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Aerosol Propellant



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India's commitment towards
Aerosol Sector

An Indian Scene - Eco Mark Criteria
for Aerosol Propellants

The Environmental Information System acronymed as ENVIS was implemented by the Ministry of Environment & Forests by end of 6th Five Year Plan as a Plan Scheme for environmental information collection, collation, storage, retrieval and dissemination to policy planners, decision makers, scientists and environmentalists, researchers, academicians and other stakeholders.

The Ministry of Environment and Forests has identified Consumer Education and Research Centre (CERC), Ahmedabad, as one of the centers to collect and disseminate information on "Eco-labelling and Promotion of Eco-friendly Products". The main objective of this ENVIS Centre is to disseminate information on Eco products, International, and National Eco labeling programs.

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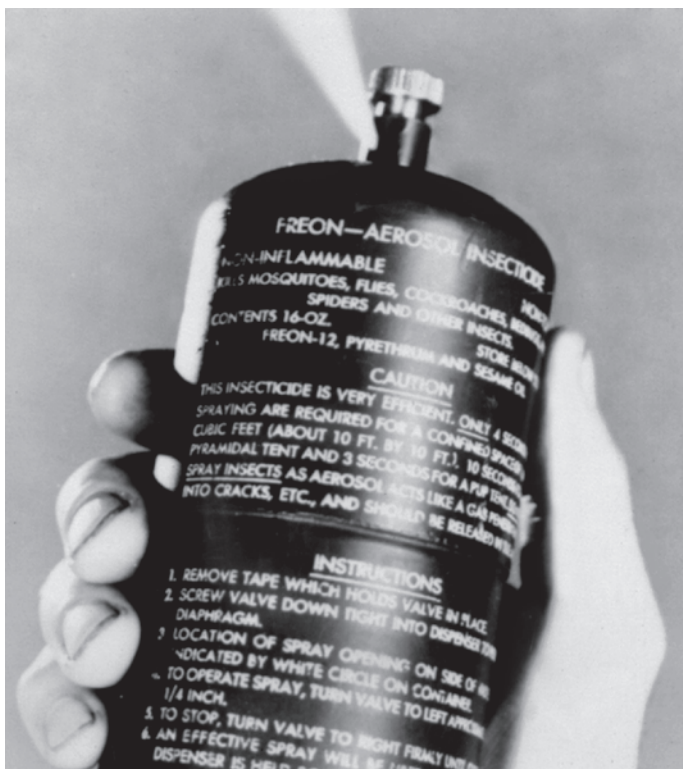
Aerosol Propellant

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Foreword

European thinkers took notice of the mists and vapour that clouded the earth during 18th century. They have started to work on how liquid turned to gas and back again. In nature these transformation include fog, dew, and even clouds. Those are now called “atmospheric aerosols.” The aerosol technology has evolved to what we use today since 18th century. During 18th century French Confectioners had created the self-pressurised carbonated beverages. They had figured out how to get the bubbles into a soda pop bottle. During late 18th century Helbling & Pertsch developed a method of pressurized aerosol delivery using gases as propellants. A Norwegian man named Erik Rotheim in 1927 patented an aerosol devised for dispensing different products and fluids using the chemical propellant system.



Under the Kyoto Protocol- the United Nations Framework Convention on Climate Change (UNFCCC) the industrialised countries are required to set up and maintain a national system to monitor its greenhouse gas emissions. As part of the Kyoto Protocol, many developed countries have agreed to legally binding limitations/reductions in their

emissions of greenhouse gases in two commitments periods. The first commitment period applies to emissions between 2008-2012, and the second commitment period from 1 January 2013 to 31 December 2020. Developing countries do not have binding targets under the Kyoto Protocol, but are still committed under the treaty to reduce their emissions. Under the Protocol, emissions of developing countries are allowed to grow in accordance with their development needs.

Due to ban in the emission of greenhouse gases, the aerosol industry had started to find new chemicals to use as propellants, replacing the dangerous Chlorofluorocarbons (CFCs). The CFCs, the chemical propellant used in aerosol products that deplete the Ozone layer and have a strong global warming potential. US Environmental Protection Agency in 1978 banned the use of CFCs in consumer aerosol products with a couple of exceptions like medical inhalers.

Since 2000 the sale of aerosols containing CFCs has been banned in the UK. Many other countries have ceased the use of CFCs in their technology. Under Montreal Protocol of 1987 agreement 24 countries agreed to stop using known Ozone Depleting Chemicals (ODCs). In India, the consumption of CFCs in this sector has already been completely phased out except use in manufacturing of metered dose inhalers (MDIs) for Asthma and chronic obstructive pulmonary disease (COPD) patients. Now aerosol technology is completely CFC free and eco friendly.

Now the consumer products with sustainable packaging in market with aerosol technology will reduce ecological footprint. Demand for eco-friendly products will increase in the future if consumers understand the importance of sustainability. Now consumers have eco-conscious options, so next time you use any spray – personal care products, paints, pesticides, and many more-remember that the aerosol technology you are using is safe for the ozone, safe for you, and fully recyclable.



Aerosol Propellant

Aerosol propellant is defined "as compressed gas or vapour in a container which, upon release of pressure and expansion through a valve, carries another substance from the container, known as aerosol; used for cosmetics, household cleaners, and so on; examples are butanes, propane, nitrogen, fluorocarbons, and carbon dioxide" - McGraw-Hill Science & Technology Dictionary

US Environment Protection Agency has defined –

Aerosols are substances stored under pressure and then released as a suspension of particles in air, and

Propellants propel out the pressurised contents of a container.

Categories of Aerosol Propellants

Compressed Gases which are used as propellants are nitrogen and carbon dioxide. These gases are inert and are used to dispense the aerosol as a solid stream, wet spray, or foam. The gas is compressed in the can, and it is the expansion of the compressed gas that gives the thrust or the force required to push out the contents from the can. These Aerosol propellants occupy the head space above the liquid in the can and when the valve is opened the gas pushes the liquid out of the can. This system has been used to dispense food and non food products, to dispense the product in its original form as a semi solid. These are used in the products like dental creams, hair preparations, ointments, and aqueous antiseptic and germicidal aerosols and are useful in contact lens cleaner saline solution and barrier systems.



The **Liquefied Gases** used as propellants are very effective in dispersing the active ingredients in to a fine mist or foam; depending on the form it is required. These are relatively inert and non toxic and

have the advantage that the pressure within the can remains constant. The chlorofluorocarbons (CFCs), hydro fluorocarbons (HFCs), and hydrocarbons (HCs) are used. The chlorofluorocarbons (CFCs) and hydro fluorocarbons (HFCs) are nonflammable as compared to hydrocarbons which are flammable. The hydrocarbons are advantageous since they are less expensive and are environment friendly e.g. propane or butanes. The US Environmental Protection Agency has banned chlorofluorocarbons (CFCs) in American-made aerosols, but has allowed for a few uses. These are health and pharmaceutical products that represent less than 1% of the US aerosol market. Even these uses are also in process of phase out as formulations with non-CFC propellants and are approved as appropriate substitute.



Components of the Aerosol

Although 'aerosol' refers to a finished product, it is made up of four components: the container, the valve, the actuator, and the cap.

The **container** is usually made of tinned steel or aluminium. It stores the product to be sprayed under optimal conditions. Containers are of different shapes and sizes depending on the characteristics of products and the gas used.

The **valve** keeps the container airtight and regulates the flow of the product during use.

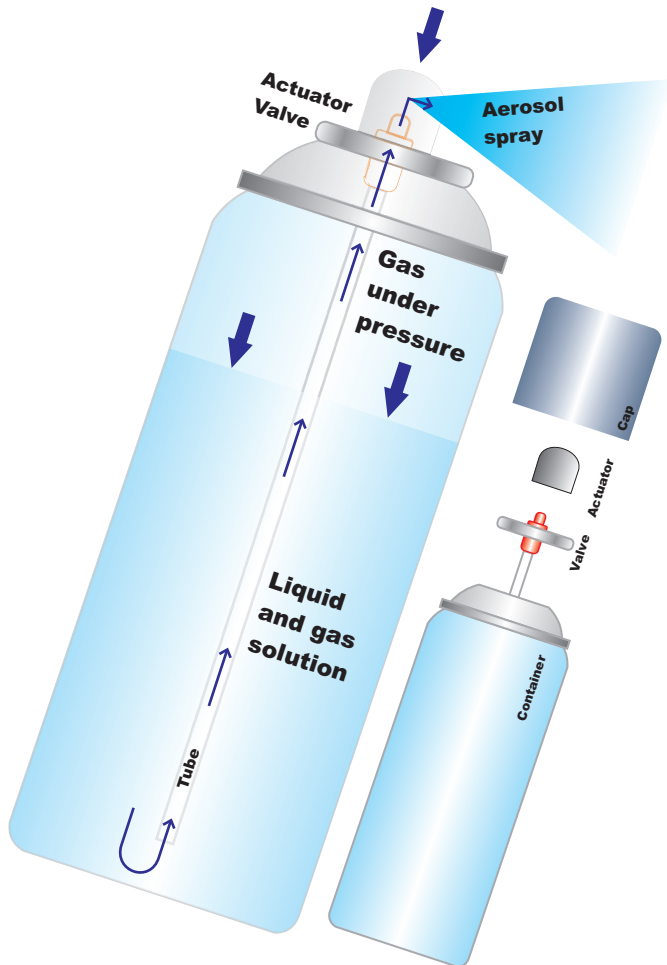
The **actuator** or button controls the angle, amount, shape and the fineness of the product spray. The type of content and the aerosol's use are key factors in the selection of the actuator.

The **cap** acts as a seal and keeps the aerosol under optimal conditions. Some act as an actuator for certain products.



How the Aerosol works

Aerosols work on a basic principle of physics: a gas under adequate pressure turns into a liquid, and when that pressure is relieved will expand and turn back into a gas. That process is called vaporisation. Products are packaged in aerosol containers and the particular product is dissolved or suspended in liquid solvent. A liquefied gas generally works as



Curtsey (<http://www.aerosol.org/about-aerosols/aerosol-s-functioning>)

(Graphic reproduction)

propellant and the propellant in its liquid state is very often part of the solvent system. In a typical aerosol some of the propellant remains as a gas under pressure above the liquid mixture. This gas pushes down on the liquid forcing the liquid up through the dip tube and the valve when opened. The liquid that comes out is a mixture of product concentrate with liquefied gas.

When the mixture is used up gas evaporates from the liquefied gas propellant to give regular pressure inside the container. The valve gets open when there is pressure on the button of an aerosol container. The product mixture is pushed out of the container because the pressure inside the container is more than the pressure outside. When the mixture leaves the can, the liquid propellant turns into a gas and helps to break the spray into droplets giving a finer spray – the aerosol. In foam or mousse, the liquefied gas forms bubbles to make the product 'grow' once it is outside the container. The liquid propellant is also a quick drying solvent. The actual amount of propellant found in an aerosol container varies depending on the product; a higher percentage for fine sprays, low for foam or mousse.

Source: <http://www.aerosol.org>

<http://www.yorks.karoo.net/aerosol/link4.htm>

<http://www.diversifiedcpc.com/PDF/intro.pdf>

<http://www.aerosolproducts.org>

Remington: The Science and Practice of Pharmacy edited by David Troy, Paul Beringer

http://www.bama.co.uk/pdf/Aerosols_Explained/01%20Aerosols%20Explained%20-%20How%20Aerosols%20Work.pdf

<http://www.aerosol.org/about-aerosols/aerosol-s-functioning>



India's commitment towards Aerosol Industry

The Government of India and the United Nations Development Programme (UNDP) have signed a five year development cooperation framework to

support the implementation of the Government's 12th Five-Year Plan. The Country Programme Action Plan (CPAP - 2013-2017) is based on the Country Programme Document (2013-2017) approved by the UNDP Executive Board in September 2012. The Permanent Mission of India to the United Nations at the annual session of the Executive Board stated: **'the Government of India and UNDP Country Programme will contribute to informing policies and practices advancing a stronger inclusive growth driven path and contributing to the poverty alleviation efforts of the government.'**



United Nations Framework Convention on Climate Change (UNFCCC) are met.

Aerosol Sector

Aerosols are widely used in several applications involving propellants including perfumes, shaving foams, insecticides, pharmaceuticals, paints and inhalers. Twenty three projects were supported covering 44 enterprises to phase out CFC-11 and CFC-12 in this sector.

Industry Status: The total production of aerosol containers in 1991 was estimated to be 45 million, of which over 90% used CFCs (chlorofluorocarbons) as propellants. About 200 aerosol manufacturers were identified, concentrated mainly in the western and northern parts of India.

All enterprises were in the private-sector. Significant majorities of these enterprises (about 70%) were SMEs (small and medium enterprises), many of which were in the informal sector, principally manufacturing personal care products such as perfume and deodorant sprays.



UNDP's objective in the Sustainable Development area is to expand access to clean energy and help build the capacity of communities to manage natural resources and withstand climate change and disasters. To reduce the impact of climate change, UNDP as lead agency appointed by Ministry of Environment and Forests (MoEF) will be responsible for coordination, strategy preparation, and implementation of phasing out of hydrochlorofluorocarbons (HCFCs) in the aerosol, firefighting, foam refrigeration, air-conditioning and solvent sectors in close cooperation with the Ozone Cell in MoEF. To execute the phase out schedule of the Montreal Protocol on Substance that Deplete the Ozone Layer, UNDP will work with government to make sure the national commitments under the

ODS (Ozone Depleting Substances)

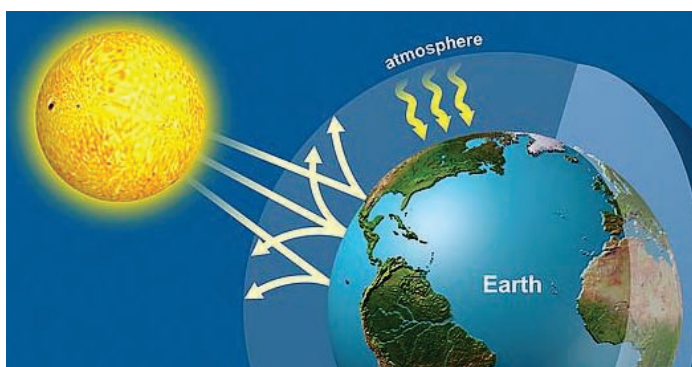
Consumption in Aerosol Sector: In 1991, the Aerosol sector consumed 1,100 MT of CFCs (about 40% CFC-11 and 60% CFC-12), which amounted to about 22% of India's total CFC consumption at that time. It was estimated that the demand for aerosol products would grow at 20% annually until 2000, 18% annually until 2005 and 15 % annually until 2010. These estimates were based on considerations such as emerging customer base for personal care products, entry of multinational corporations in India leading to expansion of the manufacturing base in this sector, reduction in taxes on cosmetics, etc.

Technology: Hydrocarbon-based aerosol propellants were identified in most of the aerosol sub-sectors as the preferred substitute technology for phasing out CFCs, specifically, butane, de-stenched liquefied petroleum gas (LPG), etc.



The SMEs predominantly used locally developed manual propellant filling machines, which, were suitable for CFC propellants, but considered unsafe and unsuitable for hydrocarbon-based substitute propellants. Moreover, many of the SMEs had manufacturing facilities in locations which could be considered unsafe for handling hydrocarbon-based propellants. Thus, safety measures for handling hydrocarbons including safety training and audits were identified as important inputs in addition to investments needed for conversions.

The consumption of CFCs in this sector has already been completely phased out except use in manufacturing of MDIs (metered-dose inhalers) for asthma and COPD (chronic obstructive pulmonary disease) patients.



Roadmap for Phase-Out of HCFCs in Aerosol Industries in India

The phase-out schedule for Hydrochlorofluorocarbons (HCFCs) was accelerated through a decision of the Meeting of the Parties to the Montreal Protocol in September 2007. HCFCs are potent Green House Gases (GHGs) and also ozone depleting substances. The MoEF established Ozone Cell within the Ministry, dedicated to managing and coordinating the implementation of the Montreal Protocol in India.

The Government of India had formulated draft Ozone Depleting Substances (Regulation and Control) Rules under the Environment (Protection)

Act, 1986. It has come in to effect from January 2000. The provisions of this comprehensive legislation are made for ODS production and consumption; trade and its measures and fiscal measures.

India with the assistance of UNDP, Tata Energy Research Institute (TERI) and representatives of various Ministries, industries, and scientific institutions identified long-term management of HCFCs by replacing with sustainable environment-friendly alternatives.

The formulation of the comprehensive road map for management of HCFC phase-out in India began in 2008. UNDP in association with other implementing agencies under the guidance of the Ozone Cell, MoEF had taken the task for 10% reduction of baseline in 2015, 35% in 2020, 67.5% in 2025, and 100% phase out in 2030. An annual average of 2.5% during the period 2030-2040 for servicing will be allowed. For replacing HCFC-141b use in non-medical aerosols, HFCs (134a, 152a, 227ea) as well as Hydrocarbon Aerosol Propellants (HAPs) (where flammability is not a concern) are the commercially available alternative propellant technologies.

Source: <http://www.ozonecell.com/viewsection.jsp?lang=0&id=0,166,229>
http://www.undp.org/content/dam/india/docs/undp_country_programme_for_india_2013-2017.pdf
<http://moef.nic.in/downloads/public-information/Final%20Book%20Roadmap.pdf>
<http://www.docstoc.com/docs/123395295/ROAD-MAP-FOR-PHASING-OUT-OF-HCFCs-IN-INDIA>



An Indian Scene - Eco Mark Criteria for Aerosol Propellants

General Requirements:

Propellants used in aerosol products shall meet the relevant Standards of BIS (Bureau of Indian Standards) pertaining to safety, quality and performance. The manufacturer must produce the consent clearance as per the provisions of water (Prevention and Control of Pollution) Act 1974 and Air (Prevention and Control of Pollution) Act 1981 along with the authorisation, under Environment (Protection) Act 1986 and the rules made there under to BIS while applying for Eco Mark.

The product package shall be suitably marked that the Eco Mark label is applicable only to the propellants used in Aerosol sprays, if the product package is not separately covered under the Eco Mark Scheme.

Product package or leaflet accompanying it may display instructions of proper use, storage and disposal so as to maximise the product performance, safety and minimise wastage. The material used for product packaging shall be made from recyclable or biodegradable material

Product Specific Requirements:

The aerosol propellants shall not contain any Ozone Depleting Substances (ODS) relevant to Aerosol industry as identified under Montreal Protocol (Annexure A)



NOTE: Use of mechanical devices for generation of aerosols shall be encouraged for Eco Mark. List of Controlled Substances (CDS) as identified under Montreal Protocol**

Annexure A Controlled Substances

Group	Substance	Ozone Depleting Potential*
Group I		
CFC1 3	(CFC-11)	1.0
CF 2 CL 2	(CFC-12)	1.0
C 2 F 3 Cl 3	(CFC-113)	0.8
C 2 F 4	Cl 2 (CFC-114)	1.0
C 2 F 5	Cl (CFC-115)	0.6
CF 2 BrCl	(halon-1211)	3.0
CF 4 Br	(halon-1301)	10.0
C 2 F 4 Br 2	(halon-2402)	6.0

* These ozone depleting potentials are estimates based on existing knowledge and will be reviewed and revised periodically.

** Source: Handbook for the Montreal Protocol on Substances that deplete the Ozone layer', Ozone Secretariat, UNEP, August 1993.



Annexure B Controlled Substances

Group	Substance	Ozone Depleting Potential*
Group I		1.0
CF 3 Cl	(CFC-13)	1.0
C 2 FCl 5	(CFC-111)	1.0
C 2 F 2 Cl 4	(CFC-112)	1.0
C 3 FCl 7	(CFC-211)	1.0
C 3 F 2 Cl 6	(CFC-212)	1.0
C 3 F 3 Cl 5	(CFC-213)	1.0
C 3 F 4 Cl 4	(CFC-214)	1.0
C 3 F 5 Cl 3	(CFC-215)	1.0
C 3 F 6 Cl 2	(CFC-216)	1.0
C 3 F 7 Cl	(CFC-217)	1.0
Group II		
CCL 4	carbon tetrachloride	
C 2 H 3 Cl 3 *	1,1,1-trichloroethane	
	(methyl chloroform)	

* This formula does not refer to 1, 1, 2 trichloroethane.

Propellants used in aerosol products shall meet the relevant Standards of BIS. These are:

IS 14642 Part 2: 1999, MED--**Compressed air for general use Part 2-Test methods for aerosol oil content**

IS 12868: 1989, CHD—**Glass Aerosol Container**

IS 9209: 1979 MTD **Methods of tests for the compatibility of aerosol products with the metal aerosol dispensers**

IS 8469: 1977 MTD-- **Methods of tests for flammability of aerosol products**

IS 9635: 1980 MTD-- **Methods for sampling of aerosol valves**

IS 8449: 1999, MTD -- **Non-returnable metal aerosol dispensers**

IS 8593 Part 3 PGD-- **Recommendations centralized lubrication as applied to plant and machinery Part 3 Aerosol Lubrication**

IS 9634: 1980, MTD—**Methods for sampling of aerosol valves**

Source: <http://cpcb.nic.in/EnvironmentalPlanning/Eco-label/Aerosol.pdf>
BIS Catalogue 2010



Environmentally friendly low cost foaming technology from UK based Cambridge Consultants

New foaming technology developed by UK based Cambridge Consultants is set to banish potentially unsafe emissions from aerosols of everyday items like shaving foam and hair mousse. It provides a low-cost alternative to volatile organic compounds (VOCs) – significantly contributing to greenhouse gases.



VOCs are organic chemical compounds - propane and/or butane. It is under pressure remain in liquefied state inside an aerosol can along with a foaming agent. The mixture is expelled as a vapour through the nozzle when the valve is opened. The expanding gas puffs the foaming agent up to froth.

The new foaming technology devised by Cambridge Consultants does not require dissolved or liquefied gases such as VOCs or even carbon dioxide or nitrous oxide – the foam is formed simply with compressed air or nitrogen. The bubbles produced are a fraction of the size of a grain of sand – with a diameter of less than 40 microns – giving a very creamy texture. Yet the cost is lower than traditional products – and they can still be manufactured on a standard aerosol production line.

VOCs – used for non-food aerosol applications ranging from hair mousse to sunscreen – contribute to the creation of ground-level ozone, which has been linked to respiratory problems. In California, the Environmental Protection Agency has already placed limits on the amount of VOCs that can be included in aerosol products such as deodorants and antiperspirants. Europe has limited the levels of VOCs in paint products – with similar legislation imminent for deodorants and antiperspirants.

Mark Nicmanis, senior technologist at Cambridge Consultants has given emphasis that this new technology provides an environmentally-friendly alternative that will enable companies to get ahead of the impending legislation and gain first-mover advantage. He says, "It doesn't require VOCs or flammable propellants – which allow the use of low-cost, attractively-shaped PET bottles without presenting a fire hazard for warehouses. PET bottles typically cost half as much to produce as aluminium cans. And on top of the environmental benefits of doing away with VOCs, PET bottles can be recycled and have half the environmental impact of aluminium can"

The foaming technology could also be incorporated into an appliance – or into a disposable pod for use in conjunction with an appliance – to create milkshakes, ice cream or milk froth for coffee machines. It is equally applicable to dispensing systems for things such as soap or shaving foam that use a motion sensor to automatically dispense a rich creamy foam when a hand is detected under the appliance nozzle.

<http://www.cambridgesciencepark.co.uk/sectors/environmental/foam-breakthrough-to-shake-up-aerosols/>



Environmental Choice

Environmental Choice is the certified environmental label of New Zealand. The programme was launched in 1992. The programme is run independently but the label is endorsed and owned by the New Zealand government. The intent of this label is to assure consumers that a product has been proven to be environmentally better to the substitutes.

The objectives of the programme are:

- Improve the quality of the environment by encouraging more sustainable processes through the design, production, marketing, & use of products, which have a reduced environment impact during their entire life cycle.
 - Offer a credible national and/or regional (e.g. Australasian) programme for environmental labelling;
 - Work towards compliance with recognised international programmes and principles; Foster and develop international relationships with relevant recognised international networks and other ecolabelling programmes/initiatives;
 - Establish mutual recognition agreements with other similar programmes; Work towards the harmonisation of national and/or international product specifications;
- Provide a clear, credible and independent guide to help eco friendly consumers and businesses identify products and services that are less harmful to the environment;
 - Provide a market incentive to manufacturers, suppliers and retailers of environmentally preferable products and services;
 - Encourage manufacturers, suppliers and retailers to develop products and processes that are in compliance with published green product specifications;
 - Promote responsible procurement policies by central and local government, other organisations and business;
 - Establish and maintain strategic relationships with government, business and non government organisations which have common environmental and product performance interests

The eco label is allowed after the life cycle of product has been crossed through stringent norms and assessed by external, independent, and qualified assessors. The Environmental Choice planet-and-tick seal is recognised internationally. Global Ecolabelling Network (GEN) has recognized this label as absolutely trustworthy proof of environmental preferability.

Source: <http://www.environmentalchoice.org.nz/>

Write to us

We value your views and suggestions. Please send us your feedback on this issue. We would also like to have your contribution on the information relevant to the Eco product and Eco labeling. Please mail: cerc-env@nic.in



**IT'S OK
TO SPRAY**

AEROSOLS ARE CFC FREE

RECYCLE WHEN EMPTY

In conjunction with the Aerosol Association of New Zealand, the Aerosol Association of Australia developed the 'It's OK to Spray' logo (a registered Trade Mark) which is used widely in promotional campaigns and on product. This slogan was adopted by the US and South African aerosol industries.

Source: <http://aerosol.com.au/>

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**ENVIRONMENTAL
INFORMATION SYSTEM**



Ministry of Environment and Forests
GOVERNMENT OF INDIA



जहाँ है हरियाली ।
वहाँ है खुशहाली ॥

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SINCE 1978