

## **Mandating 'acceptable' fuel to be used in NCR for air pollution control**

### **Environment Pollution (Control and Prevention) Authority for NCR**

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#### **Conclusions of EPCA's investigation into quality of fuel being used in NCR; its pollution impact and recommended actions**

1. It is well recognized that the quality of fuel used for combustion has a critical role in the quantum of pollution generated. It is for this reason India has moved from petrol/diesel with 10,000 ppm of Sulphur in 1996 to 50 ppm in 2010 (this will be extended nationwide in April 2017). The improvement in fuel quality then allows for effective pollution control devices to be installed. In the case of diesel vehicles, for instance, only when fuel has Sulphur below 10 ppm, can after-treatment pollution devices be effective. The quality of fuel used for industrial production is equally important in terms of its pollution impact.
2. The key contaminant in fuel that is responsible for high levels of pollution is Sulphur – this is emitted in the form of particulates and also in the form of gas, Sulphur Dioxide (SO<sub>2</sub>). Depending on the level of moisture in the air, gas gets converted into particles. These 'secondary' particles are a key source of air pollution in Delhi/NCR. According to the IIT-Kanpur report, as much as 25-30 per cent of the winter sources are secondary particles, which are emitted from vehicles, power plants and industries. Any fuel, which is high in Sulphur will also have heavy metals, which will add to contamination of the environment.
3. In 1996, the Delhi Pollution Control Committee issued a notification mandating the 'acceptable fuels' that could be used in Delhi. This notification was issued under section 19 of Air Act. The list did not include furnace oil or pet coke or other fuels that could have high Sulphur. In 1996, it specified that coal with low Sulphur (4000 ppm) could be used in Delhi and also termed fuel oil with 18,000 ppm of Sulphur as low-Sulphur.

4. This notification did not extend to NCR and therefore, there was no restriction in the use of extremely polluting fuel at the border of Delhi and in the same air-shed.
5. Recently, it came to the notice of EPCA that with the crash in international fuel prices, the price of furnace oil (FO) and pet coke has also come down, which was increasing their use as fuel in industry and in generator sets above 1 mw. It was also learnt that other fuels, which were by-products of refineries and petro-chemical processes were also being used for combustion. EPCA also learnt that in most cases there were no specifications for the quality of this fuel.
6. The only BIS specification that exists is for fuel oil, which is also used for furnace oil (FO), and allows the product to have between 35,000-45,000 ppm of Sulphur. Furnace oil is the last grade produced by refineries and this 'bottom of the barrel' product is therefore, extremely polluting.
7. Pet coke, a by-product, of refineries, which is even more polluting does not even have any specifications for the Sulphur content that is permissible.
8. EPCA's investigation has found that large quantities of FO are sold in Delhi and NCR by oil Public Sector Undertakings (PSUs) and Reliance Industries Limited (RIL). This year, in fact, sale is even higher than last year and some 30,000 metric tonnes (mt) has been sold every month in NCR. According to this data, RIL has sold 51,000 mt in Delhi in the past 7 months. However, RIL has informed EPCA that only its point of billing is in Delhi and not its customers. EPCA is unable to verify this but it is clear that even if this fuel is sold in NCR, it adds to the burden of pollution in the region.
9. There is no information about the quantum of sale of pet coke in NCR as oil companies do not collate this. During its factory visits in NCR, EPCA found that industries were importing pet coke for use. It then found that data from the Ministry of Commerce showed that pet coke imports are up – in 5 months up to August 2016, India had imported 7 million mt as against 10 million mt imported in 2015-16.

10. EPCA has also learnt that refineries and petro-chemical industries are selling by-products as fuels and that there are no specifications for these in the country.
11. EPCA has also had the samples of these fuels, namely FO and pet coke, which it collected personally during its visits, analysed to check on the Sulphur content.
  - 11.1 **The analysis of the samples of pet coke done has found that the Sulphur level is between 69,000 ppm (imported) and 74,000 ppm (Indian).**
  - 11.2 **The analysis of the samples of FO has found that Sulphur level is between 15,000 to 20,000 ppm.**
12. The key substitute for FO is natural gas, which is cleaner and environmentally friendly. EPCA has learnt that pricing of FO is kept lower than gas so that it can be more competitive. The price of furnace oil has fluctuated over the past few years and currently it sells at Rs 22-24/litre. EPCA has learnt that the cost of power generated through FO is roughly Rs 5-6 per unit; natural gas Rs 6-7 per unit and diesel Rs 13-14 per unit. The other alternative is to use electricity, as this would be also Rs 6-7 per unit, but according to sources power supply is unreliable and unavailable in UP. In other words, substitutes for FO exist and they are competitive. The key substitute for petcoke, which is used in furnaces, would be electricity, natural gas or even low-sulphur coal. All these will be less polluting than pet coke.
13. However, while governments provide tax exemptions to FO – Uttar Pradesh does not charge VAT on FO – natural gas is taxed. In Uttar Pradesh, cleaner natural gas is charged VAT at 10%. This is the case in other states as well. Therefore, if policy is made to incentivize clean fuel over polluting fuel, it would increase the competitiveness of natural gas.
14. It is also clear that even though Delhi has closed down its industries because of pollution, it has only transferred the problem to its neighbouring states, where these industries using polluting fuel now operate. EPCA visited industries in Ghaziabad, which is in the same air-shed, which were using furnace oil and pet coke and therefore, greatly adding to pollution. Also many industries in Delhi operate in non-

authorised colonies (illegal colonies) and so are outside the 'control' of the Delhi Pollution Control Committee (DPCC). It is therefore, necessary to mandate the need for clean fuel, not just in Delhi but across NCR, so that there are clean air benefits.

15. There are no standards for SO<sub>2</sub> and therefore, the pollution from the use of these fuels in industry furnaces and generators is enormous. It is also clear that controlling pollution from such high Sulphur fuels requires huge investment in abatement technologies and this is why it must be restricted. Pet coke, for instance, which is a high calorific by-product of refineries can be used by cement industry, where combustion technology is regulated.
16. There is no doubt that the use of such high Sulphur fuel is greatly contributing to pollution in the region and needs urgent steps to curtail use.

Based on these findings, **EPCA recommends the following:**

- 16.1 The list of 'acceptable fuels' that can be used in NCR (not just Delhi) as per section 19 of the Air Act should be as follows:
  - a. Coal with low-Sulphur (1000 ppm or less) for use in power plants (until these can be switched to natural gas)
  - b. Petrol (BS IV with 50 ppm Sulphur)
  - c. Diesel (BS IV with 50 ppm Sulphur)
  - d. Natural gas/CNG
  - e. LPG
  - f. Kerosene (for domestic use)
  - g. Naptha (for power plants and under strict enforcement for pollution)
  - h. Aviation turbine fuel (for aircraft)
  - i. Firewood(only for domestic use in rural areas and crematorium)
  - j. Biogas
- 16.2 **The use of furnace oil and pet coke would be strictly banned in NCR.** Pet coke will be allowed only in cement plants, where combustion and emissions are controlled. However, if any cement plant requires the

use of pet coke in NCR, it will have to seek permission from CPCB and EPCA.

- 16.3 All other fuels, which do not have specifications laid down by BIS would be banned for use in NCR. Any new fuel to be added to the list of acceptable fuels will be done only after consideration of its parameters as laid down by BIS and its fuel test reports by CPCB and EPCA.
- 16.4 Government should finalise specifications for fuels used for industries/generators urgently so as to make sure that only low-Sulphur and clean fuels are available for use in the country.
- 16.5 The use of pet coke should be regulated across the country. All industrial fuels should be included in the list of hazardous waste so that import and use is regulated by the Ministry of Environment and Forests and Climate Change.
- 16.6 The NCR governments should be directed to provide fiscal incentives to clean fuel as against polluting fuel.
- 16.7 The GoI should revise its fiscal policies, which incentivize polluting fuels over cleaner fuels.

#### **A. Furnace oil: high Sulphur fuel**

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Furnace oil (FO) is the last grade of oil (bottom of the barrel) that a refinery produces and it contains very high levels of sulfur – which is the key pollutant in fuel when burnt. As per the Bureau of Indian Standards (BIS), different grades of fuel oil, which is also the standard used by refineries for furnace oil are allowed between 35,000 to 45,000 ppm of sulfur. Compare this to the BS IV standards, which require that only fuel meeting 50 ppm can be sold in NCR.

#### **Sale in NCR**

As per information gathered from oil companies in 2015-16 some 318,000 metric tonnes of furnace oil was sold in Delhi and NCR. This year (April to

October 2016), 204,000 metric tonnes of furnace oil has been sold in 7 months in the region. Reliance Industries Limited (RIL) is the key seller in Delhi and Rajasthan, while IOCL, HPCL, BPCL sell in Haryana and Uttar Pradesh regions of NCR.

According to Reliance, they do not sell in Delhi, but sell in NCR and their point of billing is in Delhi. Reliance has given EPCA a list of their customers, which are primarily in Ghaziabad (however, this list does not add up to the entire volume sold). Therefore, it is difficult to say if all the FO is used in NCR or it is used also in the small scale industries found in the unauthorized areas of Delhi. But needless to say, even if it is used only in NCR, it is extremely polluting and given that it is in the same air-shed, it is part of Delhi's problem.

**Table: FO sales in Delhi and NCR parts of Haryana, Rajasthan and UP: 2015-16 and 2016 up to October 31, 2016**

	Region	2015-16 PSU	2015-16 Reliance	Total	2016-Oct PSU	2016-Oct Reliance	Total (up to Oct)
1	Delhi	17,000	59,000	<b>76,000</b>	18,000	39,000	<b>51,000</b>
2	Haryana	80,500	2,500	<b>83,000</b>	56,000	--	<b>56,000</b>
3	Rajasthan	4,000	56,000	<b>60,000</b>	9,000	20,000	<b>29,000</b>
4	Uttar Pradesh	99,000	--	<b>99,000</b>	68,000	--	<b>68,000</b>
		200,500	117,500	<b>318,000</b>	151,000	59,000	<b>204,000</b>

### **Price of FO: cheaper than natural gas/diesel**

Furnace oil is used by industries because it has a high calorific value – 9000-9500 kcal/gm and it is cheap. The price of furnace oil has fluctuated over the past few years and currently it sells at Rs 22-24/litre. EPCA has learnt that the cost of power generated through FO is roughly Rs 5-6 per unit; natural gas Rs 6-7 per unit and diesel Rs 13-14 per unit. The other alternative is to use electricity, as this would be also Rs 6-7 per unit, but according to sources power supply is unreliable and unavailable in UP.

The key substitute for furnace oil is natural gas and when the price of FO increased to Rs 50/litre a year ago, customers moved to natural gas. But in the past 8 months the price of FO has seen a steep decline – it has fallen to Rs 16.70/ litre some months ago and now Panipat refinery of IOC sells it at Rs 22.07/litre (burning grade) and Mathura at Rs 24.70/litre (original grade).

It is also ironical that FO does not have value added tax (VAT) imposed on it as against cleaner natural gas. Therefore, another 10 per cent is added on the cost on cleaner natural gas in UP. The situation is the same in other NCR states as well.

It is not clear at what price Reliance sells FO, but industry experts say it is below what is sold by PSUs. The disadvantage is that Reliance customers have to transport the produce from Jamnagar Refinery, which adds to costs for north India. However, as the figures above show, it is selling in Delhi and so it must be competitive.

The price of FO is determined by PSU oil refineries who set the price in relation to the market and the price of its fuel substitute – in other words, price is kept lower than the price of natural gas or diesel, which is the key substitute for FO. There is also an import and export market for FO, which also determines the price in the domestic market.

### **Customers of FO**

FO is used in a variety of industries as energy source and is also used in generator sets – particularly large industrial energy generators. A large number of industries are steel foundries – which are the key source of pollution in most parts of the country.

In most cases, large industrial customers buy directly from refineries in tankers, which are kept till stock is exhausted. During its visit to the factory, EPCA learnt that Moser Baer, which uses FO to run its 34 mw generators has a tank of 2100 tonnes to store FO.

According to IOC, their top customers include the following:

Moser Baer (manufacturer of solar panels); in both units in NCR – (EPCA during its visit found that they have 34 mw of generator sets in which they use FO; demand at full capacity will be 180 tonne per day; currently they use 70 tonne/day).

Other units using Furnace Oil include:

- Hindustan Natural Glass
- U-Flex
- Bhushan Steel (EPCA found this was used for generator sets)
- Asahi India
- Nestle India – Samalkha
- Hero Motors
- Musahi Auto Park
- Starware

EPCA visited other industries to understand the usage of FO. It found that in most cases, industries were using FO as a substitute for natural gas (it was slightly cheaper) or electricity from the grid (which was unreliable).

According to IOC top management, they are upgrading their refineries so that there will not be any production of FO. Clearly, this must be done across the country in a time-bound manner and all refineries should be asked to minimize production of high-sulphur fuels. In addition, BIS should specify standards for different fuels that can be used for industrial uses so that pollution impacts are minimized.

## **B. Petcoke: un-regulated fuel with high calorific value**

The sulfur level in petcoke is even higher than FO – some 60,000 ppm. However, there are no BIS or other government agency specified standards for this product, which is a by-product for refineries.

Pet-coke has a higher calorific value than coal -- 8000 kcal/kg as against 3000-4000 kcal/kg of Indian coal. Given its high calorific value, it is preferred by industries as a fuel, even though it is more expensive than coal. Pet coke sells currently at roughly Rs 6000 per metric tonne, while coal price is between 3000-4000 per metric tonne. Also, while the Indian government has imposed a clean energy cess on coal of Rs 400 per tonne, it has spared pet-coke. This makes it even more cost-effective for use for combustion.

Petcoke is also imported – and as China has started restricting its use of pet coke because of pollution, the international price has dropped. Consequently, in India (which should have equal concerns about pollution) imports are up. According to data from the Department of Commerce, this year in just 5 months up to August, India has already imported some 7 million metric tonnes of pet coke, as against 10 million tonnes imported in 2015-16 (see table).

**Table 1: Trends in import of Pet coke - 2014-15 to 2016-17 (Till August)**

<b><u>Import Trends</u></b>	<b>2014-15</b>		<b>2015-16</b>		<b>2016-17 (Till Aug)</b>	
	In Crores (Rs.)	In million tonnes	In Crores (Rs.)	In million tonnes	In Crores (Rs.)	In million tonnes
Petroleum Coke	5063.1	5.8	5632.74	10.04	3064.71	7.03

Source: Export Import Data Bank, Department of Commerce, Govt of India

Not much more is known about the sale of petcoke in Delhi or NCR. There is no data maintained by government of its sale or usage. EPCA also found

that in Ghaziabad, as there is no restriction on its usage, industrial units were directly importing pet coke. This can only be stopped if the consumption of pet coke is disallowed in NCR.

### **C. CBFS, C9 and other fuels**

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During this investigation, EPCA also learnt that there are other by-product fuels that are being sold by petro-chemical and refineries. Many of these fuels are also imported. There is even less information about these fuels. There are also no specifications for these fuels.

For instance, oil companies sell CBFS -- carbon black feed stock (also called C-10), which has even higher carbon content. CBFS is not included in the category of hazardous waste in the Hazardous Waste Rules, 2008. There are no national specifications for CBFS, but test reports shared by RIL with EPCA shows that CBFS sold by them has Sulphur of 1% -- 10,000 ppm. However, the key pollutant in CBFS is carbon, roughly 90 per cent and this is measured through an index called BMCI – the blacker the fuel, the better. Therefore, the key pollutant is both carbon (CO<sub>2</sub>) and also poly aromatic hydrocarbons – according to discussions in MoEF sub-committee this could be more than 50 per cent of the content.<sup>1</sup> PAH is highly toxic and carcinogenic. There is no information about the volumes of CBFS sold; imported and consumed in the country

C9 is a petrochemical by-product, which is sold by RIL. This is also used as fuel. But in spite of all efforts to contact RIL, EPCA was not provided any information about the sale or specifications of C9.

### **D. Regulations on fuel used in Delhi/NCR**

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In 1996, the Delhi Pollution Control Committee issued a notification (F.25 (258)/SC/LC/DPCC/95/651 under the Air Act to approve fuels that could be used in NCT of Delhi. These were;

1. Coal with low-sulphur (4000 ppm)
2. Fuel/LDO/LSHS/with low Sulphur (18,000 ppm)

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<sup>1</sup><http://www.moef.nic.in/sites/default/files/Uploaded%20Final%20minutes%20of%2034%20TRC%20note%20sheet%20.pdf>

3. Motor gasoline (specified by government)
4. Diesel (as specified by government)
5. LPG
6. CNG
7. Kerosene
8. Naptha (for power station)
9. Aviation turbine fuel (for aircraft)
10. Firewood (only for domestic use in rural areas and crematorium)
11. Biogas

This notification, which specifies acceptable fuels, does not include Furnace Oil (FO) for use in Delhi. It is feared that without this explicit restricted/banned list, its use may be happening in Delhi.

There is no such notification for NCR.

It is clear that this notification is out of date and needs to be amended. Current fuel used in NCR, which has such high levels of Sulphur cannot be allowed in this pollution hot spot.

The Air Act of 1980 allows (19.1) state government, after consultation with state board, to declare any area or areas within the state as air pollution control areas or areas for the purpose of this act. Under (19.3) if the state government, after consultation with the state board, is of the opinion that the use of any fuel, other than an approved fuel, in any pollution control area or part thereof, may cause or is likely to cause air pollution, it may, by notification prohibit the use of such fuel in such area with effect from such date (not less than 3 months from the date of publication). The act also provides that boards can restrict types of industries that can operate in such control areas.

The Air also allows Standards: (depending on local conditions, state/central board can prescribe more stringent standards than those prescribed)

For pet coke Gujarat Pollution Control Board (GPCB) has devised a system, which can be followed. It has set up a committee, under the chairmanship of the board with outside experts, which decides on the use of petcoke by industry. Based on this scrutiny, GPCB allows industry to use 10-25 per cent petcoke in its production and then monitors emissions. It also stipulates the pollution control equipment (which must consist of alkaline wet scrubber – 1 stage or 2 stage -- and lime dosing/FGD). It finds that when it asks for 2 stage operation of the scrubber, companies invariably find the fuel of petcoke not profitable. Pet coke, which is a waste by-product, can be used in cement industry where combustion and emissions are regulated. Therefore, even if its use is allowed, it must be restricted to cement-type industry and pollution control must be enforced.

### **E. Analysis of Sulphur content in FO and pet coke**

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EPCA collected samples of pet coke; Indian and imported and these were sent for analysis to the Shriram Institute for Industrial Research. Analysis of the two samples shows that the Sulphur level is even higher than that was originally expected based on industry sources.

1. Sample of Indian pet coke: 7.4% by mass or 74,000 ppm
2. Sample of Imported pet coke: 6.9% by mass or 69,000 ppm

The FO samples were analysed by the Society for Petroleum Laboratory and these were found to be in the range of 15,000 to 20,000 ppm.

### **F. Pollution potential of this fuel used**

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Sulphur content is a key determinant of the pollution emitted by vehicles or industry. In the case of vehicles, Sulphur content has been drastically reduced from 10,000 ppm (1%) in mid-1990s to 50 ppm today. The refineries are currently working to produce BS VI grade fuel, which will reduce Sulphur to 10 ppm or less. Only then will the particulate traps work, which will reduce emissions from diesel vehicles. Even with Sulphur levels of 50 ppm diesel vehicles emit high levels of NO<sub>x</sub> and particulates.

In industry or generator sets, fuel with high Sulphur will produce emissions. When high Sulphur fuel is used, it contributes to emissions of

particulates directly and to emissions of SO<sub>2</sub> gas. The high combustion temperatures also produce NO<sub>x</sub>. Depending on the level of moisture in the air, these gases get converted to particulates. These are called secondary particulates and according to the IIT report, some 20-25 per cent of the pollution in Delhi during winter months is because of secondary particulates.

India does not have standards for SO<sub>2</sub> and NO<sub>x</sub> emissions for specific industries. Even in the case of power plants, only in December 2015, new standards have been notified, which include SO<sub>2</sub> and NO<sub>x</sub>. But these have still not gone into operation.

The use of FO and pet coke, which has such high levels of Sulphur must be restricted in pollution hot spots. In 1996, when technology was still nascent and pollution levels were also lower, DPCC had mandated that only low-sulphur fuel should be used in Delhi. At that time, fuel available at 50,000 ppm of Sulphur and coal had 10,000 ppm of Sulphur. Low Sulphur fuel mandated for Delhi's use, therefore, was restricted to 18,000 ppm and low-sulphur coal was 4000 ppm.

Today, refineries produce fuel with 350-50 ppm of Sulphur. Delhi and NCR gets 50 ppm of Sulphur in diesel, which can be used for combustion. Therefore, it is critical to mandate the acceptable quality of fuel that can be used in NCR for pollution control.

### **G. Recommendations of EPCA**

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Based on the above analysis and the huge pollution caused by these high-Sulphur fuels, urgent steps are required to both list the acceptable fuels that can be used in NCR (not just Delhi) and also explicitly ban the use of FO, pet coke and other non-standard fuels.

The fuels that should be allowed for use in NCR as per section 19 of the Air Act are as follows:

1. The list of 'acceptable fuels' that can be used in NCR (not just Delhi) as per section 19 of the Air Act should be as follows:

- a) Coal with low-Sulphur (1000 ppm or less) for use in power plants (until these can be switched to natural gas)
  - b) Petrol (BS IV with 50 ppm Sulphur)
  - c) Diesel (BS IV with 50 ppm Sulphur)
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  - j) Biogas
2. The use of furnace oil and pet coke would be strictly banned in NCR. Pet coke will be allowed only in cement plants, where combustion and emissions are controlled. However, if any cement plant requires the use of pet coke in NCR, it will have to seek permission from CPCB and EPCA.
  3. All other fuels, which do not have specifications laid down by BIS would be banned. Any new fuel to be added to the list of acceptable fuels will be done only after consideration of its parameters as laid down by BIS and its fuel test reports by CPCB and EPCA.
  4. Government should finalise specifications for fuels used for industries/generators urgently so as to make sure that only low-sulphur and clean fuels are available for use in the country.
  5. The use of pet coke should be regulated across the country. All industrial fuels should be included in the list of hazardous waste so that import and use is regulated by the Ministry of Environment and Forests and Climate Change.
  6. The NCR governments should be directed to provide fiscal incentives to clean fuel as against polluting fuel.
  7. The GoI should revise its fiscal policies, which incentivize polluting fuels over cleaner fuels.