



GOVERNMENT OF NATIONAL CAPITAL TERRITORY DELHI

DIRECTORATE OF EDUCATION : SCHOOL BRANCH

OLD SECRETARIAT : DELHI-110054

No. DE.23 (619) / Sch.Br./2017/2056

Dated: 19.9.17

CIRCULAR

**Sub:- Anti Fire Crackers Campaign.**

Attention is invited to proceedings in Hon'ble Supreme Court of India in Writ Petition (Civil) No. 728/2015 regarding publication of information with regard to environmental health effects-hazardous and toxic nature of ingredients used in fire crackers and circulating this information to school children. Therefore, all Heads of Un-Aided Recognized Schools are advised to initiate awareness programmes to run **Anti Fire Crackers Campaign** on the theme '**Say No to Fire Crackers**' to sensitize students and staff members, about the ill-effects of burning firecrackers, between the festival of Dusshera and Diwali.


Eco-club of the school must take proactive role and responsibility in spreading the mass awareness through the students and parents to increase outreach in society to keep Delhi pollution free during this period.

Essay Writing/Debate/Poem Recitation/Slogan Writing competitions may be organised on the following topics:

- Ways to celebrate Diwali.
- Eco-friendly and pollution free Diwali.
- Say no to firecrackers and yes to greenery/health.
- Plant a tree, not burst the crackers.
- Clean Diwali Green Diwali.
- Diwali for humanity and environment.
- Novel ways to celebrate Diwali.
- Any other related topic.

Also, please find enclosed a letter from Deptt. Of Environment, Govt. of NCT Delhi along with the information regarding known health impacts from bursting firecrackers caused due to their chemical composition (Annexure VII).

This issues with prior approval of the Competent Authority.

  
19/9/17

DDE (Schools)

Encl: As above.

DE.23 (619) / Sch.Br./2017/2056

Dated: 19.9.17

**All Heads of Un-Aided Recognized Schools under Directorate of Education through DEL-E.**

Copy to:-

1. PS to Secretary (Education).
2. PS to Director (Education).
3. All RDEs, DDEs (District/Zone), DDE (PSB) for ensuring compliance.
4. Programmer (MIS) for uploading on MIS.
5. Guard File.

  
19/9/17

DEO (Schools)

68/c

Department of Environment, Govt. of NCT of Delhi,  
6<sup>th</sup> Level, C-Wing, Delhi Secretariat, IP Estate, New Delhi-110002  
www.environment.delhigovt.nic.in  
Telephone-23392028 Fax no: 23392029

No. F.9/EC/Env/2017-18/4364-4366

Dated. 25/8/17

To.

The Secretary  
Directorate of Education, Govt. of NCT of Delhi  
Old Secretariat, Delhi-110054

Sub: **Circulating of information on firecrackers for generating 'Public Awareness for firecrackers' as per the deliberations under the Writ Petition (Civil) No. 728/2015 regarding Chemical Composition of FIRECRACKERS in the Hon'ble Supreme Court - reg.**

Madam,

With respect to the above mentioned subject, Central Pollution Control Board (CPCB) has sent an information regarding health hazards of firecrackers (copy enclosed) for circulating the same to generate public awareness. It is, therefore, requested the same may be circulated to all schools and colleges (all Govt., Private, NDMC, MCDs, KVs and Delhi Cantonment Schools).

ADD DE/Secy  
15/54/DE  
28/8/17

Yours faithfully,

25/8/17  
Copy to:-

(S.M. Ali)  
Special Secretary (Env.)

- 1. The Director, Department of Education, Govt. of NCT of Delhi, Old Secretariat, Delhi-110054.
- 2. Member Secretary, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi-110032.

2002/ADD/DE/Secy  
28/8/17  
1929/008/Secy  
30/8/17  
MBP in Relevant files  
Rettasw

### Known Health Impacts From Bursting Firecrackers Caused Due To Their Chemical Composition

#### 1. Ingredients used in FOUR commonly used sound producing fire crackers

The Hon'ble Supreme Court of India has banned the bursting of fire-crackers or any noise generating fireworks of high decibels to control the noise pollution. The Petroleum and Explosive Safety Organisation (PESO) (formerly Dept. of Explosives - DOE) has identified FOUR commonly used sound producing fire crackers namely:

- a. Atom Bomb
- b. Chinese Crackers ( no related to any country )
- c. Maroons
- d. Garland crackers

The focus has been on the following four ingredients - aluminium powder, sulphur,  $KNO_3$  &  $BaNO_3$ .

**Table 1: Usage of ingredients in FOUR common firecrackers**

Ingredients	Major uses
Potassium nitrate (Oxidizers)	Oxidizer used as component of black powder. It is usually employed in safety fuses and lift charges
Barium nitrate (Oxidizers)	It can be used as oxidizer and green color agent in flames, smoke, and flash mixtures. It can produce white or silver effect with aluminium
Aluminium (Fuel)	It is the most widely used fuel. It produces brilliant flames and white sparks
Sulfur (Fuel)	Used in white and colored smoke composition, flash and sound blends. It is a component of black powder. It could also be used as oxidizer in some mixtures

#### 2. Chemical composition adds sparkle , colour & sound to firecrackers

Light and Colour are important aspects of fireworks which depend on two basic physico-chemical properties:

- a) Incandescence: Huge amount of heat is required to generate colour which needs instantly sets of chemical reactions within the ingredient mixture of the firecrackers. For example change of colours from red, orange, yellow, and white light as the mixture gets increasingly hot.
- b) Luminescence: This feature also needs energy

**Table 2: Colour producing compounds used in firecrackers**

Metal & Its Compounds	Colour
Strontium Salts & Lithium Salts ( $Li_2CO_3$ , $SrCO_3$ )	Red
Calcium Salts ( $CaCl_2$ , $CaSO_4 \cdot 2H_2O$ )	Orange
Incandescence of Iron or Charcoal	Gold
Sodium Compounds ( $NaNO_3$ , $Na_3AlF_6$ )	Yellow
White Hot Metal ( $BaO$ )	Electric White
Barium compounds with Chlorine ( $BaCl_+$ )	Green

Copper Compounds and Chlorine, $Cu_3As_2O_3Cu(C_2H_3O_2)_2$	Blue
Mixture of Strontium (red) and Copper (blue) compounds	Purple
Burning aluminium, titanium or magnesium powder	Silver

**3. Chemistry of fireworks**

Charcoal is the most commonly used fuel in the industry. The chemistry of fireworks is based on combustive features of the ingredients used and the lighting effects that are generated.

Based on literature survey the following are the key ingredients that go into making fireworks:

- i. Fuel: Charcoal i.e. black powder is the most common fuel used in fireworks.
- ii. Oxidizing Agents: The function of the oxidizing agent is to produce the oxygen needed in order to burn the mixture within the fireworks. It can be nitrates, chlorates or per-chlorates etc.
- iii. Reducing Agents: It needs to burn oxygen provided by the oxidizing agents. Common reducing agents are Sulphur and Charcoal and these react with oxygen to form sulphur dioxide and carbon dioxide respectively
- iv. Regulators: Metals (like aluminium, titanium, copper, strontium, barium etc.) can be added to regulate the speed of the reaction and colouring agents.
- v. Binders: Binders are used to hold the mixture of the firework together in a paste like mixture. The most commonly used binder is known as dextrin, a type of starch. Paron can also be used in binding, however it is less common and only used in conjunction with red and green fireworks as it helps to enhance their colour. The binders do not actually begin to work until the firework has been lit and are potentially dangerous.
- vi. Colouring Agents: Different chemicals are used to produce coloured fireworks.

**Table 3 : Summary of chemicals used causing sparkling effects in firecrackers**

Chemical Compounds	Purpose usage	Chemical Compounds	Purpose usage
Lead Dioxide / Nitrate / chloride	oxidizer	Aluminium	Brilliant whites
Lithium compounds	blazing reds	Potassium Nitrate	In black powder
Mercury (Mercurous chloride)	chlorine donor	Ammonium & Potassium	propellant / oxidizer
Barium Nitrate	glittering greens	Copper compounds	blues
Arsenic compounds	Used as colorants	Antimony sulfide	glitter effects

**4. Non – stoichiometric ingredients in firecrackers impact health**

The lighting effects and noise levels depend on the chemistry of fireworks and the combustive features of the ingredients, the major concern being inappropriate stoichiometric amounts of the ingredients in making common firecrackers. Firecrackers are made of chemicals/metallic agents some of which are toxic when they are burst. The major constituents of smog that forms from firecracker emissions contain SO<sub>x</sub>, NO<sub>x</sub> and significant dust load or particulate matter that may contain the any of the following

heavy metals ex. Pb, Hg, Sr, Li, Al etc. Table below provides an overview of immediate/long term effects of commonly used ingredients used in making firecrackers.

**Table 4 : Environmental health Effects - Hazardous & toxic nature of ingredients used in firecrackers**

Compound	Environmental health Effects
Aluminium	Contact dermatitis, bioaccumulation
Sulfur Dioxide	Acid rain from sulphuric acid affects water sources, vegetation & causes property damage.
Potassium Nitrate	Toxic dusts, carcinogenic sulfur-coal compounds
Perchlorate - Ammonium & Potassium	Can contaminate ground & surface waters, can cause thyroid problems in humans & animals
Barium Nitrate	Poisonous. Fumes can irritate respiratory tract. Possible radioactive fallout.
Copper compounds	Polychlorinated dioxins and di-benzofurans. Can bio-accumulate. Cancer risk.
Antimony sulfide	Toxic smoke, possible carcinogen
Lead Dioxide / Nitrate/Chloride	Bio-accumulation, developmental danger for kids & unborn babies, may remain airborne for days, poisonous to plants & animals
Lithium compounds	Toxic and irritating fumes when burned
Mercury (Mercurous chloride)	Toxic heavy metal. Can bio-accumulate.
Nitric oxide	Toxic by inhalation. Is a free radical
Nitrogen dioxide	Highly toxic by inhalation.
Ozone	Greenhouse gas that attacks & irritates lungs
Arsenic compounds	Toxic ash can cause lung cancer, skin irritation and wart formation.
Strontium compounds	Can replace calcium in body. Strontium chloride is slightly toxic.

**References:**

1. C. Martín-Alberca, C. García-Ruiz/ Trends in Analytical Chemistry 56 (2014) 27-36 ; Analytical techniques for the analysis of consumer fireworks, (Elsevier : [https://www.researchgate.net/publication/260030498\\_Analytical\\_techniques\\_for\\_the\\_analysis\\_of\\_consumer\\_fireworks](https://www.researchgate.net/publication/260030498_Analytical_techniques_for_the_analysis_of_consumer_fireworks))
2. [http://www.backcountryattitude.com/toxic\\_fireworks.html](http://www.backcountryattitude.com/toxic_fireworks.html))

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