Medical Problems Associated With Use of Air-Borne Mechanical Spraying System : A Preliminary Study

Sir.

Helicopter operations in sandy terrain cause kicking up of a dust-bowl due to down wash of rotors. This impairs visibility during landing and can lead to disorientation. Therefore, stabilisation of sand particles is considered useful for a safe landing in desert. It is achieved by chemical stabilisation of sand by aerial spray of sodium silicate solution. The equipment used for this purpose is Air-Borne Mechanical Spraying System (AMSS) that is mounted in the cargo compartment of a MI-8 helicopter. A helipad is made by the spray of 800 litres of this chemical from the helicopter hovering at the height of about 20 meters AGL. The spraying process lasts about 1.5 to 2 minutes.

The stabilising chemical is an aqueous solution of sodium silicate (Na₂ SiO₃) with specific gravity of 1.2. It is highly alkaline (pH 11.5-12) and is corrosive in nature¹. Its contact with eyes cause severe pain and irritation and ingestion of the chemical leads to nausea, vomiting and diarrhoea². The spraying system discharges the chemical at different velocities through a system of curved pipes. It is rotated by a motor and is required to be projected out from the floor of the cargo compartment. For this purpose, a triangular portion of the clamp-shell door is removed.

In terms of health hazard, it was reported that during the use of the equipment, the operators had uncomfortable feeling in form of headache, choking sensation, nausea and irritation of upper respiratory tract. This preliminary study was undertaken to assess the severity of medical problems associated with use of AMSS equipment by a questionnaire survey conducted on the operators.

A structured proforma was designed for carrying out the survey on 13 aircrew consisting of

pilots. FIVGnr and FIt/Eng of two helicopter squadrons. All of them had operated the equipment during the inflight trials of AMSS. All the subjects were in full flying medical category. Their age ranged within 30 to 39 years. Number of trial sorties flown by each of them varied from 1 to 10. The total number of trial sorties operated by them was 47. We also conducted a few inflight trials of the system to observe the actual process in operation and to look into the efficacy of the protective measures.

The questionnaire survey revealed that all subjects had experienced some symptoms of other during the operation and a few subjects continued to be symptomatic after the spraying operation (Table I).

Table I : Symptoms Reported by the Subjects Operating AMSS

Symptoms	No of subjects reporting During the Operation	g the symptoms Alter the Operation	
Irritation of eyes Dry Cough Headache Nausea Feeling of Suffoca	7 (54%) 5 (38%) 5 (38%) 4 (30%) tion 7 (54%)	Nil 3 (23%) Nil Nil	

Subjective opinion on the grade of symptoms and requirement of personal protective device is reflected in Table II. During the spraying operation, personal protection in form of flying goggles and wet cloth to cover the nose was reported to be tried out by 4 out of 13 subjects. The remaining 9 subjects did not use any form of self protection. Grade of symptoms varied from 'mild' to 'severe' in the whole group. The self protected group appeared not to have much of protection and reported to have experienced 'moderate' to 'severe' symptoms. All the subjects recommended use of some protective equipment to ameliorate the short term ill effects.

Table II: Grade of Symptoms Reported by Individual Subjects

Subject No	Grade of symptoms (0 - 3)	Self protective device used (wet cloth & goggles) Yes/No	Opinion regarding requirement of additional protective equipment Yes No
1.	2	Yes	Yes
2.	2	Yos	Yes
3,	3	Yes	Yes
4_	2	Yes	Yes
5.	1	No	Yes
6.	1	No	Yes
7.	2 2	No	Yes
8.	2	No	Yes
9.	2	No	Yes
10.	2	No	Yes
11.	3	No	Yes
12	2	No	Yes
13.	2	No	Yes

Grade of Symptoms

0 = No symptom, 2 = Moderate Symptoms 1 = Mild Symptoms
3 = Severe Symptoms

During inflight trials conducted for the purpose of this study, we observed that in order to lower the spraying nozzle from the floor of the helicopter, a triangular piece of the clamp-shell door is removed from the floor of the cargo compartment. The gap thus created along the sides of the spraying unit is partially covered with a piece of plywood. This leaves a gap of about 2" along the sides of the spraying unit. Hovering of the helicopter and high wind velocity leads to entry of vapours of sodium silicate inside the cargo compartment.

During the inflight trial, it was observed that the use of flying goggles provided adequate protection to the eyes. However, the method of covering the face with a piece of damp cloth was found unsatisfactory. Hence the use of an industrial face mask was considered. A mask procured from Defence Laboratory, Jodhpur was

tried during the trial sortie, but was not found suitable in view of the following:-

- (a) There was no provision for R/T communication.
- (b) The mask did not give adequate sealing over the face.
- (c) The expiratory valve was loose and did not provide air tight sealing.

In conclusion, we would like to report that the present mode of use of AMSS equipment leads to entry of fine droplets inside the cargo compartment of the helicopter possibly from the gap around the spraying system at the floor of the cabin, causing mild to severe discomfort in the operators. Proper sealing of the gap around the spraying system is required in order to restrict the entry of droplets inside the cargo compartment. We found that the use of flying goggles provided adequate protection to the eyes. For the protection of the upper respiratory tract, use of an industrial mask with appropriate sealing and a provision of R/T communication is suggested.

References

- Technical report on development of AMSS and associated chemical light sticks for use during SHBO. Defence Laboratory, Jodhpur, 1989.
- Hurly CR, Thorn Burn TH. Sodium Silicate Stabilisation of Soils. Highway Research Record 1972;381:46-79.

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