



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Swiss Agency for Development  
and Cooperation SDC  
Швейцарийн хөгжлийн агентлаг

# RESPONSIBLE SMALL-SCALE MINERS' 10 STEPS TO PROTECT THE ENVIRONMENT

*A cooperation agreement on the mining and rehabilitation of 3.2 hectares of already exploited land at Uliin Khavchig in Rashaant bagh was signed by soum management and a small-scale miners' NGO.*

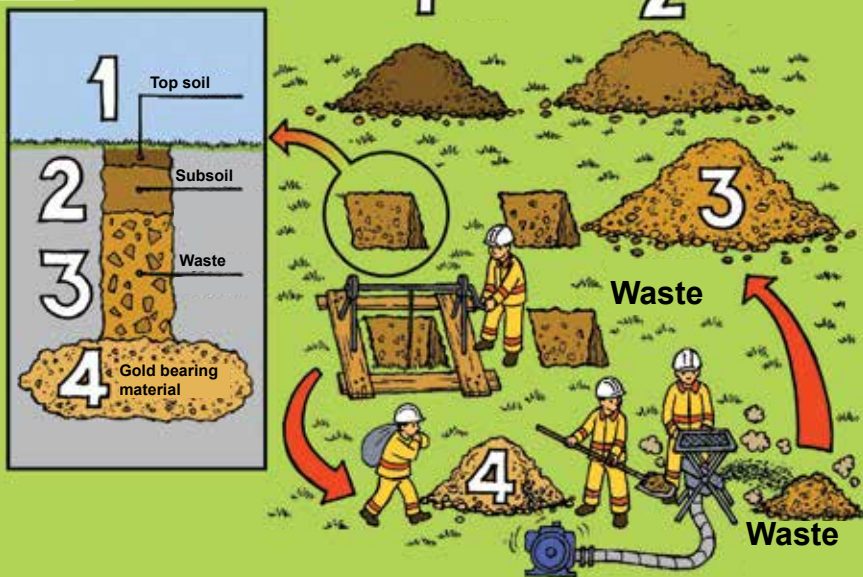
*Picture: "Gazar Shoroo Ard Tumnii Bayalag" NGO members perform technical rehabilitation of mined land in Yusunbulag soum, Gobi-Altai aimag, on July 27, 2012.*



*"Altan Usnii Khugjil" ASM NGO members refill collapsed sections of land located between the Altan Us and Aman Us areas. The miners rehabilitated the area in 2010; however, the following year holes appeared and land collapsed as the tunnels had not been properly demolished before the surface shafts were filled. Picture: NGO members M.Ariunzaya, Ch. Purevjagdag, L. Oyun-Erdene, B. Ganchimeg, Ch. Samdan, Ch. Sodnom-sambuu, S. Bat-Ireedui, G. Khatanbaatar, B. Munkhuu, B. Ulambayar, Z. Sainbayar and NGO head Ts. Ganbat.*

*Bayan-Ovoo soum, Bayankhongor aimag, July 26, 2012.*

# STEP 1



## STRIPPING THE SOIL

Artisanal and small-scale mining operations generally take place in areas that are not economically viable for industrialised mining. Mining operations begin with stripping the soil. Stripped soil must be separated into:

- i) Topsoil;
- ii) Subsoil;
- iii) Waste.

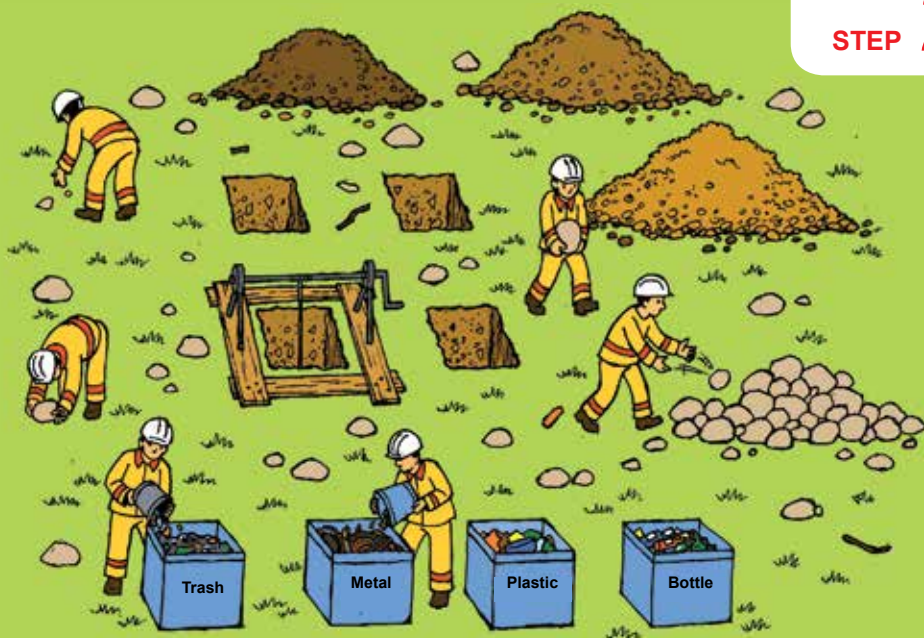
These must then be placed in separate heaps for use in later land rehabilitation. The heaps should be located at least 5m from mining shafts to prevent run-off when there is rain.

### Did you know?

Partnerships must undertake both technical and biological rehabilitation on mined land in accordance with existing regulations (Order No. 153 of the Chairman of the Mineral Resources Authority of Mongolia issued in 2011, Annex 4) and be assessed by the State Environmental Inspector before the land is formally handed over to local authorities.

Miners are required to live in residential zones defined by the soum/district governor outside the mining area.

Regulation on the Extraction Operation of Minerals from Small-Scale Mining, approved by the Government of Mongolia in 2010.



## CLEANING THE REHABILITATION AREA

Rehabilitation must be undertaken after the completion of mining operations. Trash and waste must be collected and sorted into different containers: Trash, metal, plastic and bottles. The stones used for marking mining and residential areas and the large rocks removed from mining shafts during the stripping stage must be put back in the shafts for refilling.

### Did you know?

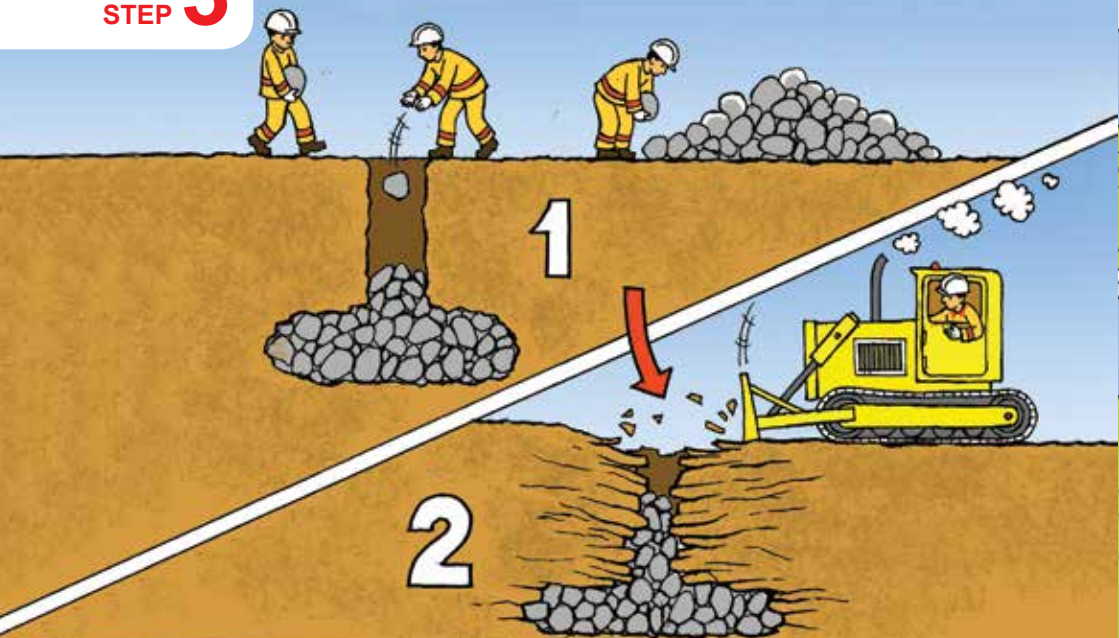
How much dust is generated each month from areas with no vegetation and loose soil? And how much dust is generated from loose-soil mining areas each month?

Dust is comprised of dirt particles carried in the air. According to international standards, it is dangerous to human health if 150 micrograms of dust with particles that are seven times smaller than the diameter of a human hair (PM10) is present in 1m<sup>3</sup> of air. Human health can be harmed if 65 micrograms of dust with particles 30 times smaller than the diameter of a human hair (PM2.5) are present in 1m<sup>3</sup> of air. One kilogram of dust with the aforementioned particles will contaminate 6,000m<sup>3</sup> of air.

If we assume that at least 0.1 kg of dust is generated with similar particulate levels as above from 1m<sup>2</sup> of loose-soil area in a one-month period, it is calculated that 1 tonne of dust from a 1 hectares area is enough to contaminate 6 million m<sup>3</sup> of air.

Air quality standard recognised by the US, China and South Korea.

## STEP 3



## PREVENTING POST-REHABILITATION COLLAPSES

It is important to demolish tunnels and deep shafts to prevent them collapsing after rehabilitation has been undertaken. Excavators or other equipment should be used to destroy the tunnels and shafts, after which they should be filled with rocks and waste from the stripping process.

Shallow shafts can be directly filled with rocks and stones.

### Did you know?

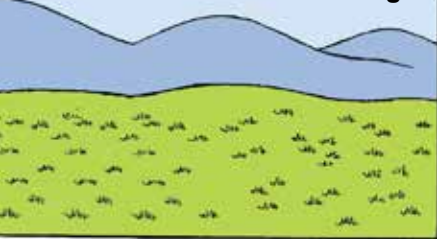
Small-scale mining involves citizens who are organised into unregistered partnerships to extract minerals in the following type of areas/deposits:

1. Deposits that are not economically viable for industrialised mining (as determined by industrial mining companies via technical and economic assessments);
2. Artificial deposits created by industrial mining technology (non-rehabilitated, abandoned mining sites or still-operational mining waste areas); and
3. Minerals occurrence (areas where there may be minerals but no economic efficiency has been defined; exploration and exploitation licenses have not been issued; there are no forest and water basins; and not in a protected area).

Provision 4.1.23, Law on Minerals.

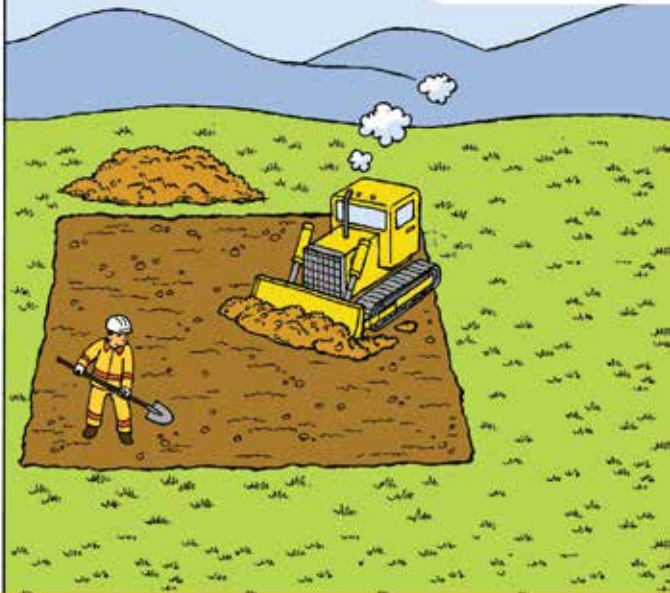


**Area-Before Mining**



**Area-Technical rehabilitation**

**STEP 4**



**Area-After Mining**



## TECHNICAL REHABILITATION

After filling shafts and holes, the surface must be evened out by hand or with such machines as excavators or bulldozers (it saves time and money to fill shafts with rocks and boulders when starting new shafts).

The rehabilitated area must be returned as close as possible to its original dimensions. Stones larger than 4 cm should not be visible on the surface of the land.

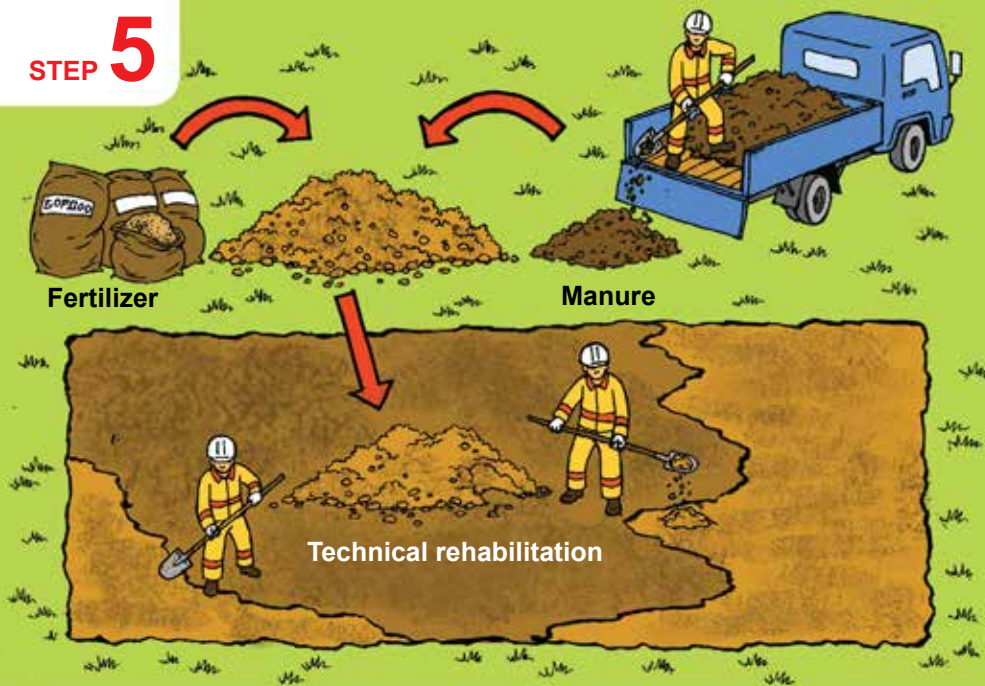
### Did you know?

How many tonnes of hay are lost from 1 hectare of destroyed land? How many sheep could graze on such an area and for how many days?

During high vegetation periods, from a 1 hectare area, 590 kg hay can be produced in the Khangai region, 300 kg in the Kheer region, 220 kg in the Gobi-Kheer region, and 170 kg in the Gobi region. If we assume that the weight of vegetation drops 15-60 percent based on the different specifications of the regions during hay-making periods, this brings the total to 350 kg in the Khangai region, 90 kg in the Kheer region, 44 kg in the Gobi-Kheer region, and 25 kg in the Gobi region. Additionally, if one sheep was fed with 1 kg hay per day during winter and spring, that would be sufficient to feed 350 sheep in the Khangai region, 90 sheep in the Kheer region, 44 sheep in the Gobi-Kheer region, and 25 sheep in the Gobi region for one day. In short, if 1 hectare of land is destroyed through mining and is not rehabilitated, it will mean the loss of one-day's feed for 25-350 sheep.

Calculations made using pastureland capacity and vegetation weight calculation method.

## STEP 5



## ENHANCING THE SOIL

After technical rehabilitation, the land needs to be covered with subsoil and topsoil. Different types of fertilisers can be used to enhance topsoil quality and health. Organic fertilisers are mainly used for soil nutrition as they easily decompose. Animal manure can be mixed with topsoil in a 1:20 ratio; 30-40 tonnes of manure is needed to fertilise a 1 hectare area. It is efficient to mix topsoil with straw, worms, food and forage waste, and plant leaves and stems.

Chemical fertilisers can be used to enhance soil nutrition, with the following ratios applicable for a 1 hectare area: Nitrogen 60-90 kg, phosphorus 40-60 kg, and calcium 20-40 kg.

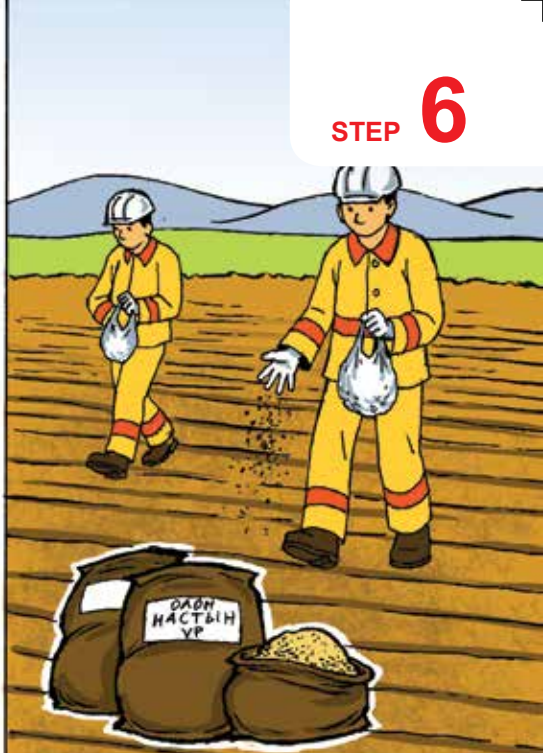
### Did you know?

How does mercury harm human health? What are the symptoms of mercury poisoning?

Mercury evaporates at a temperature of 20-30° C and enters the body through inhalation, where it is absorbed through the lungs and also through the consumption of food. It affects the central nervous system, the respiratory system and other organs when it accumulates in the body. It also causes genetic mutations that can result in intellectual disabilities in babies.

Symptoms of mercury exposure include: Coughing, sore throat, stomach disturbances, breathing difficulties, vomiting, headaches, lethargy, vision impairment, insomnia and skin rashes.

Documentary on the effects of mercury, SAM Project.



## BIOLOGICAL REHABILITATION

The following vegetation can be used for biological rehabilitation: Medicago falcata 10-12 kg/hectare, Elytrigia 25-30 kg/hectare, Festuca 10-12 kg/hectare, Elymis Sibiricus 18-20 kg/hectare, Bromus Inermis 18 kg/hectare, and Agropyron Gaerth 10-12 kg/hectare.

In relation to planting trees: 1) In the Khangai region, birch, aspen, poplar, larch, pine and fir trees - 500 per hectare, elm trees - 833 per hectare; 2) The Kheer and Gobi regions, aspen and poplar trees - 833 per hectare, and elm trees - 1111 pieces per hectare.

### Did you know?

Airlessness starts at how many metres underground?

Primary mining or mining in vertical shafts:

In vertical shafts, airlessness starts at a depth of 5m, therefore it is important to accurately measure ventilation from 5m of the shaft and to install a ventilation system.

In adits, airlessness starts at 20m and a ventilation system must be properly installed.

The shaft can be provided with natural ventilation by connecting two vertical shafts with an underground tunnel.

Lighting a candle is a simple method of checking the air content in chemical-free shafts.

Information from the Mining Rescue Service of Mongolia.

# STEP 7



## PLANTING TREES

It's important to plant trees at the right time.

No.	Regions and zones	With watering	No watering
1	Mountain Kheer	3rd 10 days of June	3rd 10 days of May
2	Forest Kheer	2nd 10 days of June	2nd 10 days of May
3	Gobi, Desert	3rd 10 days of May	1st 10 days of May

### Did you know?

The size of a land area for ASM partnerships for the purpose of small-scale mining shall not exceed 5 hectare (the number of partnerships able to work in one area is not limited). The number of the areas selected for small-scale mining within a soum/district shall not exceed 10.

Regulation on the Extraction Operation of Minerals from Small-Scale Mining, approved by the Government of Mongolia in 2010.





## WATERING PLANTS

The area prepared for trees and vegetation needs to be watered before planting. A total of 550-600m<sup>3</sup> of water is required for a 1 hectare area. Watering should also be done another four times: After planting and the sprouting period, 200-250m<sup>3</sup> of water per 1 hectare; and during the vegetation blossoming and premature seed period, 250-300m<sup>3</sup> of water per 1 hectare area. Watering can be done by creating trenches around the area, through an irrigation system, and through drops and seeping methods.

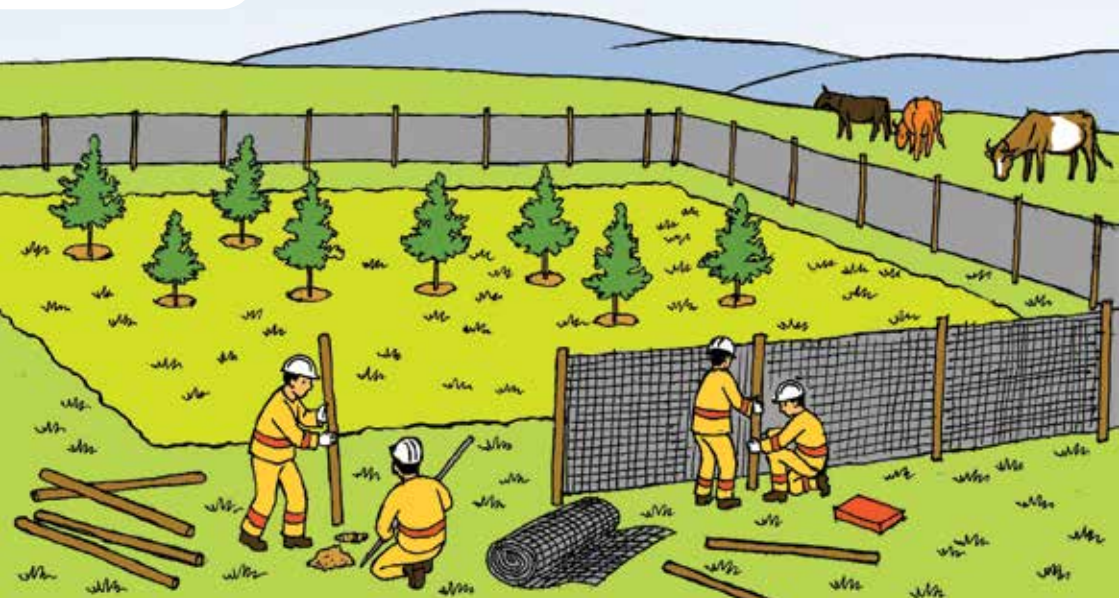
### Did you know?

How much oxygen is produced by a fully grown tree? How much carbon it can absorb in a year?

The oxygen-producing level of trees varies, and is based on the different tree types, such as conifers or foliates. A normal young tree produces on average 1310m<sup>3</sup> of oxygen per year. A fully grown foliate up to 30m high and 45cm in diameter produces 28,000m<sup>3</sup> of oxygen per year. These trees each produce 26,200m<sup>3</sup> and 560,000m<sup>3</sup> of the oxygen present in the air.

If we assume that a person needs 12.5m<sup>3</sup> of oxygen or 250m<sup>3</sup> of air per day, a fully grown tree produces the equivalent of six years' oxygen. Additionally, on average a tree absorbs 21kg of carbon per year.

Study conducted by Environment and Natural Resources Department of the Environmental Agency of Canada.



## FENCING AND PROTECTING REHABILITATED AREAS

When rehabilitation of the land is complete, the area needs to be fenced to protect it from animals for the first two to three years.

Readily available materials such as timber, welded wire mesh and metal wire can be used for fencing. Avoid using sharp barbed wire that can harm animals.

### Did you know?

What are the main causes of accidents?

Small-scale mining accidents represent 80 percent of the total number of accidents in the mining sector. Small-scale miners are at risk due to non-adherence to occupational safety regulations and standards, improperly used or malfunctioning mining equipment and tools, poor shaft safety resulting from inadequate support and timbering, and insufficient shaft ventilation.

Most of the accidents were the result of miners not taking adequate accident prevention measures and not using helmets and other protective clothing and equipment. The leading causes of mining accidents are as follows:

1. Inattentiveness and carelessness (alcohol usage) – 30 percent;
2. Airlessness and toxic gas (mainly in coal mining) – 30 percent;
3. The collapsing of mine stopes, the sliding of rocks and clay, and inadequately supported shafts – 25 percent;
4. Improper use of/malfunctioning equipment and tools – 10 percent; and
5. Others – 5 percent.

Information from the Mining Rescue Service of Mongolia.



## CARING FOR AND MAINTAINING REHABILITATED LAND

Biologically rehabilitated areas must be maintained for up to three years. This includes watering in the first and middle months of spring and summer, fixing fences and, if necessary, the additional application of fertilisers. If 80 percent of the trees and vegetation that have been planted have not survived, a second round of planting needs to be undertaken.

### Did you know?

How long it takes trash to biodegrade?

Trash biodegrades through exposure to rainwater, sunlight, wind and microorganisms. The time it takes is dependent on the type of trash:

1. Fruit and vegetable peels – 3-7 weeks;
2. Paper – 1 month;
3. Tin – 200-500 years (if it is buried, it will break into pieces in 80-100 years);
4. Glass – 1 million years (it breaks into pieces, but the actual breaking down process takes the majority of the time);
5. Plastic bags – 20-1000 years;
6. Plastic containers – up to 1 million years depending on their chemical structure (if they are buried, they break into pieces in 300-400 years); and
7. Shoes and gloves – break into pieces in 50-80 years;

Study conducted by the US National Park Administration and Mote Marine laboratory, 1998.



*130 members of the “Gazar Shoroo Ard Tumonii Bayalag” NGO rehabilitated 0.5 hectare of land in the Undur Denjiin Ar Salaa area from 16-19 June, 2012. Fifty miners from nine ASM partnerships rehabilitated 3.2 hectares of land in the Uliin Khavchig area from 7-31 July.*

*Picture: NGO members are after completing the rehabilitation*

**Yusunbulag soum, Gobi-Altai aimag. 31 July, 2012.**



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Swiss Agency for Development  
and Cooperation SDC

Швейцарийн хөгжлийн агентлаг

## **Sustainable Artisanal Mining Project**

Sky Plaza Business Center, 2nd Floor, Olympic Street 12,  
Khoroo 1, Sukhbaatar District, Ulaanbaatar, Mongolia  
P.O. Box 58, Ulaanbaatar 210648

Zip code 14210, Mongolia

**Phone:** +976 11 328848, **Fax:** +976 11 322415

**[www.sam.mn](http://www.sam.mn)**