1. Rio 2016 Pollution Update

At the time of the Rio 2016 bid in 2008 the Rio authorities had committed to use the Olympic Games as a trigger to improve the water quality of Guanabara Bay by 80%. Since 2012 ISAF has been working with Rio 2016 and the IOC to ensure a safe and fair Field of Play for the Rio 2016 Olympic Sailing Competition. The Aquece Rio 2014 International Regatta was a success from an organisation point of view but highlighted many concerns over pollution in Guanabara Bay.

2. Water Quality Task Force

Following the Aquece Rio 2014 International Regatta ISAF stepped up the pressure with the Brazilian authorities and a Water Quality Task Force was established to define the critical actions required and to ensure the delivery of all of the action points to ensure the athletes were safe and that there would be fair racing. The Water Quality Task Force includes the State Secretary of Environment, the Municipal Secretary of Environment, the State Company of Water and Sewage, Municipal Company of Waste Management, The Rio Governor's Office and the Municipal Water Company. This task force meets monthly with the Rio 2016 management teams. At the end of 2014 and in early 2015, ISAF worked closely with Rio 2016, the IOC and the task office to ensure all possible measures are undertaken to improve the water pollution in Guanabara Bay. Below were a series of concerns and action points:

2.1 Marina da Gloria

The water quality within Marina da Gloria suffers from high concentration loads of bacteria over multiple occasions of the year, mostly due to the sewage discharges into the Marina. The construction of the sewage belt around the Marina will improve this situation, avoiding direct sewage discharge into the Marina. The plan is for the sewage belt to be completed at the end of 2015. ISAF wanted the work finished before the Aquece Rio 2015 International Regatta but this was not possible. To reduce the water quality problem during this test event it was agreed that bioremediation products would have to be used to reduce the bacteria concentrations, and thus improving at the same time the oxygen concentration.

2.2 Beach Launching Area (Flamengo)

According to the beach bathing bulletins published by the State Environment Institute the water quality at Flamengo Beach does not fall within the Brazilian standards during the majority of the year. The Government has stated that the Sena Limpa Programme has the potential to solve this issue, but the programme has yet to commence and the last reports on water quality published by State Environment Institute do not mention the possible dates to start and complete this strategy.

2.3 Pão de Açúcar, Escola Naval and Ponte course areas

In order to improve the water quality and reduce the amount of physical objects within the Guanabara Bay, the Government intends to:

- Close illegal landfills and create and open new facilities, following the Brazilian standards, around the bay;
- Open and operate 8 new ecob arriers (in addition to the 11 already open – although one of these 11 is not currently functional);
- Daily operations of eco boats for collecting floating waste;
- Create river treatment units;
- Open new sewage treatment plants and expand the existent sewage network close to the bay area.

2.4 Copacabana and Niteroi sailing course areas

The water quality within the Copacabana and Niteroi course area is much better than within the Guanabara Bay as they are located within the open sea. These water quality in these race areas are consistently below the Brazilian water quality standards.

2.5 Other Inititaves

Following this review with Rio 2016, ISAF formally requested an additional race course area, Pai, to be created outside of Guanabara Bay in order to give ISAF more fexibility on the choice of course areas used during the Aquece Rio 2015 International Regatta and the Rio 2016 Olympic Games.

3. Aquece Rio 2015 International Regatta

At the Aquece Rio 2015 International Regatta ISAF appointed Dr Nebojša Nikolić, ISAF Medical Commission member, and Pedro Rodrigues, ISAF Events Committee Member, to work with ISAF on all issues relating to pollution.

This test event was a success and the full report from Dr Nebojša Nikolić can be seen at the end of this report. From a race management point of view, Pedro Rodriguez worked closely with the Rio 2016 event organisers and Nino Shmueli, the ISAF PRO, to ensure the course areas were clear of physical objects in the water that could affect racing. During the test event there was one day of rainfall and on the following day it was clear that there were more physical objects in the water on the Ponte course area. The Nacra 17s raced on the Ponte course area that day but it was clear that the water quality was not good. The following day the 470s were scheduled to race on the Ponte course but their racing was moved outside of Guanabara Bay to ensure they did not race on the more polluted course area. There was no wind outside the Bay and so later in the day the 470s were moved to the Escola Naval course area where they had a good, fair race.

Following the 2015 test event ISAF has requested another course area inside Guanabara Bay, the Aerrporto course area, to give even more flexibility for the race management team.

4. Next Steps

Following the two test events, feedback from MNAs, sailors, race officials and the ISAF Medical Commission the following actions will be taken for the Olympic Games and Paralympic Games:

- Monitor the impact of the Marina da Gloria sewage pipe to ensure the water quality improves once it has been completed.
- Conduct more testing of the Flamengo Beach launching area and ensure the water quality improves.
- Continually monitor the course areas for water quality.
- Monitor the progress of closing down landfill sites, increasing the numbers of eco barriers, etc.
- Work with Rio 2016 on a heavy rainfall contingency plan to ensure a clean and fair field of play.
- Work with the ISAF Medical Commission to publish clear advice to MNAs, sailors, coaches and race officials.
- Work with Rio 2016 to ensure the improve shower and hygiene facilities for all athletes, coaches and race officials.
- Finalise a competition schedule that is flexible, with spare course areas inside and outside of Guanabara Bay.

Alastair Fox, ISAF Head of Events

Aquece Rio 2015 test event Interim report from Dr Nebojša Nikolić, ISAF Medical Commission member

1. Introduction

ISAF is taking seriously the potential dangers to our Sports Person's health. By the nature of our sport, the 'field of play' can differ greatly from their home environment and can have a decisive influence on the final success in the competition. Major environmental changes can strongly influence not only Sports Person's fitness abilities, but also their health. Modern top-level competing sailors travel frequently and must be able to deal with environmental problems and with problems related to the mode of transportation, major time zone changes, different foods, housing and different approaches / levels of medical care at the new sailing destination.

Unfortunately, pollution is a reality and sailing events are often held on racing fields in front of the major urban areas, not always with appropriate sewage water plants. Near major towns, one should expect a high level of *coli bacteria* and potentially harmful chemicals in the water. Infection may result from ingestion or inhalation, or contact with harmful microorganisms which may be naturally present, that can be carried by people or animals using the water, or present because of faecal contamination. The most common consequences are diarrhoeal disease, acute febrile respiratory disease, ear infections and infection of skin lesions.

Being aware of the potential environmental dangers of polluted waters in the Rio sailing areas and the raised media interest; ISAF decided to closely monitor and evaluate the current situation in Rio during and after the Aquece 2015 Sailing Event.

2. Water testing

ISAF recognizes that The Rio Authorities are responsible for the water quality at the venues designated for the Olympic Games 2016. They, together with the Local Organizing Committee and the IOC, are requested to follow *WHO Guidelines for Safe Recreational Water Environments Volume 1 Coastal and Fresh Waters*. WHO's ongoing cooperation with the International Olympic Committee (IOC) began with the 2004 Olympic Games in Athens and WHO has supported all subsequent Olympic Games since 2004 focusing on the public health considerations of a mass gathering of this magnitude. WHO continues to work with the IOC and Brazilian authorities providing technical guidance on risk assessment and risk management specific to the Olympic Games. *WHO Guidelines for Safe Recreational Water Environments* recommend a combination of on-going sanitary surveys and inspections, periodic microbial water quality monitoring and predictive modelling based on historical longitudinal data, that should serve as the basis of a Water Safety Plan for the water body and the population at risk; in this case, Sports Persons and visitors attending the Olympic Games 2016.

Although independent testing of the waters in Guanabara Bay showed a high viral load, it is difficult to estimate the risk to health. As we currently don't have the global consensus on the viral testing of water and more accurate predictor of human health risk would be to detect, quantify and then model risks, based on infectious virus particles in the water of interest. ISAF decided to follow the WHO/IOC recommendations and monitor the situation based on the official data provided by the Brazilian authorities.

ISAF wanted to have, as much as possible, precise insight to the situation in the Guanabara Bay, during the Aquece Rio 2015 Sailing Event. ISAF requested the Brazilian and Rio authorities share the water quality data and to test the water every second day instead of the weekly testing. Those requests were fulfilled completely.

The Brazilian public health team (INEA) gave a presentation the first day of the event on their data and also made the data accessible on the web. They publicly invited everybody to take their own samples, what some teams (USA) actually did.

Results of the water testing showed that testing was executed according to the *WHO Guidelines for Safe Recreational Water Environments*, and were inside the recommended limits for secondary contact and even for the most of the time - inside primary contact limits. ISAF received data of the testing during the event, according to the request for every second day testing. During the monitoring period of Aquece Rio 2015 Sailing Event, no pollution peaks were registered on any of the tested points that included all of the course areas.

ISAF medical team also checked the method of taking the water samples and confirmed that it was executed according to the standards.

However, Flamengo beach was not tested and was not included in testing points although it is the point of entrance for two classes of boats (RS: X and Nacra 17). Available data from INEA website, but not presented with the data from the testing sites, showed high levels of bacterial presence that are over the limits for primary and secondary contact. The ISAF Medical team identified those points of entrance/exit from the water as **hot-spots for infection**. On entrance in the water and on the exit from it, sailors are in primary – not the secondary - contact with the water. Once in the boat they do not have the possibility to clean themselves and after exiting from the water, they usually clean the boats first, before themselves. In addition, some teams start immediately with rehydration and recuperation procedures. That opens widely the possibility of faecal-oral transmission of pathogens via soiled hands if the sailors don't have enough showers and sanitizers available on the ramps to clean themselves first, before they continue with the rest of the procedures.

Marina da Gloria is certainly the biggest problem and the open entrance of untreated sewage is visible to anybody who takes a walk in marina. That is also the **second hot-spot for infection** as sailors are entering the water, via primary contact, there too (Laser, Laser Radial, Finn, 470, 49er, 49er FX). Brazilian authorities performed the bioremediation procedure to improve the quality of the water which improved the situation but still the bacterial levels were borderline or over the accepted levels. We inspected the construction site in Marina de Gloria where organizers are already working on the construction of the "belt" that will collect all sewage pipes entering in Marina, so with great certainty we can say that for Olympics, the Marina problem will be solved and water inside the Marina cleaned. That will remove one hot-spot for infection.

Regarding physical objects / pollution on the course areas, the Rio organizers organized a good and effective system of removing the floating objects with the eco-boats. We inspected and evaluated their operation and only on one day after the heavy rainfall did a course area have to be moved, which is not an unexpected happening in the sport of sailing.

ISAF continues to monitor the situation in the Guanabara Bay and will continue to do so until the Olympic Games in 2016. Water quality data are reported regularly and are available on INEA website. ISAF also has experts on hand to assist interpreting data and advising on appropriate controls as new data become available.

3. Evaluation of hygienic measures and interventions taken during the Aquece Rio 2015 Sailing Event

During the Aquece Rio 2015 Sailing Event the ISAF Medical team inspected sailing fields and marina facilities to evaluate the hygienic measures taken and the sanitary procedures in place. After inspecting the site, procedures and data on water testing at **hot spots for infection** were identified as the launching areas in Marina Gloria and on the Flamengo beach. Based on those findings local organizers were requested to implement corrections and strengthen the hygienic procedures during the event.

Organizers were requested to put more water hoses or showers on the two launching ramps in marina and on the Flamingo beach. They were also requested to put hand sanitizers at those points.

In addition, we requested hand sanitizers on all gathering places (jury premises, ISAF staff premises, racing committee premises and press conference room). Some adjustments regarding the position of the hand sanitizing area in restaurant were suggested and different type of hand sanitizers in toilets requested too. Majority of our requests were fulfilled. Due to the objective technical limitations, showers on the launching areas could not be provided and the lack of water plumbing on NACRA launching area prevented placing of additional water hoses too. For the games, showers and hand sanitizers will be a must on those areas.

The ISAF medical team held three **meetings with the team leaders** and medical officers of the participating teams during the Aquece 2015 Sailing Event. At those meetings, they were briefed on the health situation and on the environmental risks in Rio. A special presentation on the ISAF Medical Guidelines for the International Team Coach was organized at the first meeting and they were recommended to follow them closely. Beside these Guidelines (which have been available for several years on ISAF website the ISAF Medical Commission also issued recommendations on vaccinations and chemoprophylaxis for Rio. After the study is completed, we will be able to estimate how many teams followed these recommendations. The meetings were not only technical but were also designed to raise awareness on the necessity of protection of sports people's health as an integral part of their sport success. Our aim was to work with the teams and help them to prepare for the event and to strengthen their preventative procedures. That included a major adaptation of the rehydration procedures on board during the regatta, the food and water taken during the breaks in regattas from the soiled bottles or with soiled hands and this was identified as a **hot spot for infection**.

The Team's medical leaders were urged to apply **isolation and cleaning/disinfection procedures** if they had any illness in their teams and that worked well – we did not have any major outbreaks inside teams, just the sporadic cases.

In addition, we established a **system of urgent reporting** for every case of illness during the event to avoid a major outbreak of disease. The majority of teams fully cooperated. Such meetings should be run during the Olympic Games and identical system applied.

Unfortunately, we noticed that almost half of the teams came without any knowledge of the environmental problems in Rio and without any preparation or medical support. They must be reached by other means and adequate health promotion messages delivered to them.

We were working in close cooperation with WHO and IOC and during the Aquece Rio Sailing Event 2015 I had a meeting with Dr Richard Budgett, Medical director of IOC. Dr Budgett expressed intention to cooperate closely with us and invited us to present our data, experience from Rio to other federations in an October meeting in Lausanne.

4. Studies of environmental impact on health

Besides evaluating and correcting hygiene and sanitary procedures, health promotion activities and monitoring of the water testing, the major aim of the ISAF medical team was to **study the impact of environment** on sailors and accompanying entourage. Thanks to the work of our Medical Commission (Guidelines, study on injuries and illness from Santander) we were able to control this tense situation and present it as continuation of our regular work.

The International Olympic Committee (IOC) has successfully implemented injury and illness surveillance at the recent Olympic Games. This has laid the foundation for systematic monitoring of injury trends for various sports over a long period. At the Aquece Rio International Sailing Regatta 2015, our aim was to record the newly acquired illnesses and

sports injuries incurred in competitions and/or training during the event in a format closely similar to the IOC's injury surveillance.

In the absence of the universally agreed standards for viral testing of the water, and confirmed borderline levels of the bacterial presence in the water, studying the impact of the environment on the sailors' health was the only reasonably reliable method of assessing the health risks resulting from polluted waters of Guanabara Bay.

In that order, ISAF Medical Commission continued with the **Injury and Illness Surveillance Study** already run at the ISAF Youth World Championships in Cyprus and during the Santander World Sailing Championship event in 2015. The same format and method was used with the intention to acquire longitudinal data and possibly to compare the data from Rio with the available data of the previous studies. The study was designed to register the adverse health incidents (injuries and illnesses) during the sailing events and distribute them according to classes of the boats, age, gender, and part of the body.

As the polluted waters and incidents reported in media strongly indicated the risk for the diarrheal disease, as a supplement to this study, the **study on Traveller's Diarrhoea** was launched too. This disease is usually associated with the ingestion of contaminated beverages and/or food items via faecal – oral transmission. Our aim was to identify the risk factors for diarrheal disease during the sailing events, and eventually to develop the effective prevention programs for the sailing event in the Olympic Games 2016 in Rio. The study was designed to identify the risk factors and patterns of acquiring diarrhoea and to identify the groups with higher risk of disease among those competing on the waters and in the entourage on shore. In addition, it was designed to identify behavioural risks, modes of protection used and impact on performance during the event. As the differences in the intensity of the primary contact with the water were expected (i.e. RS: X vs. Finn class) possible correlations were taken in account.

On our first meeting, we informed the teams that we are running a survey during the event and that it was of great importance for them to participate in it. Only a high response rate would allow us to obtain reliable results from this survey so we also launched a web-based questionnaire to make it as easy as possible. Data is still arriving and it is planned to complete the study before the ISAF Annual Conference 2015 in Sanya.

Currently, from the large majority of group data of the Injury and Illness Surveillance Study already received we can present the **total number of cases** during the Aquece Rio Sailing Event 2015.

Results:

Total of 688 persons participated Aquece Rio Sailing Event 2015 among them 326 sailors, 196 coaches and 181 team members.

- 43 cases of diarrhoea in total were registered during the event
- 29 of them among the sportsman (6 of those were the clear cluster of those that were infected in town without contact with the water).
- 10 cases were registered among non-sportsman (jury, coaches) who were in the contact with the waters of Guanabara Bay
- 4 cases were from those on shore without any contact with the water.

Attack rates for travelers' diarrhea range from 30% to 70%, depending on the destination and season of travel. Developing countries of South America have the highest rates. During the Aquece Rio Sailing Event 2015 out of 688 persons participated, 43 cases of diarrhoea were registered what makes the rate of 6.32 %. Of the total of 326 sailors competing and being exposed to the waters of Guanabara Bay - 29 got sick with diarrheal disease which makes 8.89 % of sick sailors.

Comparing those results with the expected rates for the general travel population coming to Brazil, we can conclude that those rates are inside the acceptable levels and actually below expected. It is also worth knowing that among those 29 cases we have a clear cluster of 6 cases that were infected in town (Maracanã stadium) and clearly were not caused by the water. They went to football game and all ate the same food during the break and got the same symptoms at the same time. That reduces the **percentage of sick sailors to 7.05%.** This could be of importance as obviously the risk is not only in the sea water. The majority of cases had a clinical picture of acute viral gastroenteritis. They felt very sick and vomited sometimes with diarrhoea. It usually lasted for 12 hours and they recovered fast.

This is simply raw data being put in context but after the study is analysed we will know more. Colleagues from Brazil are claiming that such infections in Rio are common place and that several times a year they have peaks of acute gastroenteritis. We received the data from the Public Health Registry and this data will be put in the context of our study too. We also managed to test two stool samples: one was negative and other one positive on amoeba histolytic. Stools were tested in their lab for bacteriologically, parasitological and rota virus.

5. Major Media cases comments

German Sailor Erik Heil fell ill after competing in a pre-Olympic test event and as a cause of his illness MRSA was found. Although the media connected his illness (several abscesses on the legs) with the polluted water, it is it's unlikely that his bacterial skin infection was contracted in polluted Olympic waters, as it is a bacteria that hasn't been shown to spread much via water. Although MRSA is present in Brazil, there is no evidence of any infection resulting from contaminated water. Several papers are published and are confirming the presence of MRSA in Rio but it is actually found in water all over the world. Increasing international travel (and our sailors are travellers) has facilitated the transmission of various multidrug-resistant bacteria including methicillin-resistant Staphylococcus aureus (MRSA) across continents. It has been speculated that a change in skin colonization could have resulted from reduced hygiene standards and increased sweating during travelling. The distribution of these pathogens from the colonized reservoirs such as nares, throat, axilla, and groins to areas where there is a breach to skin barrier (e.g., micro-trauma as a consequence of insect bites, scratching, or minor wounds) in travellers may result in subsequent infections. Accordingly, the same could apply to our sailors.

However, whether the contaminated seawater, presence of skin abrasions among sailors, or the failure to decontaminate dry suites and other related-sailing materials after use could be the source of MRSA transmission remains to be made clear. In Rio I noticed that very few sailors wash their wet-suites after coming out from the water.

When recognized and treated early, it's not a serious disease. The best prevention is good hygiene, including washing skin on a regular basis, using clean clothing and linens, and washing all cuts and scrapes thoroughly with soap and disinfected water. Now when we registered the problem and what is more important all sailors are aware of it - we can more easily convince them to follow necessary procedures of hygiene and disinfection.

I suggest that before Olympics we issue a new addition to our health recommendations.

The case of **Korean sailor Wonwoo Cho** got enormous publicity thanks to his picture in the hospital published on the Facebook. Actually, what happened was that he felt sick, took some medicine, vomited once, his team leaders panicked and took him to hospital. There was no fever, no diarrhoea, no dehydration and he was released after 30 min and sailed again. His team come to Rio completely unprepared, without any medical support and did not take any precautions. I spoke with them and they were literally unaware of any usual precautions that should be taken.

6. Conclusion

Our initial risk assessment concluded that the athletes will not have significantly increased health risk through water contact by competing in the Guanabara Bay. The assessment was based on a low attack rate of diarrhoea during the Aquece Rio Sailing Event 2015 and expected low risk of ingestion of water by sailors, especially if the hot spot for infection on board during the consuming of the water and food is accordingly adapted. For instance: bottles and food should be carried by coaches in containers and water bottle opened by coach and handed to sailor in the boat. If the food is handed, than the coach must have a secure way of cleaning the sailors' hands previously.

Risks would increase if athletes were to fall in the water, with ingestion of water, or otherwise, have increased contact.

Travelers' diarrhea is a clinical syndrome that can result from a variety of intestinal pathogens. Bacterial pathogens are the predominant risk, thought to account for 80%–90% of cases. Intestinal viruses usually account for 5%–8% of illnesses, although increasing use of improved diagnostics may increase recognition of norovirus infections in the future. Infections with protozoal pathogens are slower to manifest symptoms and collectively account for approximately 10% of diagnoses in longer-term travelers. As the larger part of travellers' diarrhoea are caused by bacteria our advice issued before the event: Rifaximin 400mg tbl. daily as prophylaxis of diarrheal disease should prevent the major part of diarrheal diseases and Typhoid vaccines development of the typhoid disease. That would not prevent the viral infection as there is no vaccine available for the whole palette of viral agents causing viral gastroenteritis. However, Hepatitis A is advisable and will provide solid protection from Hepatitis A virus that has the high prevalence in Rio region.

ISAF underscores that general public health concerns and public health concerns related specifically to a sports event must be considered separate, yet complementary. As such, risks associated with the sports event may be dependent on factors different from those related to general public health risks—such as foreign nationals with varying immunities from local persons. Clear cluster of six cases of diarrheal disease acquired in the city without contact with the water is pointing to general health problem that could influence the health not only of the sportsman, but also the visitors to Olympic Games in Rio 2016.

7. Recommendations

- ISAF acknowledges that recreational water in Guanabara Bay is heavily impacted by sewage outflows that are always a cause of concern and the Authorities should continue to take all feasible short-term and longer-term steps to limit the risk.
- The Marina da Gloria sewage belt should be finished by the end of the year.
- Problem of the Flamengo beach must be taken into account and Brazilian authorities requested to alleviate pollution zone of Botafogo bay that is influencing the Flamengo beach. Analyses of the currents taken by the oceanographers of some sailing teams are showing that currents are moving from Botafogo Bay towards the entrance of Marina de Gloria via Flamengo beach.
- On the hot spots for infection at the launching areas in Marina da Gloria and Flamengo beach it is necessary to place enough showers and hand sanitizers right in the zones where they are exiting the water and cleaning the boats to enable sailors to immediately clean themselves.
- Organizers should be requested to put sanitizers in all the gatherings areas (press conference rooms, race committee, jury and ISAF premises).

ISAF acknowledges that water quality varies daily especially following heavy rainfall that can lead to sewage overflows and that microbial contamination and related health risks can be considerably increased for several days following rainfall.

- ISAF should request from the INEA to report regularly on water conditions in the Guanabara Bay

Beside technical improvements, ISAF must work hard on health promotion and make it a part of the sport culture, especially for these Games.

- ISAF Medical Commission should issue updated medical advice that should include sanitation and isolation procedures for the event.
- ISAF Medical Commission should update and issue the addendum to ISAF Medical Guidelines for the International Team Coach designed for Paralympic sailing.