

Report on

# Natural Punguza™ Trials

## Kathome Location, Kitui County, Kenya

-sustainably eliminating odour, insects and solids in latrines-

**Presented to:**

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April 2017

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## Acknowledgements

This document presents the results of a pilot project in Kitui County, Kenya implemented by Revive Consulting Solutions Ltd. with the endorsement and human resources support from the UNICEF WASH Kenya program. In the pilot trials, the effectiveness of Natural Punguza™ was established. Natural Punguza™ is a natural sanitation retail product jointly developed by Revive Consulting Solutions Ltd. (Kenya) and SciCorp International Corporation (Canada). I wish to thank M. Eng. Derk Maat, President and CEO of SciCorp International Corporation, for his unwavering technical and moral support.

The pilot trials were made possible because of the valuable contributions made by many more people. Firstly, I would like to thank Caroline Mungara who believed in the potential of Natural Punguza™ to make a huge dent in solving sanitation issues in Kenya and beyond. Caroline introduced us to Agnes Makanyi, WASH Specialist in the UNICEF-Kenya office, whom I would like to thank for being willing to work with us to introduce Natural Punguza™ to schools, and for introducing us to her WASH Specialist colleagues, Shiva Singh, Pamela Koskei and Jimmy Kariuki. I thank Shiva for his enthusiasm not only for the sanitation and hygiene benefits of Natural Punguza™, but also for the economic benefits due to Natural Punguza™'s affordable price point, distribution model, and its ability to create jobs, as well as its environmental benefits. All these factors drive its sustainability. Indeed, it is the mission of Revive Consulting Solutions Ltd. to make sustainable social, economic and environmental impact with Natural Punguza™.

I also wish to thank UNICEF's Jimmy Kariuki for taking John Kithinji of Revive Consulting Solutions Ltd. to the field, and introducing him to the stakeholders and beneficiaries of the Open Defaecation Free program in Kitui County. I also thank John for his commitment to this pilot project. Our gratitude is also extended to Alex of Lixil, the County Public Health Officer, and the Community Health Volunteers for their willingness to support the Natural Punguza™ trials and for helping to identify the pilot homes and schools.

Everyone named here and many others not named here helped make this pilot study successful. It is for improved sanitation and dignity for children and their future generations that we commit this report as well as the sustainable business model to sustain the efforts of UNICEF, the Government of Kitui and all their partners.

Anja Oussoren, MSc.  
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April 2017



## Acronyms

|                  |  |
|------------------|--|
| BOD              | Biological Oxygen Demand                               |
| CHVs             | Community Health Volunteers                            |
| CHWs             | Community Healthy Workers                              |
| CLTS             | Community Led Total Sanitation                         |
| COD              | Chemical Oxygen Demand                                 |
| H <sub>2</sub> S | Hydrogen Sulfide                                       |
| ODF              | Open Defecation Free                                   |
| UNICEF           | United Nations International Children's Emergency Fund |
| USD              | United States Dollars                                  |
| WASH             | Water, Sanitation and Hygiene                          |
| WHO              | World Health Organization                              |

## Executive Summary

The UNICEF WASH (United Nations Children’s Fund - Water, Sanitation and Hygiene) Strategy for 2016 – 2030 outlines its contribution to global efforts to meet the water and sanitation Sustainable Development Goal (SDG 6) and the broader SDG agenda, targeting priority WASH interventions for children. The Strategy articulates how UNICEF will continue its core work in hygiene while doing more to build enabling environments. This includes building partnerships with the private sector to provide WASH goods and services and mobilizing the broader business community’s contribution to SDG 6.

In Kenya, the UNICEF WASH program works in 5 Counties to achieve Open Defaecation Free (ODF) status. To ensure people are not defaecating in the open, homesteads must have and use pit latrines. Recently, Kitui County was the first semi-arid County in Kenya to be declared free from open defaecation, meaning every homestead in the County has a pit latrine. This is a great achievement. The sustainability of the ODF status, however, could be threatened because once latrines are full of sewage solids, households may find it difficult to afford building a new latrine.

Revive Consulting Solutions Ltd. (REVIVE) is a water and wastewater management company incorporated in Kenya. The company has a team of national and international water and wastewater scientists and engineers, whose mission is to sustainably solve water and sanitation problems in Africa, thereby contributing to SDG 6. To that end, in 2016, REVIVE (Kenya), in collaboration with SciCorp International Corporation (Canada) developed a low-cost, packaged “bottom of the pyramid” natural product that solves the problems of bad odour, disease carrying insects, and sewage solids build-up – which are common problems of pit latrines and which threaten the ODF status. The product is branded as Natural Punguza™ (the word “punguza” means “to reduce” in Kiswahili) and is sold for less than USD 5 per 60ml bottle, which is sufficient for one household managing one latrine for one month or longer.

In a meeting with UNICEF WASH Kenya program officers in February 2017, REVIVE introduced Natural Punguza™ as a potential product to address sanitation issues associated with pit latrines. Natural Punguza™ is a retail product developed by REVIVE in Kenya in collaboration with SciCorp International Corporation (Canada) - the company from which the bacterial nutrients contained in Natural Punguza™ are sourced. These nutrients, patented by SciCorp, are used to address wastewater problems in 15 countries around the world, and growing. See Appendix 4 for additional details about Natural Punguza™.

Natural Punguza™ addresses pit latrine sanitation problems by:



- increasing the rate of digestion of the solids in latrines and therefore reducing the chance of human contact with faeces and also increasing the lifespan of the latrines;
- reducing insects that contribute to the spread of diseases; and
- eliminating odours.

During the said meeting, it was agreed to introduce Natural Punguza™ through pilot trials. REVIVE donated twenty 60ml Natural Punguza™ bottles to the community health unit in Kathome, Kitui County, the pilot site. REVIVE also developed and provided feedback forms to facilitate the data collection process, and monitored the progress of the pilot sites.

REVIVE sent a technical staff member to accompany UNICEF staff to Kitui on 21-24 February 2017 for a series of sanitation stakeholders' forums where Natural Punguza™ was introduced. In addition, during the trip, discussions on the trials were held with the relevant authorities in the County Public Health and Education offices as well as with Community Health Volunteers (CHVs) who would assist with the monitoring. The concerted efforts of UNICEF, the Kitui County public health office, CHVs and other stakeholders in parts of Kitui Rural sub-county (lower Yatta) have resulted in ODF status (meaning each homestead has a toilet) and moved to post ODF initiatives aimed at ensuring the sustainability of the ODF status.

Kathome Village, which hosted the piloting of many of the ODF initiatives and is currently in the post ODF stage, was selected to host the Natural Punguza™ trials. A selection criterion was developed to select 4 schools and 11 homesteads as trial sites for Natural Punguza™ (see Appendix III for selection criteria). The community unit comprising the CHVs from this area was tasked with the responsibility to select the trial sites and to sell the Natural Punguza™ donated by REVIVE as a means of raising the seed capital to purchase the next order of the Natural Punguza™ product for onward selling (with a profit) to the community. It was agreed that the trials be conducted between 1 and 30 March 2017.

On 21 March 2017, REVIVE technical staff visited the trial area to assess the progress and collect the preliminary results: in the trial household sites, where the application guidelines were followed, the solids in the latrines were reduced by 1-4 feet in a two-week period and the odour and insects were eliminated. The reduction of solids up to 4 feet is a remarkable result which can only be attributed to the shock dose of Natural Punguza™ and the high temperatures inside the pit: for every increase of 10 degrees in temperature, the rate of the bacterial reactions doubles. In addition, the households which added more water to their (generally dry) latrines achieved the higher sludge reduction rates of four feet. Because water is scarce in the area, we encouraged households to pour dishwashing water down the latrine, instead of the regular practice of pouring it on the yard.

The outcome in the schools was not as remarkable because of under-dosing Natural Punguza™ due to the design of the latrines whereby eight latrines used by 106-120 pupils are constructed on the same pit. Natural Punguza™ in 60ml bottles is designed for a single latrine with 20 users or less per day, and no adjustment was made for this during the trial.

Additional challenges included CHVs selecting the appropriate trial sites, CHVs monitoring all the sites because the households are far apart, and monitoring forms not being completed due to low literacy levels. REVIVE staff collected data from 9 of the 15 trial sites by either visiting the sites or by interviewing the owners of the latrines away from their sites; this is the data that is presented in this report.

The pilot has clearly demonstrated that Natural Punguza™ offers a sustainable social impact business model that supports UNICEF post ODF efforts. These results can be replicated in other counties in Kenya, in other African countries and indeed, globally. The key sustainability results were:

1. Natural Punguza™ eliminated the bad odours associated with latrines and enabled children and adults to use latrines with dignity.
2. Natural Punguza™ eliminated large and small insects in latrines (large bottle flies, mosquitoes, maggots, large cockroaches), enabling children to use latrines without fear.
3. Natural Punguza™ reduced the solids in the latrines, enabling the home owner / school to lengthen the lifetime of the latrines, from the current average of three to five years to many times longer; this is an advantage to the environment (no need to cover a latrine's pit and finding another location for a latrine) and to the household / school budget (no need to raise between \$600 and \$1500 to build a new latrine).
4. Natural Punguza™ offered an excellent price point, making it available to people in the villages. For less than USD5 (retail price), someone can purchase a one-month's supply and for less than \$60 a one-year's supply of Natural Punguza™ (12 bottles; 1 per month) to maintain a latrine to be free from odour, insects and solids.
5. Natural Punguza™ creates jobs for distributors, plumbers, stockists and individuals such as CHVs who wish to promote the product door to door because the product is available to them at wholesale price, enabling them to onward sell for the retail price with a profit of at least USD1 per bottle.
6. Natural Punguza™ is a non-toxic, natural product that simply feeds the beneficial bacteria already present in the pit latrine. It is safe to handle by people, does not harm animals and is beneficial to the environment (the leachate into the ground from the pit latrines is cleaner than without Natural Punguza™).

**In summary**, Natural Punguza™ offers affordable benefits in pit latrine sanitation and hygiene that will go a long way in sustaining ODF status. It also provides environmental, economic, health, learning and other social benefits through a sustainable business and distribution model.



## Introduction and Background

Access to improved/adequate sanitation facilities is a major challenge in many emerging and middle economies. Improved sanitation is defined as flush toilets or covered pit latrines. Lack of access to adequate sanitation has been linked to diseases, particularly affecting children. Data from the last twenty years indicates that inadequate sanitation is ranked sixth and eighth among the leading causes of years of life lost for women and men, respectively. In Kenya, 90% of reported diarrheal diseases and related annual mortalities can be linked to inadequate sanitation. More than 50% of hospital visits in Kenya are attributable to diseases associated with poor sanitation, insufficient water and poor hygiene. These diseases are rated as the number one cause for the hospitalization and mortality of children under five. Consequently, in Kenya, a child dies every 17 minutes of a preventable diarrheal disease. In addition, lack of access to adequate sanitation also affects learning because many hours are wasted queuing to access toilets and seeking treatment for WASH-related illnesses (Kahenda, et al., 2016; WHO/UNICEF Joint Monitoring Program, 2015; World Bank, 2016).

### Sanitation Statistics

An estimated 2.4 billion people in the world have no access to improved sanitation facilities. Of this population, approximately 49% live in rural areas while 19% live in urban area. In addition, of the 2.4 billion people, 946 million people (13% of the global population) have no access to sanitation facilities and must, therefore, defecate in the open. Of this population that practice open defecation, 849 million (90%) live in rural areas.

Sub-Saharan Africa faces the biggest challenge with only 30% of the population having access to improved sanitation (WHO/UNICEF Joint Monitoring Program, 2015). An estimated 695 million (29%) of the 2.4 billion people without access to improved sanitation live in sub-Saharan Africa. While access to improved sanitation in other regions of the world has increased significantly since 1990, in Sub-Saharan the situation has worsened in that the population without an improved sanitation facility increased by almost 200 million (African Ministers' Council on Water, 2012; The Water Project, 2016; WHO/UNICEF Joint Monitoring Program, 2015; Water Aid, 2017; World Bank, 2016).

In Kenya alone, 32.7 million Kenyans (about 81% of the entire population) lack access to improved sanitation (Team +254- Nairobi, 2016; Mugo, 2010; Water & Sanitation for the Urban Poor, 2013; Water Services Regulatory Board, 2015). 21 million people use unsanitary and shared latrines, and 6 million people defecate in the open due to lack of access to any kind of toilet or latrine facility.

## **Kitui County**

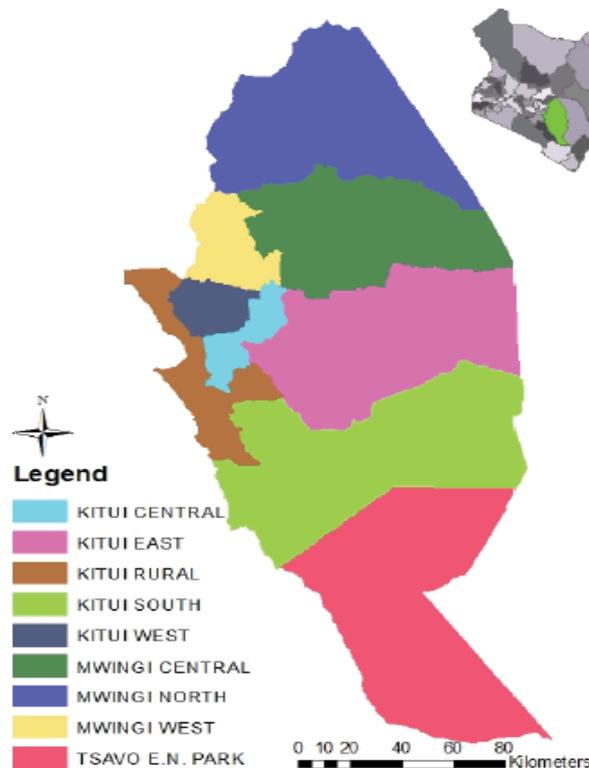
Kitui County is located in the former Eastern Province of Kenya, about 160 km east of Nairobi. The county occupies an area of 30,496.5 square kilometers and has a population of 1,012,700 people. The county borders Tharaka Nithy and Meru Counties to the north, Embu County to the northwest, Machakos and Makueni to the west, Tana River to the east and southeast and Taita Taveta to the south. The County is divided into 8 sub-counties: Mwingi North, Mwingi West, Mwingi Central, Kitui Central, Kitui East, Kitui South, Kitui Rural and Kitui West. Further, the county has 40 Wards and 247 villages. Kitui County is one of the semi-arid counties and thus is mostly dry and hot with temperatures averaging 14° C during the coldest months (July-August) and 34° C during the hottest months (January-March). The county receives between 500mm and 1050mm of rainfall annually, with average rainfall of 900mm a year. Kitui County is one of the counties that is negatively affected by lack of access to improved sanitation with 31% of the population in the rural areas practicing open defecation in 2014 and only 29.2% having access to improved sanitation facilities (Water and Sanitation Program, 2014). Through the efforts of UNICEF and the Kitui County public health department, Kitui County has now moved towards ODF (open defecation free) status.

Kitui County loses 859 million KES (USD 8.3 million) each year due to poor sanitation. This includes losses due to access time, premature death, health care costs and productivity. This estimate does not include some costs that could be significant (such as water pollution and tourism) and is therefore likely to under-estimate the true cost of poor sanitation. Unimproved sanitation and open defecation have been linked to low height-for-age scores in children. Stunted children suffer a higher mortality due to infectious diseases such as diarrhoea, pneumonia and measles as well as being more likely to have poorer cognitive and educational outcomes. Adults who are stunted are more likely to earn less. It is estimated that up to 42% children in Kitui County are stunted (Water and Sanitation Program, 2014). Kitui County was specifically selected for the Natural Punguza™ trials because of the ongoing joint program of UNICEF and the County's public health department to move the county to open defecation free (ODF) status.

The ongoing UNICEF program focuses on sensitizing the community to achieve ODF status through a community led total sanitation (CLTS) approach. This approach encourages community behavioral change through the involvement of community leaders, community health volunteers, public health officials and other stakeholders in the sanitation sector.

The stakeholders developed a list of four main ODF indicators to monitor and evaluate the progress towards ODF status. These indicators are: 1) privacy of the toilet, 2) hand washing facilities, 3) aperture cover and 4) clean floor. Through the collaborative effort, some villages have moved to ODF status and are now implementing post-ODF status activities that focus on sustainability. Natural

Punguza™ will play a crucial role in sustaining ODF status through the elimination of odour, insects and reduction of sewage solids.



*Figure 1 - Map of Kitui County and Sub-Counties*

## The Trials

The goal of the first visit by REVIVE with UNICEF WASH program staff to Kitui County (specifically, lower Yatta of Kitui Rural sub-county) on 21-22 February 2017 was to assess the possibility of sustainably pilot testing Natural Punguza™ in latrines as part of the post-ODF program. During the visit, it was agreed that trials of the product be conducted in Kathome village. A selection criterion was developed to select 4 schools and 11 homesteads as trial sites for Natural Punguza™ (see Appendix 3). REVIVE donated twenty 60 ml Natural Punguza™ bottles to the community health unit comprising of the CHVs from the selected area, who in turn sold the products to the 4 schools and 11 homesteads as a means of raising the seed capital to purchase and resell the next order of Natural Punguza™. The Kathome area was selected, with the guidance of the Kitui County Public Health Officer, on the basis of having achieved ODF status and having moved to post-ODF activities which deals with sustaining the ODF status. Kathome has hosted the piloting of several ODF initiatives (such as the Satopans which cover the latrine holes) and thus the CHVs in the area are experienced in monitoring pilot projects. The CHVs from the area helped with the actual selection of the trial sites, co-ordinating and monitoring (follow-up) the trials.

REVIVE staff made a follow-up visit on 21-22 March 2017 to assess the progress of the piloting of Natural Punguza™ and collect preliminary data of the trials. During the said visit, astounding sanitation and economical results were obtained. This is despite the fact that there was a challenge in getting the trial sites within the predetermined time and therefore some trials began later than 1<sup>st</sup> March 2017, and that some of the data was not available. Consequently, the only data available was from 9 of the 15 trial sites. This report compiles the findings of the trials, the challenges and the way forward.



## Methodology

Four schools and 11 homesteads were selected by the Chairman of the CHVs for the Natural Punguza™ pilot trials. Water scarcity is a reality in this location and the pit latrines' contents were dry. We encouraged households and schools that instead of pouring their dishwater onto the yard, to pour their dishwater into the pit latrine. Selection criteria for the pilot sites is outlined in Appendix 3.

One homestead and one school were selected because they had latrines that were over  $\frac{3}{4}$  full, had strong odour and had maggots and/or other unhygienic insects such as large cockroaches and large green bottle flies. In these two sites, a shock dose of one bottle of Natural Punguza™ was mixed in 20L of water every day for three days. This was followed by the regular dosage of 2.0mls of Natural Punguza™ (equivalent to half a bottle cap full of the Natural Punguza™ bottle) mixed in 1L of water every day for the next 24 days.

Four schools and 10 homesteads with less than half filled latrines but with strong odour and unhygienic insects were selected for trials not requiring a shock dose.

The CHVs approached the heads of households and head teachers of the schools to purchase the required bottles of Natural Punguza™ and to approve the collection of data on the outcomes of the trials. Those that gave consent were given feedback forms to complete and to note any changes in the latrine during the trial period. (See Appendix 2 for the feedback form). During REVIVE's monitoring visit, forms that were completed were collected, participants were interviewed and several trial sites were visited. One of the CHVs had taken the initiative to measure the sludge depth in the latrines of the homesteads he was monitoring using a stick prior to the application of Natural Punguza™. The sludge depth in these latrines was measured again during the monitoring visit to confirm sludge reduction.

## Findings

During the monitoring visit, four homesteads and two schools were visited and three participants were interviewed away from their homes to establish the outcomes of the application of Natural Punguza™ in their latrines. See Appendix 1 for photos. All the participants reported positive results in terms of sludge reduction and smell and insect elimination. The table below is a summary of the preliminary findings and observations.

**Table 1 - Results of Natural Punguza™ in pilot latrines in Kathome, Kitui County, Kenya**

| Trial site | Name of User           | Village     | Cell number  | Latrine's condition before applying Natural Punguza™  | Latrines condition after dosing Natural Punguza™  | No. of Days Natural Punguza™ was applied |
|------------|------------------------|-------------|--------------|---|---|--|
| 1.         | Gideon Ngambi          | Kamanyi     |              | Latrine had 1 foot of space remaining between the toilet's aperture and top of the sludge and had very strong smell detectable from an adjacent road. The owner had already constructed another latrine and was no longer using the latrine in which the trial was conducted. | The sludge reduced by 1.5 feet. The smell was eliminated.                               | 16 days                                  |
| 2.         | *Monica Peter          | Maito       | 0714-598 524 | Latrine was almost full, had a strong smell, and was infested with maggots.   | Sludge reduced by 1.25 feet, maggots still present, smell reduced.                      | 12 days                                  |
| 3.         | **Nelly Kambua         | Nthongoni A | 0720-950 469 | Toilet ¾ full, had strong smell, had cockroaches and flies. User was planning to get a loan of USD 770 to construct a new latrine.  | Remarkable sludge reduction of 3-4 feet (no longer visible) and smell, cockroaches gone | 19 days                                  |
| 4.         | Silus Mutinda          | Kyambusya   | 0727-266 089 | Toilet had strong smell, maggots and cockroaches.   | Smell, maggots and cockroaches gone   | 16 days                                  |
| 5.         | Fredric Kitunda        | Wang'ata    |              | Toilet had strong smell, cockroaches, and large green Bottle Flies.   | Smell, cockroaches, and flies gone.   | 16 days                                  |
| 6.         | *Jennifer Nyiva        | Kyusyani    | 0715-275 651 | Toilet almost full.   | The sludge reduced by 1½ foot.  | 19 days                                  |
| 7.         | Ngei Kenga             | Nzeve       | 0735-449 770 | Toilet had strong smell and maggots.  | Smell and maggots eliminated.   | 20 days                                  |
| 8.         | Nzeve primary school   | Nzeve       |              | Toilet almost full, had strong smell and maggots.   | The smell and maggots have reduced but still present.                                   | 19 days                                  |
| 9.         | Kathome primary school | Kathome     |              | Toilet was almost full, had very strong smell and had flies.  | Sludge reduction of 2-3 feet (not measured), smell reduced and flies gone.              | 21 days                                  |

\*the participant did not pour water in the latrines except for mixing 1L of water with every 2.0ml of Natural Punguza™.

\*\* the participant, in addition to dosing Natural Punguza™, poured approximately 20L of dish water per day into the latrine.

## Discussion and Value Proposition

Natural Punguza™ reduces sludge and eliminates odour and insects. Sludge reduction is important for post-ODF sustainability because the cost of constructing a new pit latrine in the Kathome area is costly. The sandy soils of the area cause latrines to collapse easily, thus requiring that the pits of latrines are lined with bricks. In addition, in some of the areas, especially in the Yatta Plateau, the rock basin is near the surface, adding to the cost of excavating the latrine. The estimated cost of constructing a new pit latrine when an existing latrine has filled is USD 1000 - USD 1500. Given that a pit latrine lasts a family 3-6 years before it is full, the cost of a new latrine represents an average cost of USD 250 – USD 500 per year. Natural Punguza™ will significantly reduce this annual cost to only USD 50 – USD 60 per year (USD5 per month) with the added benefits of eliminating latrine odour and insects and continually reducing its solids, allowing the latrine to be used for many more years.

The main objective of ODF status and sustaining the ODF status is to prevent diseases resulting from faecal contamination through direct or indirect contact with faeces. It also improves human dignity by providing a clean, comfortable and respectable space/toilet for people to defecate. Natural Punguza™ eliminates odour and disease-carrying insects, both of which otherwise make the use of latrines extremely uncomfortable, unhygienic, and for children, scary. A single fly, for example, carries up to 6,500,000 bacteria. By eliminating insects, Natural Punguza™ controls and prevents vector borne diseases as well as eliminates the fear children have of using the latrine due to the insects.

Natural Punguza™ is safe to handle, and will not harm people or animals. Containers used for mixing Natural Punguza™ with water can be rinsed and re-used for other uses. It does not corrode pipes or any other materials. Moreover, Natural Punguza™ is environmentally beneficial: the quality of the water that seeps from the latrine pits is, therefore, improved and safer for ground water. Lastly, by reducing the sludge in the pits, Natural Punguza™ saves space in the family or school compound and eliminates the need for dangerous, covered, filled sewage pits littering the compound.

**Table 2 - Results and Benefits of Natural Punguza™ to maintain ODF status**

|    | <b>Results</b> | <b>Benefit to Family / School:</b>   |
|----|----------------|--|
| 1. | Reduces solids | Ensures that the pit latrine lid can open and close without hindrance.   |
|    |                | Extends the life of the pit latrine.   |
|    |                | Makes pit latrine use more comfortable by users.   |
|    |                | Cost saving of USD 250 to USD 550 per family per year in an area where the annual wage is less than USD 480 per year.  |
|    |                | Sustains the ODF status  |
|    |                | Reduces the need for abandoning full latrines which become an environmental and human hazard in the compound, in that these full pits are a centre of contamination and a potential danger for falling in. |

|    |                         |   |
|----|-------------------------|---|
| 2. | Eliminates smell        | Eliminates the need of latrine users to remove their clothing before entry (this was done to prevent the smell lingering on their clothes). This is a significant problem for students in schools with smelling latrines. |
|    |                         | Re-establishes good relationships with neighbours   |
|    |                         | Makes use of pit latrine more comfortable and dignified.  |
| 3. | Eliminates insects      | Eliminates insects acting as disease vectors and carriers   |
|    |                         | Reduces illnesses caused by fecal contamination   |
|    |                         | Eliminates the fear young children have of the insects which prevents them from using the latrines which re-introducing ODF.  |
| 4. | Polishes the wastewater | The quality of the water seeping from the latrines into the ground is improved due to the effective bacterial action within the pit.  |
| 5. | Is Natural              | It is safe to handle by anyone and it is non-corrosive.   |
|    |                         | Does not harm people and animals.   |
| 6. | Creates jobs            | It is affordable at the retail price of less than USD5 per 60ml bottle  |
|    |                         | Is sold to hardware shops, distributors and CHVs at a wholesale price.  |
|    |                         | Is sold with a money-back guarantee, increasing buyers' confidence.   |

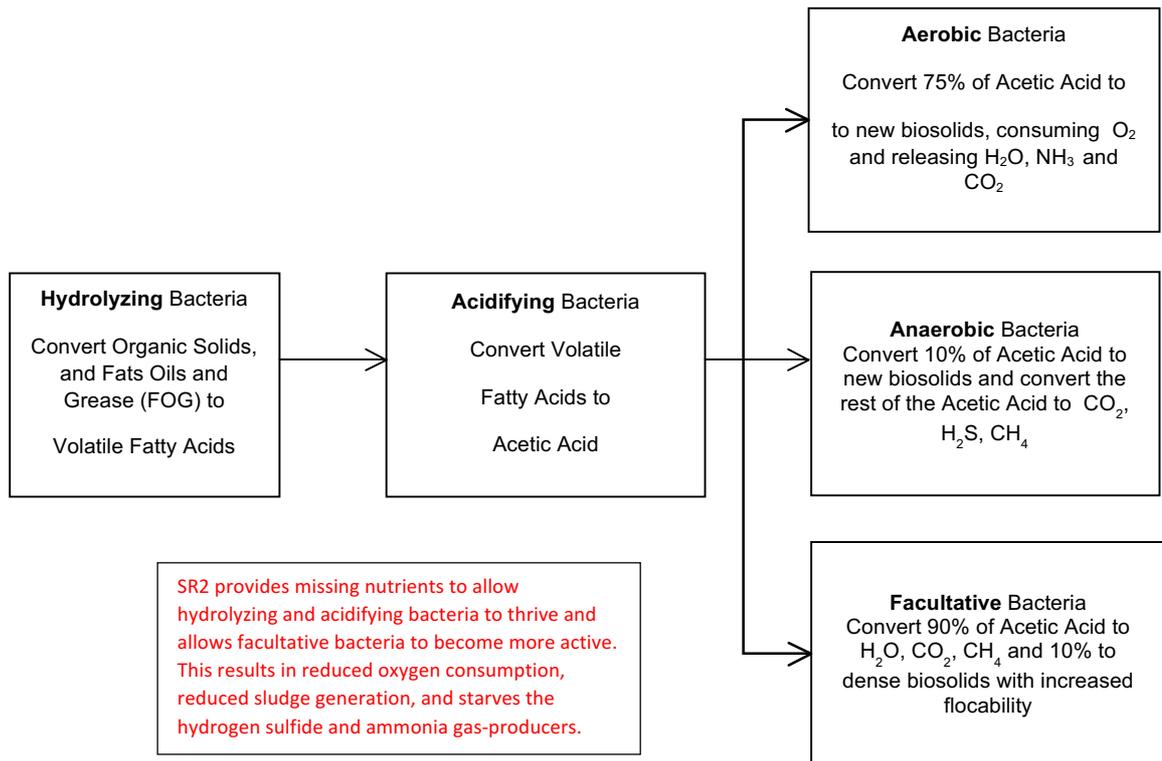
## The Science

The application of Natural Punguza™ bacterial nutrients results in the beneficial facultative bacteria out-competing the H<sub>2</sub>S producing bacteria. Unlike the odour-producing bacteria, the beneficial bacteria do not produce odour and they break down the solids.

This patented bacterial nutrient formulation that makes up Natural Punguza™ has been tried and tested in numerous waste water treatment facilities in 15 countries around the globe including in Kenya and significantly improves waste water treatment efficiency. A three-month pilot experiment with the nutrients (marketed as BIOLOGIC™ SR2 for larger applications) at the Kiambu Sewage Treatment Plant resulted in a reduction in sludge depth by 55%, a reduction in BOD and COD by 60% and a change in the colour of the effluent water from black to a clearer color (see the before and after photo in Figure 2).



**Figure 2 - Sewage effluent before and after Natural Punguza™ (SR2) nutrient injection**



**Note:** The amount of sludge and type of gases produced depends on the type of thriving bacteria population. “Bad bacteria” will produce more sludge and hydrogen sulfide gas while “good bacteria” produce less sludge and no H<sub>2</sub>S gas.

**Figure 3 - Normal biologic effluent treatment process and effect of nutrients on effluent treatment process**

## Challenges

One of the challenges encountered during the pilot trials was the perception by some of the community members that the introduction of Natural Punguza™ was a donor funded project and therefore some potential participants declined to purchase it. Consequently, the CHVs took longer to identify and establish the participants.

Secondly, it was not possible to obtain data from each of the 15 trial sites due to illiteracy and the remoteness of the sites. The CHV chairs were also not able to make all the follow-ups.

The schools presented a design challenge that was not considered. The latrines in the two schools visited are designed in such a way that there are eight latrines constructed on one pit. The eight latrines at Nzeve Primary School are used by 106 pupils while the eight latrines at Kathome Primary School are used by 120 pupils. While this gives an acceptable average of 14 students per latrine (design allows for 20 users per latrine), given that the Natural Punguza™ dosage is calculated on the assumption that a single latrine pit is used by a population of 20 people or less, the Natural Punguza™ applied in the schools was highly under dosed. Consequently, with the accurate dosing of one Natural Punguza™ bottle for each toilet or at least 5-6 bottles for the entire toilet block, remarkable results could be achieved.

Another challenge was adherence to following the instructions; this is indicated by the fact that a 60ml bottle is supposed to last 30 days but in the trial sites it lasted between 12-21 days. In addition, where the participants did not pour sufficient water in their latrines as instructed, the results were not as significant, though they were still impressive.

One of the major challenges was the illiteracy level or generally ignoring to complete the feedback forms properly which affected the volume of the data available. Where we could not visit the trial site because of the distance, we relied on the participants' verbal feedback.

## Way Forward

With the successful results of the Natural Punguza™ trials in Kitui, and with the endorsement of UNICEF, REVIVE can confidently market and sell Natural Punguza™ for the improvement of sanitation in Kitui County. REVIVE is exploring sales through existing distributors of other sanitation products (such as the Satopan through Lixil Water Technology and their local distributor Sil Africa), through the leaders of CHV units, through hardware shops, plumbers and interested individuals, in a collaborative effort with UNICEF and the public health offices to achieve and maintain ODF status regionally and globally.

REVIVE intends to repeat the school trial at one school in Kathome, to ensure that we record satisfactory and convincing results for the leaders and decision makers in education.

There is need to work with the County Education Directors in Kenya to incorporate a hygiene budget for Natural Punguza™ in the annual school budgets. This is because school heads believed - despite fundraising USD8.50 per student family for new latrines - they had no budget to purchase the Natural Punguza™ for their schools. A budget allocation together with the inspection and enforcement by public health officers will enhance the participation of schools in maintaining their toilets using Natural Punguza™. It will also postpone the need to invest additional capital for new toilets.

In addition to using Natural Punguza™, schools should be held accountable to repair doors to pit latrines and maintain general cleanliness inside the latrines for the good of the children. The girl child, especially, has no privacy when doors are broken and/or damaged which affects their school attendance and learning.

Moreover, Natural Punguza™ should now be introduced to the other four Counties in Kenya where UNICEF is working, as well as in other African nations and nations outside Africa where UNICEF is looking to achieve ODF status. We seek UNICEF's support to do so.

Lastly, REVIVE seeks the official endorsement from UNICEF for Natural Punguza™ as an affordable product with excellent price point, with excellent sanitation and hygiene results, with positive environmental and social results, and with a sustainable business and distribution model.

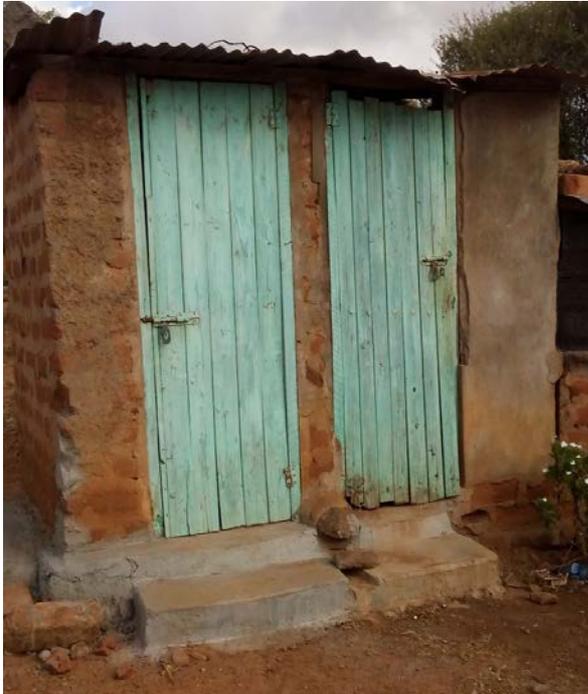


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## Appendix 1: Photos of several Pilot Trial Sites

*Trial site 1 (homestead) – smell was eliminated and sludge depth reduced by 1.5 feet over 16 days. Extra water was not added to the latrine.*



*Trial site 3 (homestead) – odour, cockroaches and flies eliminated and sludge depth reduces by 3-4 feet over 19 days. Extra water was added to the latrine daily.*



*Trial site 9 (school) – smell, maggots, flies and sludge were reduced. Sludge reduced by 2-3 feet over 21 days despite underdosing of Natural Punguza™*



*Entrance to Kathome Primary School*



*The surrounding landscape*



## Appendix 2: Feedback Form for Users of Natural Punguza™ for Latrines

Individuals/Institution's/ User Name:.....

Location:.....

Address/Contact:.....

Date of First Punguza Application:.....

Date of filling the form:.....

### *Initial Status of the Latrine*

**Smell:** 1) Not present [ ] 2) Weak Smell [ ] 3) Strong smell [ ]

**Insects present:** 1) Maggots (a) None [ ] (b) Few [ ] (c) Many [ ] 2) Flies (a) None [ ] (b) Few [ ] (c) Many [ ]  
3) Other insects (a) None [ ] (b) Few [ ] (c) Many [ ]

**Cleanliness of the Latrine:** 1) Dirty with Faeces on the floor [ ] 2) Clean [ ] 3) Very Clean [ ]

**Sludge depth:** 1) Pit less than half full [ ] 2) Pit half full [ ] 3) Pit more than half full [ ]

**Shock dose:** 1) If the pit latrine is more than half full; YES [ ] 2) If the pit latrine is less than half full; NO [ ]

**Average number of users per day:** \_\_\_\_\_

### *Daily Feedback for One Month*

| Date of Applying Punguza™ | Name of the person applying Natural Punguza™ | How Natural Punguza™ is Mixed and Applied | Any changes in smell, insects and depth of sludge | Comments by Users |
|---------------------------|--|---|---|-------------------|
|                           |  |   |   |                   |
|                           |  |   |   |                   |
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|                           |  |   |   |                   |
|                           |  |   |   |                   |
| Date of                   | Name of the person                           | How Natural                               | Any changes in smell,                             | Comments by Users |





### Appendix 3: Criteria for Latrine Selection and Trial Design

1. 1 school with an almost filled toilet, with strong smell and maggots/other insects - trial will be done in one latrine
  - Will require a shock dose of 1 bottle of Natural Punguza™ in 20L of water for three days. Then the normal daily dose for a month from day 4 i.e. 2.0mls in 1 L of water. Thus, a total of 4 bottles.
2. 3 schools with toilets that are about half filled but with strong smell and maggots/other insects – again, the trials will be done in a single latrine in each school.
3. 1 homestead with an almost filled toilet, with strong smell and maggots/other insects - trial will be done in one latrine
  - Will require a shock dose of 1 bottle of Natural Punguza™ in 20 L of water for three days. Then the normal daily dose for a month from day 4 i.e. 2.0mls in 1 L of water. Thus, a total of 4 bottles.
4. 10 homesteads with conditions as in no. 2 above - again the trials will be done in a single latrine in each homestead.

## Appendix 4 – Details about Natural Punguza™ for Pit Latrines



### PUNGUZA™ FOR PIT LATRINES

#### Direct Benefits of Punguza™

- Eliminates Odours
- Reduces Flies, Mosquitoes and Other Insects
- Reduces Solids

#### Indirect Benefits of Punguza™

- Improves relations with neighbours by eliminating the bad smell
- Improves physical health due to better hygienic conditions
- Improves mental health by everyone being able to use the Latrine with dignity
- Improves learning for students due to the improved hygienic and social conditions (clothes no longer retain the bad smell)



#### Financial Benefits of Punguza™

- Reduces the risk by the Public Health Department shutting down a school or other public institution due to the poor hygienic conditions of Latrines
- Eliminates the need to dig a new Latrine
- One 60ml bottle is enough for one month and costs Ksh 500 only

#### What is Punguza™?

Punguza for Pit Latrines is a natural, safe-to-handle, environmentally beneficial food additive solution that feeds the beneficial bacteria in the Latrine. As a result of feeding the beneficial bacteria, they become active. When these “good” bacteria are active, they do not produce bad odours and they eat up the organic solids. By feeding them, we are helping nature to do what it was designed to do.

#### How to use Punguza™?

1. Shake the bottle well before using.
2. If the Latrine is more than half full of solids, pour one 60ml bottle of Punguza™ into 20L (one jerrycan) of water. Mix well and pour down the Latrine. Do this for 3 days. Then follow the next instruction.
3. Daily, add 2.5ml of Punguza™ (that is, half the lid of the Punguza™ 60ml bottle) to one litre of water (or one debe). Mix well and pour into the Latrine at the end of the day. Do this every day.
4. If the Latrine is used by more than 20 people per day, increase the dosage proportionally.

#### Results of Punguza™

You will notice the following results when you use Punguza™ according to the instructions above:

1. After 4 days, bad odours will be gone.
2. After 7 days, the flies and other insects will have reduced.
3. After 1-2 months, you will begin to see a reduction in the solids in the Latrine.

Remember, Punguza™ feeds the “good” bacteria in the Latrine which are starving right now. Nature takes over as the good bacteria do their work. That is why the results are not instant and the results are very, very effective – because the process is natural and it is doing what nature intended it to do.

If you are not attaining the results, call Revive Solutions Ltd. for advice. We offer a money-back guarantee on Punguza™ because we know it works so well. It works because nature works.

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