



# Oilleakage in aircraft: adverse effects for pilots?

L.J. de Graaf, intern neurology ([L.degraaf@mst.nl](mailto:L.degraaf@mst.nl))  
Dr. G. Hageman, Head of Solvent team Enschede, neurologist MST ([G.Hageman@mst.nl](mailto:G.Hageman@mst.nl))  
Drs. M. Mulder, aviation medical consultant ([muldermd@planet.nl](mailto:muldermd@planet.nl))  
Mw. Dr. M.S.E. van Hout, neuropsychologist MST ([m.vanhout@mst.nl](mailto:m.vanhout@mst.nl))

## BACKGROUND

Cabin air on commercial aircraft is supplied from the engines or auxiliary power unit. When there is an engine oil seal failure, lubricating oils can enter the combustion airstream from which ventilation air is bled of. These oils contain a large number of chemicals (for example, the organophosphate tricresyl phosphate (TCP)) which can cause neurotoxicity.

Flight crew often report symptoms including dizziness, disorientation, blurred vision and tingling in legs and arms.

There is an urgent need to increase awareness of this problem among medical practitioners in order to improve the recognition, diagnosis and development of treatment protocols for individuals with neurologic complaints following these events.

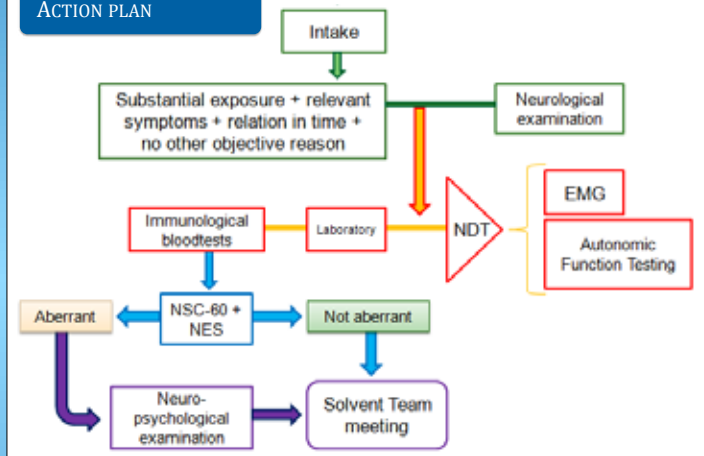
## AIM OF THE STUDY

The general aim of the assessment was to investigate whether there was evidence of cognitive impairment among the subjects and to determine the role of the applied diagnostic procedures. All subjects underwent a clinical interview, neuropsychological and neurophysiological tests and serumanalyses to search for evidence of physical or psychological impairment as a result of possible exposure to toxic fumes.

## SUBJECTS

Demographics			
	N (%)	Function	N (%)
<b>Sex</b>			
- Male	9 (82%)	- Pilot	8 (73%)
- Female	2 (18%)	- Cabin crew	3 (27%)
<b>Age</b>		<b>Airline</b>	
- 30-40 years	4 (36%)	- KLM	5 (45%)
- 40-50 years	4 (36%)	- Lufthansa	1 (9%)
- 50-55 years	1 (9%)	- Martinair	3 (27%)
- 56+ years	2 (18%)	- Transavia	2 (18%)
<b>Medical suspended</b>		<b>Flight area</b>	
- Present	4 (36%)	- Europe	2 (18%)
- Past	3 (27%)	- Intercontinental	5 (46%)
- Never	4 (26%)	- Both	4 (36%)
Flight career			
	Flight hours each year	Flight hours total	Flight years
<b>Mean</b>	600	10.000	17,2
<b>Range</b>	(250-1400)	(4.000-18.8000)	(4-32)

## ACTION PLAN



## RESULTS – INTAKE

Subjects reported alarming cognitive failures such as having 'black-outs' and problems with multitasking. Pilots sometimes made procedural errors during flight or kept their plane on the ground because they didn't feel responsible enough to fly anymore.

There appeared to be a clear relationship between the experienced (neurological) symptoms and environmental factors inside of the airplane.

Neuropsychological screening presented little evidence of cognitive impairment.

The EMG and the EEG results showed only nonspecific findings and were not yet proven valuable in the search for neurotoxic damage.

## Neuropsychological testing

Results NSC-60			
Category	N*	Mean <sup>+</sup>	Median <sup>±</sup>
Absence / Memory problems	4 (36,4%)	2,4 (0,8)	
Chest discomfort	6 (54,5%)	2,1 (0,7)	
Balance disorders	3 (27,3%)	1,5 (0,5)	
Sleep disorders	7 (63,6%)		2,7 (1,7-3,0)
Solvent-related complaints	4 (36,4%)	2,3 (0,6)	
Mood changes	3 (27,3%)	2,3 (0,7)	
Sensory / motor symptoms	0 (0,0%)		1,1 (1,0-2,4)
Physical complaints (other)	7 (63,6%)	2,6 (0,6)	
Fatigue	1 (9,1%)	2,3 (0,6)	
Control-items	1 (9,1%)	2,0 (0,5)	

\* Number (%) Candidates with an abnormal value.  
+ Mean (SD) is presented for normal distributed variables.  
± Median (Range) is presented for non normal distributed variables

Results NES-battery				
Category	N*	Mean <sup>+</sup>	Mean Percentiel	Median <sup>±</sup>
VOC	0 (0,0%)			15 (14-19)
SRTT	0 (0,0%)	230,36 (18,00)	55%	
CWVT	0 (0,0%)	634,55 (61,97)	40%	
SDST	0 (0,0%)	2,3 (0,33)	73%	
HECT	0 (0,0%)			1,10 (0,72-2,29)
DMST-F	1 (9,1%)	6,46 (1,04)	63%	
DMST-B	0 (0,0%)	6,30 (0,99)	66%	
FTT_D	0 (0,0%)	219,36 (34,65)	93%	
FTT_N	0 (0,0%)	242,73 (42,76)	100%	

## Discussion - Conclusion

The evidence in this study does not enable firm conclusions to be drawn regarding a causal link with contaminated air. Further research is needed to determine the potential toxicity of oil leakage under aviation conditions.