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INCIDENTS OF FALL OF ICE FROM SKY

1. *Incident in Village Fazilpur Badli (Haryana)*: On 20 January, 2018, a large block of ice crashed in Village Fazilpur Badli (Haryana) near Gurgaon, which hit the ground with a big thud. It had a white texture and was ice cold with a transparent surface. Some villagers quietly sneaked a few pieces and swiftly kept them in their refrigerators assuming them to be a priceless object from heaven. Then they were informed not to keep such materiel in their fridge, as they could be from aircraft toilets.

Then a team from the India Meteorological Department and National Disaster Management Authority collected the ice samples for investigation, as the ice was suspected to be the 'blue ice', a term used for frozen toilet waste leaking from planes. Final results will be known on getting the test results.

Author of this paper examined the location (Approx. Coordinates 28°24′28.62″ N, 76°49′33.74″ E) and found it to be lying at a distance of 30 Kms on a bearing 237° (South west) from IGI Airport, Delhi, on the ATS (Air Traffic Services) Routes G452/W65/R462/A474 where planes arriving from West and South West approach for landing at IGI Airport.

This was not the only case. A number of cases have been reported from India and abroad, where reports of ice (or the 'Blue Ice') falling down from the commercial airliners have been reported. Author of this paper has collected more than 70 cases of fall of ice in India.

It is normally assumed that snowfall and fall of ice either in the form of hails or in the form of a lump of ice from the sky is a weather related phenomenon. However, some cases of fall of heavy lumps of ice (Coloured or white) from the sky were observed even when the weather may be dry. Thus it was seen that the origin of such ice was not the weather, but from the leaking toilet lines of a passenger aircraft flying high in sky.

2. *Some Prominent Cases of Ice Fall in India* : One notable Incident of fall of Blue Ice that had occurred near Mt. Abu (Distt Sirohi, Rajasthan) in early morning at around 0515 Hrs on 6th October, 2009, when a large lump of blue Ice (Deep blue colour) weighing about 25 kg fell from the sky in a farmhouse in Tokra village near Mount Abu (Approximate Geographical Coordinates 24^{0}40'25" N, 72°42′40″ E). The ice sample was examined in the laboratory by a team of professors from Government College, Sirohi, headed by Prof K. K. Sharma, which confirmed the ice from the lavatories of an aircraft.

And then there was an incident of fall of Green Ice from aircraft in Greater Noida Near Delhi on 19th February, 2011. Ice sample was later tested at Central Soil and Materials Research Station, New Delhi (Govt of India, Ministry of Water Resources), where it was concluded to be frozen bio-waste mixed with commonly used blue colored liquid disinfectant material.

3. *How it happens?* : If fact, the Toilet System of modern commercial airliners work on the principle of Vacuum suction, unlike the siphons of household toilets, which use water based flush system. Use of vacuum, requires very little water to clean the bowl.

Thus, when a vacuum toilet is flushed, the solid waste and a small amount of sanitizing liquid are sucked into the tank. The lavatory waste is then stored in a storage tank located inside the aircraft. After landing, the toilet cleaning vehicles are used to remove the waste from the storage tanks. This job is done by ground crew personnel who operate exterior lever outside the aircraft to empty the Waste storage tank.

The use of vacuum system in aircraft results into reduction of the weight of the aircraft on one hand and on the other, it also saves the water.

Many a times, a chemical (Sanitizing liquid), dark blue in colour is mixed with cleaning water inside the aircraft lavatory holding tanks to deodorize the waste and to break down any solids. Thus, in the event of any leakage from the drain pipes, the ground engineers are able to detect the leakage by observing the presence of blue colour on the exterior of the aircraft and thus would be able to repair it.

In case of any abnormality or defect, (Such as due to leakage or seepage from the toilet drain lines), small amount of lavatory fluid (With sanitizing liquid) comes outside and is condensed into ice due to low outside temperature. With time more and more ice keeps on accumulating over it and when the ice becomes too heavy it gets detached and falls on ground. (Normally it happens during descent when the aircraft encounters higher atmospheric temperatures on coming from higher altitude to lower altitude.). The colour of such ice is normally blue due to sanitizing liquid. However in certain cases it could be green, blackish, yellow, muddy or even grey, depending upon the type, amount and conditions of sanitizing liquid used.

According to the Federal Aviation Administration, USA modern commercial aircraft cruise at high altitudes and the sub-zero temperatures outside cause any liquid to freeze immediately. The resulting ice then breaks off the aircraft, gaining speed as it falls to the ground far below. Normally Most ice will break up on descent, however, in certain cases it may fall in pieces. It is also obvious that the colour of ice formed as a result of water from aircraft galleys may not be blue but may be white or other colour.

4. *Reports from Other Countries* : As per the report, in USA between 1979 and 2003, a total of 27 incidents of fall of aircraft lavatory ice were reported and investigated by FAA (Federal Aviation Administration, USA).

In fact, there is big list of cases of fall of ice from aircraft reported in a large number of countries I many languages.

5. *Ice from Aircraft is not a "Megacryometeors"* : It can be mentioned that sometimes the case of ice from aircraft is mistakenly reported as a megacryometeor.

A megacryometeor is in fact a very large chunk of ice which, despite sharing many textural, hydro-chemical and isotopic features detected in large hailstones, is formed under unusual atmospheric conditions which clearly differ from those of the cumulonimbus cloud scenario (*i.e.*, clear-sky conditions). Jesus Martinez-Frias, a planetary geologist at the Centre for Astrobiology in Madrid, pioneered research into megacryometeors in January 2000 after ice chunks weighing up to 3.0 kg rained on Spain out of cloudless skies for ten days.

Thus, this is a myth or a misnomer to consider any large piece of ice falling from sky as a "Megacryometeors". This is not true and there is major difference between a "Megacryometeor" (Which is phenomenon related to unusual Weather) and an ice from aircraft. (Which is unrelated to the weather)

With a view to differentiate between the aircraft ice and of Megacryometeor, a hydrochemical and isotopic analyses of the ice and liquid samples should be carried out If it is a "Megacryometeors", the sample would confirm the presence of pure water. On the other hand, the "Blue Ice from passenger aircraft" may contain traces of disinfectant liquid, urine, toilet residue, etc. and on melting the liquid could be thicker, sticky or gelatinous (viscous). The above could give a confirmatory evidence for the fallen ice being from an aircraft.

6. *Source of Blue Ice* : Such Ice Blocks having their origin in aircraft mostly fall from large and medium passenger airliners operating commercial flights (equipped with full-fledged passenger toilets) are involved in such incidents where there is some kind of leakage or seepage from the drain lines of aircraft toilets.

Normally such occurrence may take place while the airliner is descending, during landing, so that the outside atmospheric temperature starts rising from higher atmospheric region to lower region, when the ice starts melting and falls down.

The ice fall may also happen during cruise, when the ice lump becomes too heavy (Of the order of 50 to 100 kg or more) and then the Ice gets separated from the aircraft and ultimately falls on account of its own weight.

7. *Safety Suggestions* : Thus author is of the view that it definitely calls for some action from the airlines to strictly check the leakage or seepage from the toilet drain lines. Regulatory authorities of Aviation such as Director General of Civil Aviation (DGCA), International Civil Aviation Organisation (ICAO), CAA (UK), Federal Aviation Organisation (FAA), USA etc. may also perhaps think of viewing the cases of Ice Fall from aircraft with more seriousness & strictness.

In case any such abnormal case of fall of Ice comes to the notice of Meteorological or police, administrative authorities, author is of the view that they should immediately inform the nearest airport and to DGCA (Director General of Civil Aviation) giving the details of the observations including the time and type of fall, Kind of ice found. They should also take a note whether any aeroplane was seen flying near the site and whether the site lies on regular aeroplane path?

If any such case is sent to the Meteorological or other concerned authorities for testing of Ice samples, they should also try to get the testing done by keeping the aspect of aircraft toilet liquid also in mind.

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