

#### CHEAP. SIMPLE. SAFE.



## Guidelines and Frequently Asked Questions 2016







Pacific Community Communauté du Pacifique

**GIZ** Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH





### Foreword

Solar water disinfection (SODIS) is an effective, environmentally sustainable, low-cost solution for drinking water treatment at a household level. The process of SODIS uses solar energy (ultraviolet and infra-red radiation) to destroy pathogens that cause water-borne diseases. It has an equivalent disinfection effect to boiling water.

SODIS is already used extensively throughout Latin America, Asia and Africa and extensive research on the technique has been carried out globally since the 1980s. For more information and a comprehensive list of research papers on SODIS globally, see Switzerland's Eawag Aquatic Research Institute website at: <u>http://www.sodis.ch/site/fachleute\_EN</u>.

SODIS has been successfully tested, trialled and launched in the Pacific island nation of Kiribati over the period 2014 – 2016 by the European Union-funded Global Climate Change Alliance: Pacific Small Island States (GCCA: PSIS) project implemented by the Pacific Community (SPC). The research component was also supported by SPC's Water and Sanitation Programme and the German Agency for International Cooperation (GIZ). For more resources on SODIS in Kiribati, including the research results, visit the Pacific Climate Change Portal at: <u>http://projects.</u> <u>pacificclimatechange.net/gcca-psis-kiribati\_or gsd.spc.int/ccprojects/</u>

From 2016 onwards SODIS will be expanded throughout Kiribati and the Pacific island region with the help of SPC, the World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF), among others.

The text in this booklet has been arranged as a step-by-step poster and a series of frequently asked questions (FAQs), supported by a video showing how SODIS is being used in Kiribati.

The purpose of this booklet is to share user-friendly information about SODIS with other development and climate change professionals in Pacific island countries and territories (PICTs). PICTs are encouraged to further explore their potential for using SODIS nationally, especially in outer islands where reticulated water supplies are limited or non-existent, and in all islands where normal water supplies may be disrupted after natural disasters.

The guidelines in this booklet are based on the environmental conditions in Kiribati, so there is a need for each nation to properly research and develop their own guidelines for SODIS according to their local conditions. SODIS has been used globally in nations up to 35 degrees north or south of the equator so this method is very likely to be suitable across PICTs, but the guidelines for the length of time bottles should be exposed to sunlight may vary, especially in the winter months in higher latitude regions, when UV light is weaker.

Other PICTs wishing to learn more about SODIS and how to use it themselves are advised to contact their government ministries responsible for health and/or the following organisations:

Ms Rhonda Bower Robinson Water and Sanitation Programme Geosciences Division Pacific Community (SPC) Mead Road, Suva, Fiji E-mail: rhondar@spc.int

Dr Rohko Kim, MD, DrPH Environmental Health Specialist World Health Organization (WHO) Division of Pacific Technical Support Suva, Fiji E-mail: kimr@wpro.who.int

Mr Marc Overmars WASH Specialist United Nations Children's Emergency Fund (UNICEF) Fiji Regional Office Fiji Development Bank Building 360 Victoria Parade Suva, Fiji E-mail: movermars@unicef.org

The content of this booklet in no way represents the views of the development partners: European Union, World Health Organization, United Nations Children's Emergency Fund, Deutsche Gesellschaft für Internationale Zusammenarbeit.

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## **SODIS** is saving lives

#### What is SODIS and how does it work?

SODIS (Solar Disinfection) is a simple, low-cost solution for preparing drinking water at the household level. SODIS uses both sunlight and the heat of the sun to kill 99.9% of germs in water. The sun kills the germs that cause illnesses such as diarrhoea, typhoid fever and other water-borne diseases.

#### **SODIS works**

SODIS is used by five million people in more than 50 countries in Asia, Latin America and Africa to prepare their daily drinking water. Since first used in 1980, SODIS has been proven to be a safe, effective and low-cost way to clean water. Whilst relatively unknown in the Pacific, SODIS trials in Kiribati have indicated its effective-ness and potential for widespread use across this region.

#### Safe water benefits

Dirty water leads to a high risk of water-borne diseases such as diarrhoea and typhoid fever, for instance, Kiribati has one of the highest rate of deaths of children under five from diarrhoea in the Pacific region. Access to clean and safe water through SODIS is critical to improving the livelihoods of children in countries like Kiribati.

#### SODIS is making children grow healthy and strong

Children who are often sick with diarrhoea do not grow as fast as other children. They are not as strong as other children. They find it more difficult to learn and to do well at school. Giving them SODIS water gives them the best start in life. When SODIS is used to disinfect drinking water, children and families are protected from the germs that cause diarrhoea. Children can grow up healthy, smart and strong.

SODIS gives children the best start in life.

1



## SODIS guidelines

## When followed correctly, SODIS kills 99.9% of harmful germs found in water.

1. Select a clear plastic or glass bottle (not coloured plastic) up to 1.5 litres in size. If using plastic, the bottle must be labelled with the PET symbol and the number 1 triangle

2. Wash the bottles and lids with washing soap or bleach before using them for SO-DIS the first time. Wash your hands with soap before preparing the SODIS bottles.

3. Start the SODIS process by 9am. Fill the bottle  $\frac{3}{4}$  with clear water, shake for ten seconds and then fill the bottle to the top.

4. Lay the bottles on a corrugated iron roof or a piece of iron that can reflect the sun's rays.

5. The bottles must be exposed to at least six hours full sun (or two days in a row if very cloudy weather) in order for the SODIS process to kill all the germs in the water. SODIS cannot be done on rainy days.<sup>1</sup>

6. Drink SODIS water directly from your personally identified bottle. If SODIS water is poured into another container, make sure it has been washed with washing soap.

7. The treated SODIS bottles can be stored for up to three days in a dark place. If stored longer, any bacteria that may be in the bottles could reproduce and make the water unsafe for drinking.

<sup>1</sup> Recommended disinfection timings in this booklet are derived from studies specific to Kiribati. While SODIS is broadly applicable to Pacific tropical locations, research should be conducted through local studies to determine appropriate local guidelines (see foreword). Guidelines based on *Solar Water Disinfection in Kiribati: Assessment and implementation of Solar Water Disinfection Systems, Dr Christian Starz, European Union funded Global Climate Change Alliance: Pacific Small Island States project, Secretariat of the Pacific Community, 2015. http://www.pacificclimatechange.net/components/com\_booklibrary/ebooks/SODIS%20research%20report.pdf* 

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## **SODIS Frequently Asked Questions**

#### WHAT AND HOW

#### 1) How does SODIS work? What happens to the water when you put it in the sun for six hours?

Across much of the Pacific, the sun is strong and the temperature gets very hot during the day. During SO-DIS, the combination of the strong sunshine and heat work together to kill the germs found in contaminated water. Sometimes you can see bubbles when the water gets very hot.

## 2) Why must SODIS bottles be clear (transparent)?

Coloured bottles block the sun from reaching, and heating the water. It is important to only use clear plastic or glass bottles for SODIS (not bottles tinted blue).

## 3) Do we need to clean the bottles each time we use them for SODIS?

No. You only need to clean the bottles with washing soap before using the bottles for the first time. Make sure you also clean the bottle lids with washing soap. You may wish to clean the bottles once a week with washing soap or a little bleach to kill any bacteria that may be building in the bottles. Also wash hands with soap before preparing SODIS bottles.

## 4) Why do we need to shake the bottles before filling them up with water?

The process of SODIS is more effective when there is oxygen in the water. Shaking the bottles after filling them ¾ full will inject oxygen into the water, and help the sun do its job. The bubbles in the bottles mean that there is air in the water. Only shake at the beginning of the SODIS process.

## 5) Why do we need to lie the bottles down?

During SODIS, the sun needs to reach all of the water in the bottles. Laying the bottles flat ensures that the sun can cover the whole bottle, which won't happen if the bottles are standing. SODIS will not work in large bottles or other plastic containers larger than 1.5L. Once bottles are laid down in the sun, they should not be moved until after six hours (in full sun), or two days (in cloudy weather).

## 6) Why must the bottles be placed on corrugated iron?

SODIS is more effective when the bottles are placed on a surface that reflects the sun's rays (such as a roof or piece of corrugated iron). This also helps to heat the water that is part of the SODIS process.

## 7) My house has a thatch roof. Can I use SODIS?

You cannot use a thatch roof for SODIS. But you can use corrugated iron or any material that reflects the light such as foil or aluminium trays as long as the bottles are exposed to six hours of full sunlight. The bottles can also be left on the roof or bonnet of a car.

## 8) If I use SODIS for all our drinking water, does this mean my children will never get diarrhoea?

When the SODIS guidelines are followed correctly, SODIS can remove 99.9% of germs found in water. However, access to clean and safe drinking water is only one way to reduce the risk of getting sick from diarrhoea and other diseases. A key way to protect your family from diarrhoea is to wash your hands with soap at key times, particularly, after using the toilet, before preparing food and before eating food. It is important to combine good hygiene with clean water to keep your children healthy and strong.

#### **EXPOSURE TIME**

## 9) How long must the SODIS bottles be in the sun?

The SODIS bottles must be in the sun for at least six hours. If it is VERY cloudy, the bottles must be in the sun for two days. You cannot use SODIS on rainy days (guidelines based on Kiribati, see foreword).

## 10) What happens if I leave the bottles out for more than six hours?

The bottles must be in the sun for at least six hours or two days in VERY cloudy weather. There is no problem if the bottles stay out in the sun for more than six hours.

## 11) What if the bottles stay out overnight until morning?

There is no problem if the bottles stay out overnight, but when SODIS treatment is complete, bottles are best kept stored in a dark place for no longer than three days.

#### 12) What if my house is in the shade? Can I use SODIS?

For SODIS to work the bottles need to be in direct sunlight for 6 hours. If your house is in the shade, ask your neighbour to use their roof or find a space that has sun for six hours.

#### WEATHER

## 13) Should I take the SODIS bottles inside when it rains?

During cloudy days it is important to expose the bottles for two days in a row. If it rains during the entire day, it is best to not use SODIS and instead boil water.

## 14) What if it is sunny in the morning and then suddenly raining and then sunny again?

If you are unsure whether there is enough sun to use SODIS, drink boiled water.

#### 15) How do I decide when it is too cloudy and the bottles must be out for two days?

If the day is mostly sunny or a mix of sun and clouds, the bottles need only be out one day (see figure below).

If the day is mostly cloudy or overcast, the bottles must be out for two days (see figure below).

### "How long must the SODIS bottles be in the sun?"



Very sunny

Sun and clouds

#### Lots of clouds

SODIS does not work on rainy days.

#### WATER SOURCES

#### 16) What water can be used for SODIS?

Any freshwater that is not muddy or contaminated with chemicals can be used for SODIS including public utilties water, water from wells and rainwater.

## 17) Should I use SODIS for rainwater or is rainwater safe to drink?

While rainwater can provide a relatively safe alternative to other water sources, contamination from roofs, gutters and tanks can sometimes occur. It is therefore best to treat the water (by boiling or using SODIS) beforehand to reduce the risk of sickness for you and your family.

#### 18) How is water contaminated?

Water from public utilities, wells and tanks can get contaminated when exposed to harmful germs. It is mostly understood that it is not safe to drink water from pipes, wells or tanks before treating it first.







Any freshwater (that isn't muddy or contains chemicals) can be used for SODIS.

#### NUMBER OF BOTTLES NEEDED

### 19) How many bottles should one family make every day?

The World Health Organisation (WHO) recommends 2.5 – 3 litres of water per person per day to meet basic drinking and eating needs. This would mean each member of your family needs two 1.5 litre bottles each day. You may also want to SODIS extra bottles for washing food, bathing children, etc.

#### **SODIS BOTTLES - SIZE**

### 20) What size bottles can we use for SODIS?

You can use bottles up to 1.5L for SODIS. If the bottles are larger than this the sun cannot reach all the germs. Make sure that bottles have a lid and close tightly. Children may prefer smaller bottles (so it's easier for them to hold when they drink).

## 21) Can we make SODIS water inside a drum or another big container?

No. SODIS will not work in larger containers as the sun cannot reach the water at the bottom of the container and therefore will not be able to kill off all the germs. You must use a bottle that the sun can easily reach all the germs in the bottle.

#### **SODIS BOTTLES - TYPES**

### 22) What kinds of bottles can I use for SODIS?

You can use any clear plastic bottle from 500ml to 1.5 litres.

Do not use tinted or coloured bottles. Coloured plastic will block the sunshine from reaching the water in the bottles.

## 23) What types of plastic bottles are best to use for SODIS?

At the bottom of the bottle should be the PET sign or the number 1 triangle symbol. PET is a type of plastic that is strong and safe. It cannot melt in the sun and will not contaminate the water with chemicals from the plastic.



#### 24) Can I use glass bottles for SODIS?

Yes, you can use CLEAR glass bottles up to 1.5 litres for SODIS. However, as glass can chip and break, it may be better to use plastic which is stronger.

#### **BOTTLE DURATION**

#### 25) How long can I use the same bottles?

If you look after them well, you can use the same bottles for 3 to 6 months.

### 26) When will I know when to replace the bottles?

You must replace the bottles when they become scratched, dented or not clear. If there are too many scratches on the bottle the sun cannot easily shine through the bottle. You must get new bottles.

#### **BOTTLE SUPPLY**

#### 27) Who will supply the bottles?

You can collect bottles from hotels or restaurants or from recycling centres. You can also buy them new. It is important to label your bottles on the bottom to prevent others from using them.

#### **STORAGE AND USE**

## 28) How long can you keep/store the water after SODIS?

If unopened, bottles can be stored for up to three days in a dark place. Beyond three days, any bacteria that may be left in the bottles after SODIS, may reproduce and pollute the water making it unsafe for drinking.

## 29) Once I open the SODIS bottle after treatment, how long is the water safe to drink?

Once the bottle has been opened after SODIS, the water should be drunk soon after to reduce the risk of any potential bacteria/algae in the water making the water unsafe for drinking.

## 30) Can I SODIS multiple bottles and use them the next week?

No. It is not safe to store unopened SODIS bottles for more than three days.

## SODIS water storage and use Guidelines

- If unopened, SODIS water bottles can be stored for up to three days in a dark place.
- Drink SODIS water directly from the bottle.
- Do not pour the SODIS water into another glass or container (unless it has been washed first with soap and clean water).
- Do not share the bottles with other people. They could be sick and sharing water could mean sharing germs.

## 31) What is the best way to drink water made safe through SODIS?

Drink SODIS water directly from the bottle. There is a risk of contamination if the SODIS water is poured into another container or glass that may not be clean. If you pour SODIS water into a glass, make sure the glass has been cleaned using soap and clean water. Do not share the bottles with other people. They could be sick and sharing water could mean sharing germs.

## 32) What does it mean if algae appears in the water?

Algae is a sign that SODIS is not working. This may be because the SODIS bottles have been left out during rainy days when SODIS does not work. It is best to fill the bottles with water just before starting SODIS on a sunny or cloudy day.

## Drink SODIS water directly from your personal bottle.



## SODIS is cheaper than boiling water.



#### SODIS vs. BOILING

## 33) Is SODIS better than boiling water on the fire or stove?

Both SODIS and boiling water are effective ways to disinfect water.

If you boil water on the fire or stove for 10 minutes after the water has started to bubble, 99.9% of the germs are killed and the water is safe to drink. If you do not boil for 10 minutes, there may still be germs and you and your family may get sick. SODIS cannot be used on rainy days, in which case boiling should be used.

If you put SODIS bottles in the sun for six hours, or two days in a row on cloudy days, 99.9% of the germs are killed and the water is safe to drink. SODIS uses the power of the sun's heat and ultraviolet radiation to disinfect the water.

It is important to note that neither boiling water nor using SODIS removes the chemicals that can be found in polluted water (such as a build-up of nitrates found in water in heavily-populated areas). Health risks have been associated with drinking water high in nitrates, so it is best to drink rain or public utilities water when possible, rather than well water.

## 34) What are the benefits of using SODIS?

SODIS is cheap. You don't need firewood or kerosene. It is also cheaper than buying bottled water and as safe.

SODIS is simple. It can be done by any member of the family.

SODIS is safe. Research in Kiribati proves that 99.9% of germs are killed after six hours in the sunshine or two days in a row in cloudy weather.

SODIS is good for children. Small 500mL bottles can be used for SODIS for children.

SODIS saves time. It does not take much time to prepare the bottles for SODIS and find a spot where they can be left in full sun for six hours.



#### **SODIS WATER USES**

#### 35) How can we use SODIS water?

SODIS water is clean of germs and can be used for:

- Drinking
- Making tea, coffee, hot drinks, and juice
- Washing fruit and vegetables
- Preparing food
- Making baby food (from 18 months)
- Bathing babies
- Ice-blocks
- Medication
- Cleaning teeth

## SODIS iceblocks provide income.

## SODIS – SAFE FOR BABIES AND CHILDREN

## 36) When can I introduce SODIS water to my baby?

SODIS water can be introduced to children when they actively move around and start to drink on their own (around 18 months).

## 37) Is SODIS safe for children under five years?

Yes. SODIS water is safe for all members of the family, especially children. UNICEF uses SODIS in schools around the world.

## 38) How do we know that SODIS is safe for children?

Since its first use in 1980, many studies have shown that SODIS is safe for children. In several studies the number of children with diarrhoea from contaminated water was cut in half when the family started using SODIS for all their drinking water. See <u>http://www.sodis.ch/methode/forschung/</u> <u>index\_EN</u> for a list of research published on SODIS.



#### SODIS – DANGERS/HARM

## 39) How can I tell if the water in the SODIS bottles is safe to drink?

It is difficult to tell at the user level how effective the SODIS process has been (i.e. there is not a simple way to tell). Whilst there are ways to test if the treated SODIS water is safe for drinking, this is not possible for each SODIS bottle. If the proper SODIS process has been followed, it is proven that 99.9% of harmful germs found in the bottles are killed through SODIS.

## 40) Can the plastic bottle melt in the hot sun?

PET bottles are made with less harmful chemicals and do not release chemicals into the water to harm our health. Check the bottles for the PET or number 1 triangle symbol.

#### 41) How do we know the SODIS water is not "poisoned" by the plastic in the bottle?

Numerous scientific studies have shown that when the SODIS method is applied correctly, there is no danger to our health. For more information visit: www. sodis.ch/methode/forschung/publikationen/index\_ EN#pet-bottles

#### SODIS KNOWLEDGE

## 42) Who in the house should prepare the bottles for SODIS?

Everyone should be taught how to do SODIS, including children. One person should be responsible for placing bottles in the morning and bringing them back inside at the end of the day.

## 43) Who should we teach about SODIS and why?

All members of the community should be given the opportunity to learn about SODIS. Some of the freshwater available in Pacific Islands is not safe for drinking. It needs to be cleaned, either by boiling or using SODIS to remove germs that make us sick. Share your knowledge about SODIS to your family and friends. Encourage them to try SODIS to protect their children and families from the harmful health effects of contaminated drinking water.

## Everybody in the community should learn the SODIS method.





The 'SODIS for the Pacific' video describes a technique for disinfecting water in Kiribati. SODIS is an inexpensive, reliable and safe method that has spread throughout the developing world. Although more than five million people in 50 countries globally disinfect their drinking water with SODIS, this technique is hardly known in the Pacific region.

The video describes the benefits and the steps to disinfect drinking water using only the power of the sun. The video was produced nationally by the Kiribati Ministry of Health and Medical Services (MHMS) – Environmental Health Unit and remastered by the Pacific Community. It was funded by the European Union through the Pacific Community implemented Global Climate Change Alliance: Pacific Small Island States (GCCA:PSIS) project.









