Submarine Air Quality and Monitoring for Contaminants - Canada

Luc Maheux, Industrial Hygienist

SAMAP 2015

Den Helder, Netherlands

October 5-8, 2015

Presented by:
Ken Cox, A C.E.T. BMT Fleet Technology
Frans Planken, Nav Arc BMT Fleet Technology

The RCN Victoria Class Submarines Current Atmosphere Monitoring Tools:

- Routine at sea monitoring: Drager Tubes & Analox Sub MKIIP
- Escape atmosphere monitoring: Drager Tubes & Analox Sub MKIIP
- Emergency Stations atmosphere monitoring: Drager Tubes
- Alongside diesel engine run gas detection: Drager X-am 2500

The RCN Victoria Class Submarine Future Atmosphere Monitoring Tool(s):

- The RCN Submarine Design Authority is beginning the investigation into introducing a Submarine Atmosphere Monitoring System which will provide a live continuous representation of the submarine atmosphere during routine operations
- Still determining the scope of gases, functionality of the system and suitable integration methods into the existing platform and its existing systems

The Royal Canadian Navy's 'Air Quality Manual' defines mandatory requirements for the management of Air Quality in Victoria Class Submarines.

Retrospective Air Monitoring for a list of 44 potential atmospheric contaminants is required:

- Semi-annually
- Post extended docking work period (EDWP)
- Whenever contamination is suspected

Lists of 44 contaminants is comprised of the following:

-VOC’s
-Metals
-Products of combustion: NO_2 , SO_2, ……

Acetylene
Acetonitrile
Ammonia
Aerosols
Antimony
Benzene
Beryllium
1.3-Butadiene
Butanolamine
Cadmium
Chromium
Cobalt
Copper
Ethylbenzene
Ethyltoluenes
Halon 1301
Hydrogen Bromide
Hydrogen Chloride
Hydrogen Cyanide
Hydrogen Fluoride
Hydrogen Sulphide
Iron
Lead
Manganese
Methane
Methanol
Mercury
Molybdenum
Nickel
Ozone
Phosphine
Refrigerant 134a
Refrigerant 426a
Sulphur dioxide
Tin
Titanium
Toluene
Total Aerosols
Total Organics
Triaryl Phosphate
Trimethylbenzenes
Vanadium
Vinyl Chloride
Xylenes

The Submarine Atmosphere Health Assessment Program (SAHAP) was used to establish the list of contaminants

- takes into account risk of exposure and outcome of exposure

- index ranking score for each contaminant evaluated is used to determine the type of monitoring required.

  - Continuous,
  - Retrospective, or
  - No monitoring

Two sets of air samples are required; one during dived operations, and the other while snorting with diesels running.

Collecting these air samples has proven to be both technically and financially challenging.

The RCN would like to know:

1) Do other Navies perform retrospective air monitoring in circumstances similar to those listed above?

- Semi-annually
- Post extended docking work period (EDWP)
- Whenever contamination is suspected

What list of potential contaminants do Navies include in such air monitoring and how was that list of potential contaminants evidentially derived?

Is there a link between nationally legislated Occupational Health and Safety standards and submarine air monitoring requirements?

How is the air sampling procedure conducted, and by what means are the air samples analysed?

What is the approximate cost of performing such air sampling?

Also, there is an initiative to evaluate existing air monitoring/sampling equipment on-board the submarine.

Ex: monitoring of CO, CO2, etc.

The RCN would like to know what air monitoring/sampling equipment is used on-board your submarine, whether your sub is Diesel-electric or another platform?

- Type of monitoring/sampling equipment
- Specifications
- Cost

In summary,

The RCN is re-evaluating the retrospective air monitoring and air monitoring/sampling equipment on-board their submarines.

Any information you can provide will be very helpful

Thank you

Merci