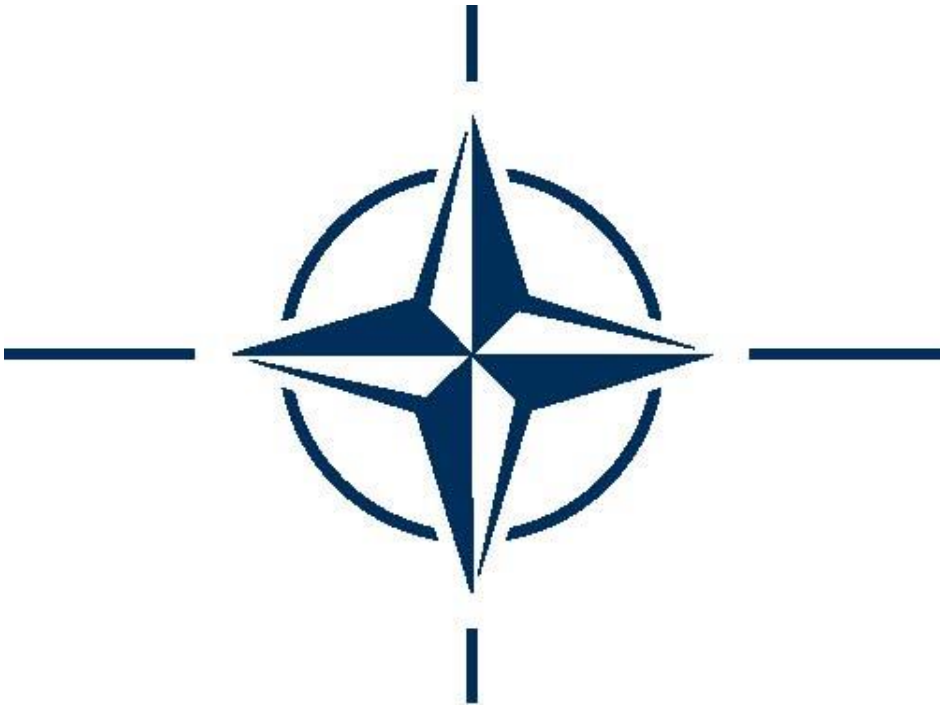
STANDARD RELATED DOCUMENT

SRD-7063

PROCEDURES FOR THE TREATMENT OF FUELS CONTAMINATED BY MICRO-ORGANISM

Edition A Version 1
June 2015



NORTH ATLANTIC TREATY ORGANIZATION

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NATO LETTER OF PROMULGATION

19 June 2015

1. The enclosed Standards Related Document SRD-7063, Edition A, Version 1, PROCEDURES FOR THE TREATMENT OF FUELS CONTAMINATED BY MICRO-ORGANISM, which has been approved in conjunction with AFLP-7063 by the nations in the Petroleum Committee is promulgated herewith.

3. This publication shall be handled in accordance with C-M(2002)60.

Edvardas MAŽEIKIS
Major General, LTUAF
Director, NATO Standardization Office

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SECTION 1 GENERAL

INTRODUCTION

0101. From the moment it leaves the refinery fractionation column, fuel is polluted by the surrounding air and run-off water during handling and storage.

0102. Two types of micro-organisms may develop:

a. Aerobic micro-organisms (which require the presence of oxygen).

b. Anaerobic micro-organisms (which develop in an oxygen-free environment).

AEROBIC MICRO-ORGANISMS

0103. Aerobic strains (fungi, yeasts or bacteria) need water to develop. They feed on hydrocarbons and live at the water-fuel interface, which offers suitable conditions for their proliferation. Other factors besides the presence of water will intensify the phenomenon:

a. The oxygen content of the fuel, which is increased by the agitation of the fuel in the tank of the vehicle, machine, aircraft or ship.

b. Temperature (optimally 30–40°C).

c. Presence of metallic oxides or mineral salts in the water bottom of the tank.

d. Presence of surface-active additives that keep the water in suspension in the fuel and increase the area of the fuel-water interface.

0104. The consequences of aerobic contamination are numerous and often serious:

a. Fuel degradation resulting from the appearance of acid products of organic origin.

b. Reduction of the fuel demulsibility resulting from the production of bio-surfactants by some bacteria. The bio-surfactants keep the water in suspension, slowing the settling process and hindering coalescence, in the filter/water separators.

c. Clogging of filters by a zooglea (gelatinous mass) on the filtering agent itself or by the mycelium (fibres) produced by fungi.

d. Damage to inner linings and corrosion of tanks.

e. Malfunctioning of gauges.

0105. Additionally, several indirect consequences caused by personnel intervention must be considered:

a. Deterioration of engine units resulting from intentional bypassing of the filters which are too often clogged.

b. Damage to the tank inner lining caused by high-pressure washing devices.

c. Use of detergents to clean the tanks, which further reduces the fuel demulsibility through the introduction of surface-active agents.

ANAEROBIC MICRO-ORGANISMS

0106. In some cases, the development of anaerobic micro-organisms (which proliferate in an oxygen-free environment) may be observed. There are two phases to their development:

a. Development of aerobic micro-organisms which use up the oxygen and form an initial substrate.

b. Development of anaerobic micro-organisms on this oxygen-free substrate.

0107. This mechanism is particularly dangerous for storage depots if the tanks are poorly drained. The anaerobic micro-organisms release reaction products, some of which are corrosive: hydrogen sulphide (H_2S), ammonia (NH_3), methane (CH_4), etc.

0108. If contamination occurs, this may lead to:

a. Corrosion of the metal sheets making up the tanks.

b. Toxicity.

c. Danger of fire or explosion.

SECTION 2 TREATMENT OF FUEL STORAGE TANKS

CURATIVE TREATMENT

0201. Curative treatment is a three-step process. The final concentration should be the one required for the biocide used.

a. Step 1: Treatment of the fuel. Depending upon the configuration of the installations, two procedures can be used:

(1) Treatment by suction upstream of the transfer pump. Connect a plastic hose dipped in the biocidal additive containers upstream of the transfer pump via a metering pump and start the suction as soon as the fuel delivery rate is steady. This procedure is recommended whenever possible as it enables the pipes to be treated and reduces the risks of an accident caused by a handling error.

(2) Treatment by introduction of the product at the top of the tank. Introduce the biocidal additive regularly at the top, at the beginning of filling the empty tank or with at least 20% of the initial fuel quantity in the tank, to ensure minimum stirring of the fuel.

b. Step 2: Settling. After treatment let the treated fuel settle for the time required for the biocidal additive used, then remove water and organic waste. The treated fuel should then be designated for priority use or transferred in order to empty the storage tank. If necessary, a special filtering operation may be recommended before use.

c. Step 3: Cleaning of the storage tank. As soon as the storage tank is empty, an inspection should be carried out to determine whether complete cleaning of the storage tank is necessary.

d. Step 4: Elimination of organic wastes after treatment. The organic wastes must be destroyed by a specialized incineration plant.

PREVENTIVE TREATMENT

0202. Preventive treatment at a sub-lethal dose is prohibited due to the risk of the micro-organisms developing resistance to the treatment.

0203. Preventive treatment of the storage tanks and fuel tanks can be done on an occasional basis, when there is a high risk of biocontamination, in particular:

a. in the fuel tanks of aircraft coming from hot, humid countries;

b. prior to long-term storage.

0204. The procedure for preventive treatment is identical to the procedure for curative treatment. A lethal dose of the treatment must be used.

0205. a. The pipes and pumps are disinfected by circulating the treated product.

b. Decontamination residues not eliminated by the settling process may still clog the filters at the end of the operation.

c. Treatment of tank trucks (fuel tankers) is similar to the treatment of storage tanks.

STORAGE TANKS CONTAINING JET ENGINE FUEL

0206. Curative treatment. The procedures are those described in paragraph 0201.

0207. Preventive treatment. The procedures are those described in paragraph 0202.

0208. Use of treated products. Aircraft can only continuously use jet fuel in which the concentration of biocidal fuel additive is that recommended by the STANAG. Therefore, after curative treatment and before use, the jet fuel must be diluted with untreated, uncontaminated fuel.

0209. Recovered fuel. Fuel recovered from aircraft defuelling poses a major risk of contamination. If in doubt, the recovered fuel must be isolated and checked before use.

SECTION 3 TREATMENT OF GROUND VEHICLES AND EQUIPMENT

INTRODUCTION

0301. Like storage tanks, vehicle and equipment tanks must be carefully maintained and checked, particularly those tanks installed in a hot environment (exhaust pipe crossing, close by the engine compartment) or a humid environment (on bridging equipment, or in a maritime or tropical climate).

TREATMENT

0302. Four steps are necessary to decontaminate the tanks:

a. Step 1: Treatment of the tank. After removing the water from the tank, introduce the biocidal additive into the half-filled tank and stir the product by adding fuel, or add fuel already containing the biocidal additive. The final concentration must be the correct one for the additive used.

b. Step 2: Settling. Let settle for time required for the biocidal additive used, then drain and empty the tank contents.

c. Step 3: Rinsing of the tank. Fill the vehicle tank with uncontaminated fuel with biocidal additive at the curative treatment concentration. Let settle and drain.

d. Step 4: Treatment of the vehicle fuel feed circuit. Decontaminate the feed system by running the engine a few minutes on the fuel treated in step 3. Change the fuel filter if necessary.

NOTES:

1. Dead micro-organisms that have not settled out may clog the filters for some time, which does not mean that a new contamination has started.

2. If a large part of the vehicle pool has been contaminated, it is advisable to completely drain the tanks of the vehicles concerned into a storage container which should be treated according to the instructions in Section 2, and then to refill the vehicle tanks with the fuel thus decontaminated following the instructions above.

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SECTION 4 TREATMENT OF AIRCRAFT

TREATMENT

0401. Treatment is carried out in accordance with the procedures described below:

a. Treatment of the tank

(1) Remove any separated water from the tank.

(2) Adjust the fill level (by adding or removing fuel) until the quantity of fuel is approximately equal to 30% of the full capacity of the tank.

(3) Fill to 100% with jet fuel to which the biocidal additive has already been added so as to obtain a final biocidal fuel additive concentration appropriate to the additive used (this can be added from a fuel tender in which the mixing has been carried out).

(4) If the aircraft's internal pumping system permits, make the jet fuel circulate to ensure effective mixing that results in a homogeneous concentration of the additive.

b. Settling. Let settle for time required for the biocidal additive used.

c. Reconditioning of the aircraft after treatment.

(1) Drain the fuel tank to remove the biomass which has settled out.

(2) Idle the engine for 10 minutes, keeping the aircraft stationary on the ground, to remove any sediment which may have gathered in the feed lines and prevent clogging of the filters in flight.

(3) Check and clean, or replace, the engine filters in accordance with the technical instructions in force.

d. Check after treatment.

(1) One week after the treatment, check the cleanliness of all engine filters.

(2) After 50 hours of flight, check the effectiveness of the decontamination treatment by carrying out three micro-organism detection tests on three samples taken from the tank.

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SECTION 5 TREATMENT OF SHIP BUNKERS

SHIP IN HOME PORT

0501. Unload any remaining contaminated fuel oil for treatment in accordance with the procedures in Chapter 2.

0502. De-gas and clean the bunkers in accordance with national instructions. For small bunkers, de-gas and clean by removing the most of deposits on the walls with a pressurised fresh water-jet after taking out the bunker plugs and installing a jet pump for drying purposes.

0503. Resupply with a treated fuel oil or treat by adding small amounts of biocidal additive as regularly as possible during the bunker topping-up phase.

0504. Let the biocide act for the time required for the biocidal additive.

0505. After treatment, let settle and drain the separated water out of the bunkers frequently, and possibly conduct a detection test to check that there are no more living micro-organisms.

SHIP OUTSIDE HOME PORT

0506. In this case, the contaminated fuel oil cannot be unloaded. In order to decontaminate it is necessary to:

a. Let the bunker(s) settle as thoroughly as possible.

b. Treat with biocidal additive, ensuring that the fuel oil is stirred, which may cause fuel movements.

c. Let act and settle, drain the separated water out frequently.

NOTES:

1. Manifolds are decontaminated by the movement of the treated fuel oil.

2. Any sediment not removed by the settling process is picked up by the filters; this may result in significant consumption of filter cartridges after decontamination.

3. After treatment, the separated water and the dead micro-organisms in suspension may be discharged into the sea according to the regulations on the release of bilge-water. In port they may only be discharged into tanks for oil-contaminated water.

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SECTION 6 DEFINITION OF TECHNICAL TERMS

BIOCIDE:	A product that kills micro-organisms
COALESCENCE:	A physical process by which the particles of the discontinuous phase of an emulsion or suspension aggregate
FILTERING MEDIUM:	A substance that ensures filtration.
BIO-SURFACTANT:	A product of biological origin which makes sediments and water fuel soluble.
SURFACE-ACTIVE AGENT:	A product that changes the surface tension of a fluid in which it is dissolved.
MYCELIUM:	Long filaments produced by fungi.
ZOOGLEA:	A conglomerated mass of micro-organisms held together by a viscous matrix.
GELOSE:	A seaweed-based nutrient medium for micro-organisms used in bacteriology.

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