinerators

Important and main parameters in emissions from industrial incinerators include heavy metals, dioxins and suspended particles that are mentioned in the following table for controlling the emissions from industrial incinerators.

### 5. Suggestions

At present, there are no standards for the incinerators. With respect to the lack of land in Northern and industrial regions of Iran we can consider the incinerators as an appropriate option. In other hand, using

incinerators in non-standard ways may aggravate the air pollution, and harm the environment and human health. Based on the performed studies in this research, a local standard for incinerators can be formulated for different provinces and regions of Iran.

Table 2: Controlling the emissions from industrial incinerators

Parameter	Allowable limits of pollutants in polluted cities	Allowable limits of pollutants in non-polluted cities
Nox	450 Mg/Nm <sup>3</sup> (12% Co <sub>2</sub> )	500 Mg/Nm <sup>3</sup> (12% Co <sub>2</sub> )
CO	45 Mg/Rm <sup>3</sup>	50 Mg/Rm <sup>3</sup>
So <sub>2</sub>	55 Mg/Rm <sup>3</sup>	55 Mg/Rm <sup>3</sup>
Particles	150 Mg/Rm <sup>3</sup>	200 Mg/Rm <sup>3</sup>
Cadmium	15 µg/Rm <sup>3</sup>	20 µg/Rm <sup>3</sup>
Lead	50 µg/Rm <sup>3</sup>	55 µg/Rm <sup>3</sup>
Mercury	10 µg/Rm <sup>3</sup>	15 µg/Rm <sup>3</sup>
Chloridric compounds	10 Mg/Rm <sup>3</sup>	15 Mg/Rm <sup>3</sup>
Other heavy metals	1.2 Mg/Rm <sup>3</sup>	1.2 Mg/Rm <sup>3</sup>
Dioxins and Furans	80 Mg/Rm <sup>3</sup>	85 g/Rm <sup>3</sup>

The present research can be continued in the following fields:

1-Formulating a method for controlling the emissions from the industrial incinerators (for different industries separately)

2-To Formulate standards for emissions from the incinerators in different regions of Iran.

3-Studying the methods for controlling the emissions from the incinerators, separately for different types of wastes used in them.

## 6. References

- [1]. Qiaseddin, Mansour, 2006, Air Pollution, Tehran University Publications
- [2]. Abbaspou, Majid, 2010, Environmental Engineering, Vol.2, Islamic Azad University Publications
- [3]. Omrani, Ghasemali, 2004, Solid Waste Materials, Vol.1, Islamic Azad University Publications
- [4]. Yaqmayian, Kamiar, 2007, Environmental Aspects of Applying Incinerators, Kamal kar International Investing and Commercial Company
- [5]. UK EA MCERTS Personnel Competency Standard for Manual Stack-Emission Monitoring Environment Agency, Version 4, April 2006. [Weblink: <http://publications.environment-agency.gov.uk/pdf/GEHO0705BKAG-e-e.pdf>]
- [6]. CEN/TS 14793:2004, Air Quality – Stationary source emission – Interlaboratory validation procedure for an alternative method compared to a reference method
- [7]. Integrated Pollution Prevention and Control (IPPC) Reference Document on the General Principles of Monitoring, July 2003