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E-mail: [ochagva@un.org](mailto:ochagva@un.org)**Update to Partners on Environmental Aspects of the  
South Asia Earthquake**

EMERGENCY SERVICES BRANCH

Joint UNEP/OCHA Environment Unit

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## 1 Introduction

This document provides: the results from a rapid environmental assessment of impacts of the South Asia Earthquake, carried out by UNDAC team environmental experts in collaboration with the Joint UNEP/OCHA Environment Unit (Joint Unit) and completed on October 30; an update on ongoing Joint Unit activities that respond to these assessment findings; and the recommendations the Joint Unit has, and continues, to make.

Much of the information in this update has already been released through sources including OCHA Situation Reports. It is anticipated that some of these findings will be also be shared through the upcoming South Asia Earthquake Early Needs Assessment. The assessment findings were compiled in close cooperation with the Pakistani Ministry of Environment, the Environment Protection Agency of Pakistan, the Environment Unit of the United Nations Development Programme office in Islamabad, and UNEP.

The support of the Swiss and Swedish governments for Joint Unit activities in Pakistan is gratefully acknowledged.

## 2 Context

On Saturday 8 October 2005 at 8:50 local time a 7.6 magnitude earthquake occurred in northern Pakistan, its epicentre situated just 95 km northeast of the Pakistani capital of Islamabad. The initial earthquake, and the over 300 aftershocks, caused massive destruction in the area. Latest information on casualties, damage and humanitarian activities are available in OCHA situation reports at (<http://www.reliefweb.int/rw/dbc.nsf/doc100?OpenForm>)

Earthquakes of this magnitude have severe environmental consequences that directly impact on the lives and livelihoods of affected populations in the short, medium and longer term and which must, therefore, be taken into account in disaster response, recovery and rehabilitation stages. Accordingly, the Joint Unit took steps to identify and, where required, act upon urgent environmental issues with immediate relevance for human life and health, in collaboration with national authorities and international partners.

### **3 Summary of key Joint Unit activities**

- Two environmental experts deployed as part of the United Nations Disaster Assessment and Coordination (UNDAC) teams were requested to identify issues with potential impacts on human life and health, for example, hazardous materials resulting from damage to industrial facilities and urgent waste management and debris problems. Their assessment was completed by October 30.
- Based on assessment findings, two additional waste management experts, kindly made available by the Swiss and Swedish authorities, have been providing technical support, advice and solutions in collaboration with partners, as noted in more detail below. Both experts arrived on October 29.
- An expert on forest management was made available by Swiss authorities and deployed to Pakistan ensure that cutting of trees for fuel and shelter does not exacerbate erosion/landslide risks, or degrade the environment more than necessary under the circumstances. The expert arrived October 31.
- An expert on slope instability, also made available by Swiss authorities, will be deployed next week to Pakistan to support government authorities, the shelter cluster, camp managers, and other partners, minimize the risks to relief workers and settlements from slope instability, avalanches, and related risks. His activities will build on earlier, related activities conducted independently in Pakistan by Swiss authorities, as well as UNDAC team findings.
- All findings to date, plus technical assistance from the above-noted experts, have been provided to UNEP to support environmental aspects of the early needs assessment activities they are leading in Pakistan. The Joint Unit will continue to work closely with UNEP to support their recovery stage activities, and to ensure an effective transition between response and recovery phases of the disaster.
- Information on key environmental findings has been shared through OCHA situation reports and with key partners.

### **4 Overview of assessment methodology**

The first UNDAC team environmental expert arrived on October 9. He conducted, in collaboration with a UNESCO representative, a rapid environmental assessment at Muzaffarabad and nearby areas, in addition to carrying out regular UNDAC humanitarian duties. A second UNDAC team environmental expert from the Joint Unit began his environmental assessment mission by way of expert meetings with national officials in Islamabad. Prior to his arrival on 15 October, he had already been in contact with the respective Pakistani authorities in the Ministry of Environment. He continued his environmental assessment in Masehra along with regular UNDAC humanitarian duties. Together, the experts conducted activities in Islamabad, Muzaffarabad, Mansehra, Batagram, Balakot and the Nhelum Valley.

A consultant to CARE International also conducted assessments independently, and shared results with the Joint Unit. The United Nations Environment Programme deployed

environmental experts on October 24 to participate in United Nations needs assessment activities related to the disaster recovery phase. The findings from UNDAC environmental experts assessment and subsequent response phase activities will support and inform these recovery stage efforts.

The main conclusion from the assessment was that, while there are no major life-threatening secondary impacts resulting from the earthquake, there are urgent environmental issues to be addressed during the response phase.

## **5 Findings to date, activities and recommendations**

### **A. Waste Management & Debris**

The earthquake created a large number of waste management issues in affected areas that need to be addressed during the response phase, as well as longer-term challenges. Generally speaking, the earthquake destroyed practically all infrastructure in heavily impacted areas such as Muzaffarabad, and normal pre-disaster waste management has been completely disrupted. For example, while some waste disposal occurred before the earthquake, the road to the Muzaffarabad dumpsite is now destroyed and waste is being deposited elsewhere, without proper site selection. This may lead to problems in the immediate term such as groundwater pollution. The arrival of populations from villages and settlements in the mountains will likely aggravate the waste management situation in affected areas.

Based on these findings the Joint Unit has deployed two additional experts in waste management. The experts were kindly made available by the Swiss and Swedish governments. The experts have worked in close collaboration with Pakistani authorities; visited numerous affected areas; provided technical support and advice through cluster meetings; developed medical waste management guidelines in collaboration with WHO and other partners; and are in the process of developing camp waste guidelines as well as an annex on sanitary landfill. The guidelines are being shared widely with partners. They have also contributed to UNEP's recovery stage activities.

### **Shelters/Camps**

Many survivors displaced by the earthquake live in, or are moving to, temporary settlements and shelters, although not all primary shelter needs have been met. The site selection process for temporary shelters is seriously hampered, as the mountainous terrain, especially in the region of Muzaffarabad, does not offer much suitable space for temporary shelter requirements. Open spaces, such as a sport stadium in Muzaffarabad, are being used. The situation in Masehra is similar to an extent. As many as 100,000 people could come down from the mountainous villages in the Siran and Kaghan Valleys and suitable shelter will need to be found before the onset of winter.

The creation of camps or 'tented villages' is further straining damaged waste management and sanitation systems, and creating new waste management challenges in camps. Waste

problems can create serious public health risks.

Recommendation: Spontaneous as well as organized settlements for the affected population should be assessed and adequate management should be provided to avoid future public health risks. (As noted, waste management experts deployed by the Joint Unit are developing guidelines and providing technical advice to assist in this respect).

### Sewage

In Muzaffarabad, a small sewage system including basic treatment was in place, but is now believed to be faulty. More generally, according to the Ministry of Environment, no septic tanks are in use in the villages in the mountains and hygienic standards are generally poor, a situation significantly exacerbated in some areas by the earthquake. Affected villages including Balakot, Batagram, Abbottabad and Manshera generally have septic tanks. Depending on specific earthquake impacts, these too may be damaged. In emergencies, it is generally accepted that sanitation risks can be avoided in the early stages of relief and recovery by providing access to clean water and hygiene education. The usual sanitation phases are: defecation fields, followed by pit latrines, septic/containment tanks, and then treatment.

Recommendation: Wastewater and its treatment in general should be urgently considered, especially since human concentration in camps can lead to the spreading of epidemics. Diarrhoea reports are on the increase and skin diseases have been reported.

### Health Care Waste

At the time the rapid environmental assessment was completed, the earthquake had wounded an estimated 74,000 people. Emergency field treatment tents have been set up at numerous places, and hospitals that are still operational continue to function in overcrowded circumstances. Management of health care waste is thus an important consideration. In Muzaffarabad, reports indicate that hospital waste such as used bandages, used needles and other potentially infectious material are now either disposed off in a haphazard way (for example in rivers or outside without appropriate containers, or burnt, without, in many cases adequate control. Generally, burning is a safe option if done according to WHO guidelines and certainly preferable to dumping waste in areas where it can create risks through dermal contact or disease vectors, or contaminate soils and groundwater. Problems may arise, however, if burning is not executed properly. For example, air can be polluted causing illnesses to the nearby populations.<sup>1</sup> Combustion temperature and residence time in burners are key factors in successful medical waste burning.

Recommendations: Healthcare waste management systems must be rapidly introduced to minimize the potential for contamination and further public health risk, including of drinking water, and avoid dermal contact/ puncture. Guidelines to this end have been distributed to partners by the Swiss and Swedish experts and sent to the Pakistan Humanitarian Information Center (HIC). The experts continue to provide technical advice and support to all relevant partners.

## Debris

The earthquake has destroyed an enormous amount of houses, thus leaving an equally enormous amount of debris. The total amount of waste is still unknown, but it is assumed that 80% to 90% of Muzaffarabad has been destroyed, rendering its entire surviving population homeless. At the time of writing, rough estimates suggest that there are 10,000,000 m<sup>3</sup> of debris in Muzaffarabad and another 50% more than that in Bagh. Assessment reports received so far indicate similar situations of villages in valleys. Debris mainly consists of concrete, bricks, steel, glass and plastic. Villages higher in the mountains consist of mud, clay and wood.

To prevent long-term damage to ecosystems, removal of debris is required. Clearance and removal operations however, remain still constrained by a lack of appropriate heavy equipment<sup>2</sup>. Currently, national authorities are attempting to identify possible removal sites.

Additionally, the re-use and recycling of waste will have to form an important element of the early recovery process. In some areas, the waste created by the earthquake may possibly represent a livelihood opportunity since it comprises valuable resource materials including scrap metals (copper, steel, aluminium), timber (for reconstruction and heating/ cooking), demolition waste from buildings, structures (for re-use, reworking as an aggregate or infilling/protection material), and uncontaminated soil/ sediment (for restoration or in-filling).

There are important ethical considerations related to how debris removal is carried out. The remains of many earthquake victims are still buried under collapsed buildings and residences and these sites require special clearance procedures. Mass waste disposal options are limited until all dead have been recovered. Family members prefer to remain on-site and will only resettle in other locations after a recovery and burial has taken place. This must be considered in logistics and planning of the relief efforts and the early recovery process.

Recommendations The international community could offer Pakistani authorities technical assistance for debris removal and management<sup>3</sup>. Appropriate links with the World Bank and the Asia Development Bank should be established in the course of this project. While a priority, debris removal must complement and not detract from more urgent humanitarian priorities.

## B. Secondary Threats from Industrial Facilities/sources

The affected region is predominantly agricultural with smaller towns in the valleys, including Abbottabad, Mansehra, Bagh, and Muzaffarabad. According to the Ministry of Environment, there are no major industrial facilities and there is no use or storage of large quantities of hazardous substances. In general, no life-threatening secondary impacts from industrial facilities or sources have been identified, however some areas do require follow-up

assessment. The following is an overview of key issues identified during the rapid environmental assessment.

### *Gas Pipeline: Islamabad - Mansehra*

The gas transmission system runs up west of Islamabad in the northern direction to Mansehra. It has smaller distribution pipes running off the main pipe to supply Naugazi,

Taxila, and Hattar. The gas is mainly used for distribution to households for cooking and heating. No power stations are run on natural gas in the region.

According to the Ministry of Oil and Gas, Directorate General for Gas, visual inspections were carried out immediately following the earthquake to identify any cracks or leakages on the parts of the distribution system situated above ground. In addition, the entire track of the underground section was checked for any disturbances. No leakages or cracks in the terrain were observed during these inspections. The gas distribution system is equipped with a 'Supervisory Control and Data Acquisition System' that monitors any major drops in pressure and will automatically engage in closing valves. Since the earthquake, no differences are observed between the gas pumped in and received and it is believed that no secondary threats or impacts can be expected from the gas transmission system.

### *Oil and Gas Fields*

The oil and gas fields of Pakistan are situated south of Islamabad and thus out of the main impact zone of the earthquake. The Ministry of Oil and Gas, Directorate General for Oil, did not report any damage to its installations. Only one observation was made: the retail side of the distribution system was affected and an unknown number of petrol stations had been damaged. There are no major oil and fuel storage facilities in the affected region.

### *Radiation*

The International Atomic Energy Agency (IAEA) has no reports that the one nuclear facility in the general vicinity of the earthquake (Chashma-CHASNUPP) is affected. Built in 2000, it is equipped to withstand earthquake shocks and reportedly safe and operational. Numerous hospitals have collapsed and one potential hazard that should be considered during the emergency relief phase is the radiation risk from machines that have been damaged during the earthquake. The main hospital in Muzaffarabad, as well as a number of private clinics, might have included x-rays machines. Dialogue with the IAEA indicates that risks from these sources should not be significant; however, the organization has offered to provide follow-up assessment assistance, as required.

### *Water Storage Dams*

Within a 100 km radius of the earthquake epicentre, a number of water storage dams that form part of the Indus Basin Settlement Plan are situated. The most important of these dams is the Tarbela dam on the Indus River. Other important dams include the Mangla dam at the Jhelum River and Basha dam, also on the Indus River.

According to the Water and Development Agency of Pakistan (WAPDA), the earthquake seriously affected none of these dams, as they are designed to withstand earthquakes of

this magnitude. Inspections were carried out on all dams and the Minister of Water and Power made a public statement on the second day after the earthquake that all dams were safe.

### *Smaller Industrial Installations*

Smaller facilities, such as dairy and meat processing plants (which could use ammonia for cooling), and leather processing are limited. In addition, there are no major airports, except for some helipads and therefore no major fuel storage capacity exists either.

A source of pollution that still requires further investigation is the underground storage tanks of petrol stations. It is estimated that between Mansehra and Abbottabad approximately 10 such stations are situated. A further 20 petrol stations are apparently situated along the road between Islamabad and Muzaffarabad. The number of petrol stations in the affected towns is unknown.

### *Pesticide/Fertilizer Storages*

Most agriculture practised in the affected region is of a subsistence nature and only a minor amount of pesticides and/or fertilizers are used. Agriculture around Mansehra includes rice, potatoes, wheat and maize. Livestock consists of extensive farming of cattle and goats. The Environment Unit of UNDP is supporting a project together with the Ministry of Environment to develop an inventory of persistent organic pollutants, which will include obsolete pesticides.

### *Asbestos*

Asbestos cement sheets are not reported to be widely used in the affected areas. Generally, materials like concrete, clay or galvanized metal sheeting are used for roofing.

### *Transformer Stations*

A number of transformer stations, containing PCBs, might have been destroyed and could pose a health hazard.

Recommendation: Notwithstanding that there are no clearly life-threatening secondary impacts from industrial facilities, further assessment is required.

## **C. Natural Hazards**

The earthquake created or exacerbated a number of natural hazards such as landslides, with immediate as well as longer-term implications. At the time of writing, the Joint Unit was deploying an expert to assess and address slope instability and landslides. A second expert had been deployed to ensure that tree cutting does not exacerbate erosion and landslide risks or damage country's resource base more than necessary under the circumstances. Both experts were made available by the Swiss government. More detailed findings from assessments to date are below.

## *Erosion*

Harvesting of forests in Pakistan has been subjected to a government ban, and until the disaster struck, the ban was generally respected. Still, wood continues to be one of the main energy sources for remote communities. The population's immediate needs for fuel wood and timber to be used in reconstruction of dwellings are anticipated to lead to increased deforestation in the next months, which may increase soil erosion and create further landslides risks.

A Swiss expert deployed through the Joint Unit is acting as a technical resource person and providing advice and solutions to minimize erosion from tree cutting. In the past week he has visited areas including Masehra, Bagh, and Chakar, and provided technical advice and briefings to a wide range of organizations. He will conduct final debriefings and reporting in Islamabad between November 13-15.

Recommendation: The findings and recommendations of the Swiss expert should continue to be integrated into operations and his final report widely shared with all partners. The erosion risks could also be reduced if energy efficient stoves and other alternate energy resources are provided to the affected population. As deforestation will however be almost unavoidable in the short term, reforestation programmes may be needed in the next years.

## *Landslides*

The earthquake and the aftershocks triggered numerous landslides, which are seriously hampering the relief efforts. Roads being blocked over stretches of six kilometres have been reported. The landslides however can and will have a major impact in the short, medium – and long term. Many remain unstable and may pose ongoing threats to the population, especially as aftershocks occur. Related degradation of agricultural land and pastures may contribute to long-term vulnerability of rural communities as the subsistence farmers usually living in the region suffered the loss of grazing pastures for their goats and sheep.

Secondly, some landslides have occurred on riverbanks and might have blocked smaller tributaries and rivers. In the Nhelum Valley, for example, a natural dam has been created which may increase future flooding risks. In addition, sediments that are now being deposited in rivers will contribute to siltation/ sedimentation of reservoirs downstream. Referring to the affected areas' geological conditions, the arrival of winter in the region with

heavy snowfall at higher elevations and rainfall at lower elevations additionally poses an increased risk to already unstable slopes<sup>4</sup>.

A Swiss expert is being deployed by the Joint Unit to work with local partners to help address these findings. His work builds on an earlier assessment conducted independently by Swiss authorities.

Recommendation: Further assessment and monitoring that builds on these findings and those of the Swiss experts, as well as possible stabilization of landslide areas, are necessary. Recovery activities should also include efforts in reforestation.

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<sup>1</sup> For further information see *WHO Website on Health-care Waste Management*, [http://www.healthcarewaste.org/en/125\\_hcw\\_risks.html](http://www.healthcarewaste.org/en/125_hcw_risks.html)

<sup>2</sup> Charles Kelly 2005. *Technical Note – Debris Removal in Muzzafarabad*.

<sup>3</sup> Charles Kelly 2005. *Technical Note – Debris Removal in Muzzafarabad*.

<sup>4</sup> CARE International & Benfield Hazard Research Center, 2005. *Provisional Organization Level Assessment Report. Rapid Environmental Impact Assessment – South Asia Earthquake – Pakistan*.