

SECURITY MEASURES
FOR HAND DUG WELL CONSTRUCTION
INTER AIDE - CHISEKA WATER PROJECT - MALAWI

Damien Delaplace.
Project Officer, November 2007.

A- INTRODUCTION

1- Context and techniques

The security rules described below were set up for the hand dug well construction activity in 2007, by the IA Chiseka Water project in Lilongwe district, Malawi. Inter Aide's water activities in Malawi started in 1992 and 20 to 30 new hand-dug wells were built per year.

Water availability and quantity are rarely a problem in the area, but traditional water sources are unprotected and very shallow. Their water quality is therefore very bad. So the objective of the well construction activity is mostly to improve the drinking water quality. The wells are usually 6 to 10 meters deep. The communities first dig on their own (about 4 weeks of work), until the water recharge requests motorized pumping equipment. Then a well-builder, trained by the project, is sent to complete the digging (about 2 weeks) and the masonry work (about 2 weeks more, only for the tank). The tank is built with bricks from the surface down and as deep as possible (diameter 1.8 meter, which allows a good water storage volume). The tank bottom is built in concrete rings in case of collapsing soil (0.8 meter diameter minimum). An Afridev hand-pump is installed after the surface work completion (4 more weeks).

The borehole drilling technology would allow a very good water quality at the pump outlet, thanks to a deep catchment (often 0 coliforms / 100 ml). Nevertheless the drinking water is largely contaminated during transportation, storage at home, and inappropriate drinking behaviours (dirty buckets, dirty hands and dirty cups). Contamination can easily reach 50 coliforms / 100 ml. Considering these poor hygiene conditions, the project chose not to focus on a perfect water quality at the pump outlet, and to address this drinking water contamination problem through a 4-day hygiene education training for the whole community and before starting any well construction (the "PHAST" training activity). Therefore water quality targeted at the pump outlet isn't perfect. It is 10 coliforms / 100 ml maximum.

On the other hand, the project focuses on the well durability. In the Malawian context, the project chose to rely on the communities themselves for the maintenance. Yet communities are close to the extreme poverty level and have a low educational level. The project has to compromise. Therefore the project has also set up a maintenance system, "Mjigo Usafe". Considering the context, the water quality objective and sustainability objective, the technique chosen is the hand dug well, as:

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- Water quality reached is usually less than 10 coliforms / 100 ml
- Due to its large diameter, a man can easily work at the well bottom. This allows an easy maintenance by the community itself (cleaning and pump maintenance).
- The construction requires a huge community involvement (3 months of community work). This brings a strong feeling of ownership and good enough maintenance skills for this simple technology.

Borehole drilling, although easier and faster, is avoided because:

- Every few years, a borehole usually requests highly skilled people and expensive compressor to clean it (to blow it). The community cannot do it nor afford it itself. Consequently, there are many boreholes built by other organizations that have become dry.
- Sometimes some parts of the pump break and fall down at the bottom. Some other times, boreholes are found fill up with stones (a universal children game). These boreholes are condemned as their small diameter doesn't allow maintenance.
- It requests less community involvement, so less ownership feeling.

2- Dangerous working conditions

Any technique used for hand digging is potentially dangerous for the worker sent down in the well. The most common hazards are: objects falling from the top (stone, bucket, pick axe, etc.); side of a wall caving in; difficulties getting out of the well (i.e. broken leg), suffocation due to toxic gas (from motor-pump or generator) and in the water, electrocution (with the submersible pump). Within a few seconds, a well can become a fatal trap.

Workers down in the well rely on the surface workers. They don't know what is going on at the surface and have very little control. Therefore they can have communication difficulties with the surface workers especially if the latter are not paying attention.



3- Responsibilities

The work crew mainly includes volunteers from the village which ensure the community's participation in the project. These volunteers are inexperienced and unorganized. However, as they are being asked to work by the project, the project is responsible for their security.

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Security rules are often established... but not always followed in the field. Time and again, staff members slip into poor work habits because rules seem bothersome, are not understood and therefore, considered useless. It is the project's responsibility to constantly check that rules are followed.

4- Objectives of specific security measures

The main objective of the measures taken is to avoid accidents and/or reduce the gravity of accident mainly for the persons working down in the well. The specific objectives of the measures taken are:

- To keep an **enclosed and organized work area**,
- To **protect** workers from injuries by wearing individual protections (helmet, gum boots, gloves)
- To systematically use **harnesses** to ensure that surface workers are able to pull the workers out of the well quickly and easily.
- To use equipment found locally, to make sure that it is easy to use by the workers (so that it does not interfere with their work), and to make sure that it is easy to renew it when needed.

B- MEASURES TAKEN

1- Team mobilization

As the builders are the most familiar with and the most concerned by their working conditions, it is possible to raise their awareness about security with a participatory approach. Training sessions consist in:

- Questions and answers: what are the hazards they encounter at work and how do they solve them
- Brainstorming : how can they increase community involvement for security
- Workshop: knot tying and climbing techniques; try to make a harness with a rope (see below what kind of harness was then created).

Moreover the Inter Aide Well Builder is the only professional worker constantly on the site. The technician (his coordinator) is only occasionally on the site. Therefore the builder is fully trained and responsible for ensuring that the security measures are followed. He has to lead the village building team (authority, organization, technical referent). The technician, who regularly visits each builder, is in charge of following up the security conditions and verifying the equipment. Both workers have the authority to stop the work in case of security failure.

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2- Security rules list

A standardized form was produced which explains the Project Security Rules. It is translated in the local language (Chichewa) to be well understood by staff and community members. There are two copies signed by the community representatives and the technician (as the Inter Aide representative). Rules are as follows:

- The village headman selects 2 men in the village (named security men - if possible from the village committee) to be responsible for the security on site - one of these two men is always on the site when men are at work.
- Villagers are trained by Inter Aide on the work to be done and the rules to respect – the villagehead man and the two security men sign the document stating the rules before the work begins.
- The community builds a fence (6 m diameter minimum, 1.5m height, and a door 1m large) around the site before the work starts.
- The area within the fence is clean and in order. Ropes are in order.
- Only 6 people are allowed inside the fence, plus the security man – anyone else should be outside. No drunk person within the fence or around the fence. No children.
- The community builds poles to hang pulley and parapet / tailor around the well before the work start.
- Use ropes of 16 mm and pulley system.
- Each community receives 3 helmets, 3 pairs of gloves and 3 pairs of gumboots before starting the work (to be returned when the work is completed). Each Well Builder has his own helmet and pair of gumboots.
- Any person going down in the well must have a harness, helmet and gumboots. The security rope remains attached to the pole during work.
- There is one surface worker taking care of each well worker.
- When sending concrete rings, nobody should be inside the well or on the rings. Always wear gumboots and gloves.
- Equipment has to be in good state – villagers report to the builder, the builder reports to the technician.
- Motor-pump is forbidden inside the well.
- Motor-pump and compressor has to be minimum 10 meters away from the well and downwind.
- Generator and motor-pump engines have to be properly maintained by a mechanic.
- Nobody should be inside the well when pumping (wheter with theelectrical or the motor-pump).
- Only the technician has the authorization to use generator or motor-pump.
- Work can stop at any time if a rule is not respected.

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3- Community training



The community can dig up to 5 or 6 meters deep on its own, before the daily builder intervention. Considering the depth, security rules are already supposed to be followed. The fence building in particular is important to protect children from falling in. Yet, it is difficult to have the community following the project rules during this period as people don't have the builder leadership, and are usually unorganized, enthusiastic, without sense of the danger nor of such security rules. Anyhow, a first security training session and a digging equipment kit are provided (about 1 hour), followed by regular visits (about once a week).

- Rules are explained. Chiefs / elders and the whole community should agree.
- The chief chooses 2 community members, if possible from the committee, to be signatories. The chief and the 2 community members sign the rules.
- Demonstration of harness making and how to use it (pulling up somebody).
- Training on how to use work equipment (helmet, gumboots, gloves).

At the builder arrival, the whole community receives a second and similar training, by the technician and with the builder in charge of the site (well builders are trained before, and soon get experienced).

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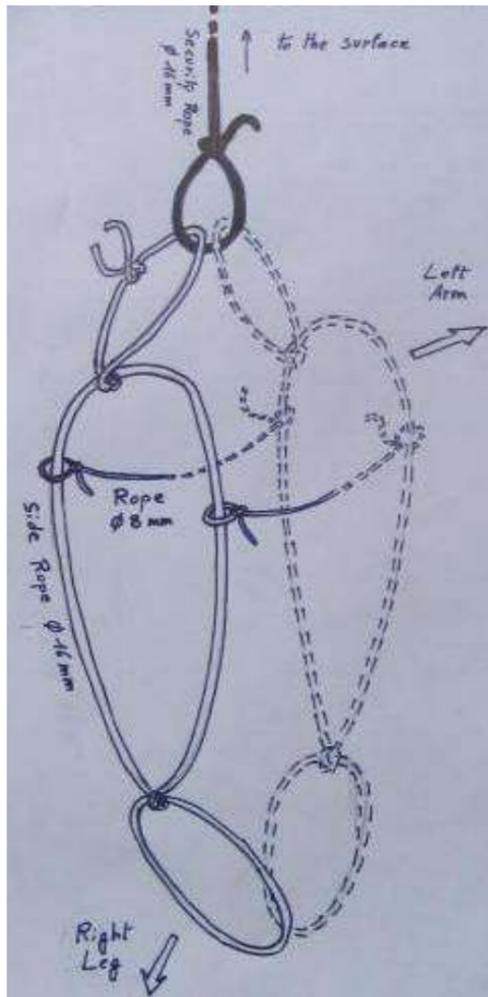


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C- TECHNIQUES

4- Harness



Harness scheme

Material:

- 2 usual nylon ropes diameter 16mm, 2,5 meters long each : the *side ropes*
- 2 usual nylon ropes diameter 8mm, 1 meter long each : the *transversal ropes*

Process:

- The leftside rope is first tied around the left leg, then around left shoulder, and then makes a loop in the back (to tie the security rope). Same on the right. The security rope fixes the 2 upper loops together.
- The 2 transversal ropes (chest and back) tie the 2 side ropes together. They should be adjusted.

Remarks:

- The worker literally "sits" in the rope. It is comfortable with diameter 16mm.
- Transversal ropes tie other ropes together around the chest. This prevents the worker

from sliding out of the loops if he is unconscious.

- The security rope (to pull up, diameter 16mm) is always attached to the back of the worker. Use a bowline knot for safety and to remove it easily.
- Knots have to be properly made, i.e. simple and clear. Improperly made knots may be unsafe and difficult to remove.

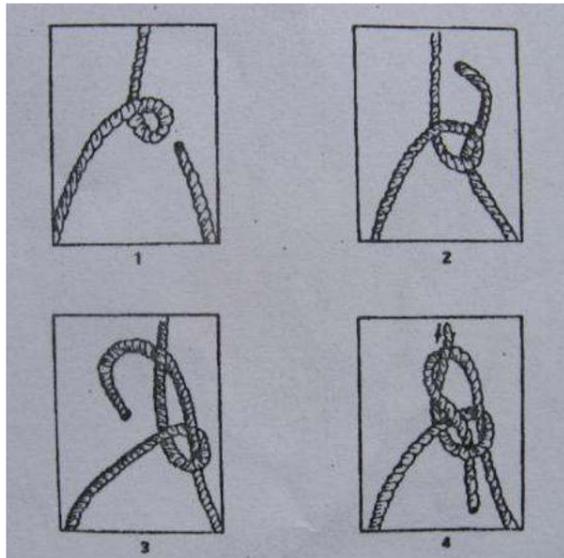
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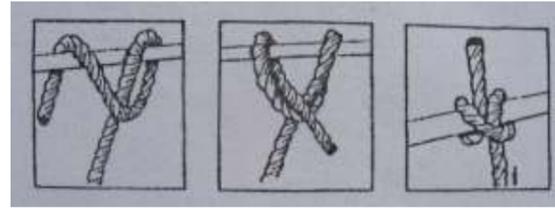
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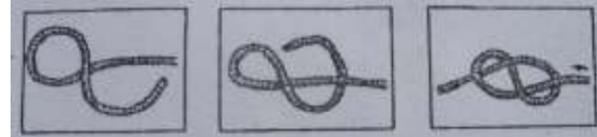
5- Most useful knots



Bowline: will not slip if tied, and easy to untie.



Rolling hitch: to secure a rope



Eight: at the end of the rope, to stop it when slipping.

See the **Chiseka Security video** online on Pratiques Website, water page :

<http://www.interaide.org/pratiques/pages/eau/eau.html>

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