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KAHRAMANMARAŞ CENTERED EARTHQUAKE PERIOD DISASTER MANAGEMENT AND SOLID WASTE PROBLEMS

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ABSTRACT

Reducing the risks before the earthquakes that occur because of the breaking of the tectonic plates on the fault lines in the earth's crust would prevent the occurrence of major disasters. As in many parts of the world, earthquakes of various sizes occur at frequent intervals in Turkey. One of the most important of these earthquakes is the two major earthquakes that occurred on the Turkey-Eastern Anatolian fault line, 9 hours apart, on February 6, 2023. caused property damage. The impact of the Kahramanmaraş earthquakes in an area of 108,812 km2 caused damage to the highways and railways to be used in the delivery of aid to the earthquake region, therefore delays were experienced in the region until the disruptions were eliminated, and the maintenance-repairs of these infrastructures were completed. For this reason, it is very important to take precautions before, during and after an earthquake and similar disasters. It has been revealed that the measures to be taken in this regard should be taken together by all the people. In this context, it is important that local governments and the public cooperate in establishing earthquake-resistant cities for disaster risk reduction activities. Public institutions and relevant departments of universities and research centers should work together. Post-disaster conflicts can generate large amounts of solid and liquid waste that threatens public health, hinders reconstruction, and affects the environment. Disaster waste can be produced because of a real disaster, or it can be produced later in the intervention and recovery stages. Disaster waste also offers opportunities: it can contain valuable materials such as concrete, steel and timber, as well as organic materials for composting. This value can be realized as a source of income or reconstruction material and reduces the burden on natural resources that might otherwise be harvested for rebuilding. During the sequence of earthquakes focused on Kahramanmaraş, the debris in the earthquake areas and many items that carry out debris removal operations and come to the region to meet the social needs of the people of the region emerge as solid waste. Since solid wastes disrupt the work and cause infectious diseases as much as their economic value, necessary precautions should be taken within the emergency action plans.

Keywords: Kahramanmaraş, Earthquake, Disaster waste, solid waste, economic

INTRODUCTION

As there have been many destructive earthquakes in Turkey in the past, it is possible to suffer great loss of life and property due to future earthquakes. Minimizing death, damage, social and economic losses caused by earthquakes is an important problem that concerns the whole society. By predicting earthquakes in advance, it will be possible to minimize the seismic hazard in a region. For this reason, the issue of predicting earthquakes is a subject that is constantly on the agenda of people. Knowing the earthquake for a certain period is accepted as knowing the place of occurrence, time of occurrence and magnitude of the earthquake within certain and accepted error limits. Earthquakes are one of the natural disasters that most affect and scare societies throughout human history. The history of scientific studies on predicting earthquakes is very new, and the beginning of studies on this subject developed in parallel with modern seismology after the 1960s. As it is known, Türkiye is located on one of the most active earthquake zones in the world. According to the Turkey Earthquake Zones Map, 92% of Turkey is in seismic zones, 95% of the population lives under earthquake risk, and 98% of large industrial centers and 93% of our dams are located in earthquake zones (URL-1). While 400 km of surface rupture occurred in the earthquake area, the region shifted 3 to 9 meters west. The Kahramanmaraş earthquakes, which had twice the magnitude of the 1999 Gölcük earthquake and about 2.8 times the power it released, surpassed the 1939 Erzincan earthquake and became the earthquake that caused the most loss of life in Turkey.

It is important how vital a comprehensive disaster risk reduction system is for both developed and developing countries. For this, the plans that have an important place in the disaster risk management planning system prepared and being prepared by the Disaster and Emergency Management Presidency (AFAD) in Turkey are evaluated. It is considered as the process in which the risks related to the next disasters are reduced, which includes recovery before earthquakes, return to normal life after disaster response, and long-term reconstruction. Turkey Post-Disaster Recovery Plan (TASIP) is being prepared to plan the effective management of this process. While AFAD prepares plans to reduce the effects of disasters, it supports the planned execution of the most effective struggle in the event of a disaster. In the event of a disaster, the organization is as important as the total mobilization of the available resources. In addition to the delay of the response with the irregularity that will occur in the dispatch of the disaster response teams to the region, the turmoil that will occur will not only hinder the work, but also create risks in the region. While the humanitarian aid delivered to the region in a short time sometimes turns into waste, the debris will disturb the works and the employees. While the debris workers are driving, the debris should be removed from the area on a regular basis, as well as the garbage generated as a result of social activities should be removed in a way that does not disturb the environment. Solid wastes and corpse parts may deteriorate depending on seasonal conditions, causing the spread of infectious diseases (URL-2).

Environmental impacts closely related to human impacts can include waterways contaminated with chemicals and heavy metals and can affect agricultural areas and communities. Physical clogging of waterways can also occur. Therefore, safe handling, removal, and management of DW are important issues in disaster response and recovery. Effective approaches can help manage DW risks to life and health and seize opportunities from waste to support recovery and development outcomes. Current DW management practice often includes either no action where waste is allowed to accumulate and decompose, or inappropriate action where waste is removed and dumped in an uncontrolled manner. In the latter case, improper dumping can create long-term environmental problems that affect the community or occur on economically important lands and may require transportation of waste, creating additional costs. While national authorities have primary responsibility for dealing with DW, it is unclear which international aid agency can provide them with what kind of assistance when they are overwhelmed by a disaster (URL-3).

These guidelines provide advice and tools to overcome these challenges and manage DW in emergencies (disaster waste) and achieve early recovery stages. They target practitioners of disaster waste management projects. Their purpose is to i) minimize risks to human life and health, ii) reduce risks to the environment, and iii) ensure that any value in DW is realized for the benefit of affected communities. A wide variety of stakeholders were consulted in the development of these guidelines. They are not very technical, but rather a common-sense compilation of good practices drawn from experienced disaster waste managers and available materials. National authorities have primary responsibility for DW (disaster waste) management, as a result, where these guidelines are used by parties other than national authorities, a formal request for national assistance is presumed.

MATERIALS AND METHOD

Features of the workspace

It is in the east of the Mediterranean. Kayseri, Sivas and Malatya provinces are located in the north of Kahramanmaraş. In the south, there are the cities of Osmaniye and Gaziantep. Kahramanmaraş is the 11th largest province of Turkey with an area of 14,346 km². It is located between 37-38 north parallels and 36-37 east meridians. The central district is 568 m above sea level. It is at an altitude and the northern parts of the province are quite mountainous. Landforms generally consist of mountains, which are extensions of the Southeast Taurus Mountains, and the depressions between them. There are wide plains in our province, whose land height is from 350 meters to 3000 meters. These; Gavur, Maraş, Göksun, Aşağı Göksun, Afşin, Elbistan, Andırın, Mizmilli, Pomegranate and İnekli Plains (URL-4).

The most important river in terms of hydrographicality is the Ceyhan River. The first source places are the mountains surrounding the Elbistan plain. Its length is 509 km. is It comes out from Nurhak Mountain in the Central Taurus, with the name of Söğütlü Stream. It takes the name Ceyhan after the combination of Hurman and Göksun teas. It enters Çukurova by passing through the gorges of Engizek and Ahır mountains. After turning the Misis hills, it pours into the Iskenderun Bay. It collects many streams along the way. Göksun Stream is 115 km. has extension. It starts with Kömürsuyu descending from the Binboğa Mountains. Another branch of the Ceyhan River is Aksu Stream (150 km). This stream emerges from a strong spring in the Kayadibi locality, in the Engizek Mountains, in the south of the basin, east of Küçükcerit village. A splitting strait from the southwest of Erince Mountain passes through the valley and opens to Gölbaşı depression near Sarayköyü. Aksu Stream, which also receives the ground waters of Gölbaşı depression, turns southwest from İnekli Lake and pours into Kartalkaya Dam located in Pazarcık. Aksu Stream collects the water coming from the side streams and pours into the Sır Dam in the southwest of Kahramanmaraş. Except for the Ceyhan river and Aksu Stream in Kahramanmaraş, the remaining waters are generally small streams that are the branches of Ceyhan. Other streams in the province include Deliçay, Erkenez Stream, Körsulu Stream, Cheese Stream, Kerhan, Geben, Nurhak, Söğütlü, Hurman, Üngüt, Mismilli, Göksu and Gökpınar located in Türkoğlu. Mountains make up 59.7% of the land, plateaus 24% and plains 16.3%. The main mountainous areas within the province are generally the extensions of the Southeastern Taurus Mountains. These are Engizek Mountain, Ahırdağı, Amonos (Nur) Mountains, Nurhak Mountains, Kandil Mountains, Garlic Mountain, Düldül Mountain, and Binboğa Mountains. The mountains within the province are among the Alpine system fold mountains of the third time. These are fractured and folded mountain ranges that were flattened by various erosions and uplifted at the end of the Neogene (URL-5).

Kahramanmaraş centred earthquakes

Republic of Turkey, Ministry of Interior, Disaster and Emergency Management Presidency (AFAD) On 06.02.2023, at 04:17 and 13:24, Turkey time, two earthquakes of magnitude Mw 7.7 and Mw 7.6, the epicentres of which were in Pazarcık (Kahramanmaraş) and Elbistan (Kahramanmaraş) stated to have occurred (Erol & Çekilme, 214). The earthquakes that occurred were close to the ground surface and the 7.7 Mw earthquake occurred at a depth of 8.6 km, while the 7.6 Mw earthquake occurred at a depth of 7 km. The closest settlement to the epicentre of the 7.7 Mw earthquake was Pazarcık/Akdemir (2.72 km), and the closest settlement to the epicentre of the 7.6 magnitude earthquake was Elbistan/Gümüsdöven (1.70 km). After the earthquakes that occurred, approximately 1300 aftershocks were recorded until 09.02.2023 at 16.00 and nearly 3000 aftershocks were recorded until 16.03.2023 at 24.00 (AFAD, 2023; ITU, 2023). Figure 1 shows the provinces that were primarily affected by the Kahramanmaraş-centered earthquakes.

Figure 1. Provinces primarily affected by Kahramanmaraş earthquakes (AFAD, 2023; URL-6).

Figure 2 shows the earthquake sequence that occurred with the 06.02.2023 Pazarcık (Kahramanmaraş) Mw 7.7 and Elbistan (Kahramanmaraş) Mw 7.6 earthquakes and aftershock activity (AFAD, 2023).

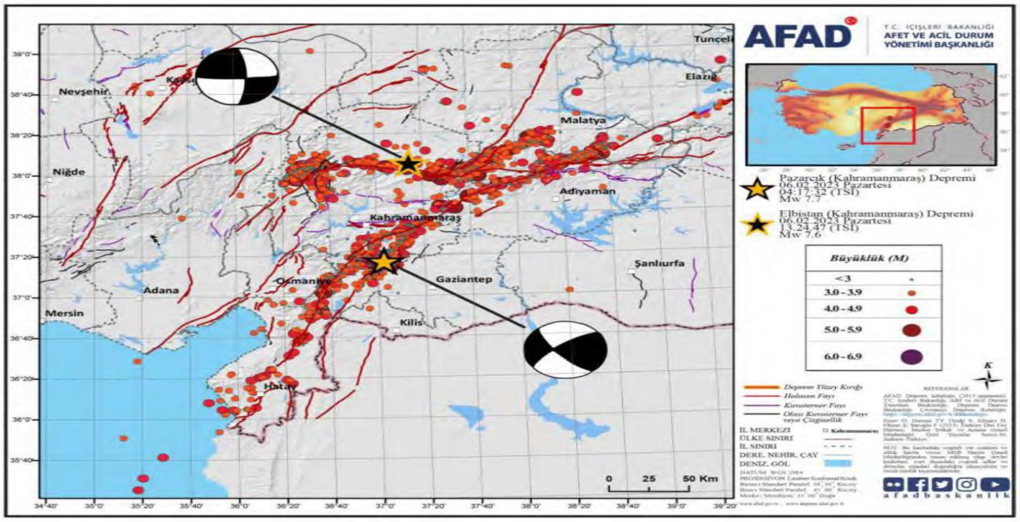

Figure 1. Provinces primarily affected by Kahramanmaraş earthquakes (AFAD, 2023). (URL-7)

RESULTS

Turkey is located on the highly seismically active Anatolian plate, where major earthquakes have occurred throughout history. The old earthquake recorded in this geography, BC. It took place in 411. Since 1900, there have been 20 earthquakes with a magnitude greater than 7. This shows that Turkey is at the top of the list of countries damaged by earthquakes. Between 1900 and 2023, there were 269 earthquakes that caused loss of life or damage in Turkey. The biggest earthquakes in terms of loss of life and heavy damage are the 2023 Kahramanmaraş, 1939 Erzincan and 1999 Gölcük-centered Marmara Earthquakes, respectively. Turkey is located on the Alpine-Himalayan belt, which is one of the most important earthquake belts in the world. The geology of our country, which is between the Euro-Asian (Eurasian) Plates in the north and the African Arabian Plates in the south, has developed depending on the ongoing movements of these two plates and their closure along the Bitlis-Zagros suture located between these plates.

The East Anatolian Fault has a total of 6 parts (segments). While 5 of these 6 segments produced earthquakes in the 1800s, (the section between Türkoğlu and Antalya in 1822, the section between Bingöl and Karlıova in 1866, the section around Antakya in 1872, the section between Palu-Caspian Lake in 1874, 1875' The section between Hazar Lake and Sincik, which is right next to it, produced earthquakes around the section between Çelikhan and Erkenek in 1893, and the Gölbaşı-Türkoğlu segment did not produce earthquakes during this period. This segment, which produces an earthquake approximately every 400 years, has not produced earthquakes since 1513 and has been accumulating energy. Therefore, energy has accumulated on this segment for approximately 509 years, and therefore this segment is defined as one of the most important seismic gaps in Turkey. , is still considered as a fault that has not produced earthquakes.This segment, which has produced earthquakes greater than or around 7 in the past, is thought to produce an earthquake of 7 or around at any time. The effect of this will be felt very seriously in Kahramanmaraş. For example, the effect of the last Sivrice earthquake, which occurred hundreds of kilometers away from Kahramanmaraş, was felt very clearly in Kahramanmaraş and people tried to flee here and there in fear and panic. On the other hand, an earthquake related to the Gölbaşı-Türkoğlu segment is predicted to be both very close and much larger (URL-1). A total of 16000 earthquakes were recorded in the region between 19.03.2023 from the time of the main earthquakes in Pazarcık, Kahramanmaraş. The magnitudes of these earthquakes varied in a wide range (Figure 3).

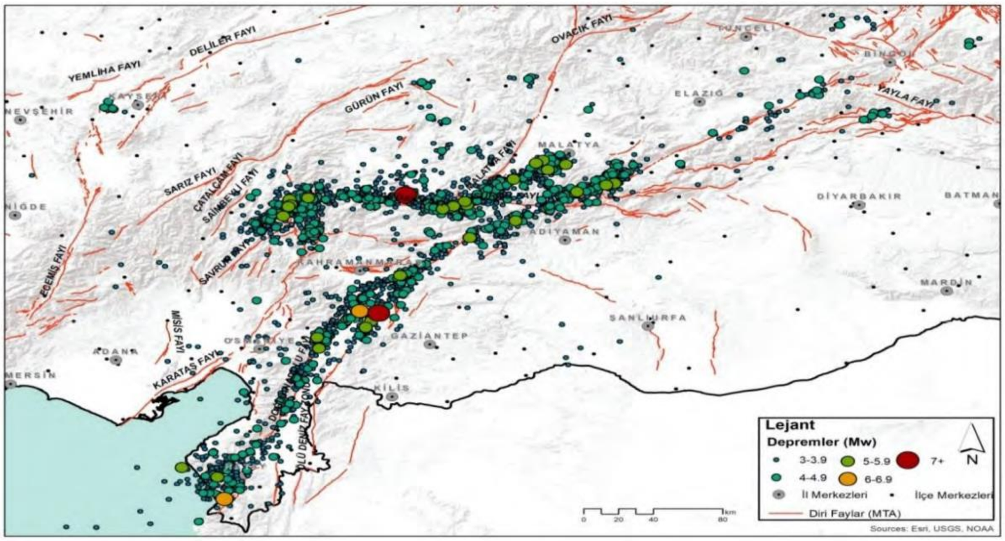

Figure 3. Aftershocks activity of 6 February 2023 Pazarcık and Elbistan earthquakes (3.0≥Mw) (Compiled from data between 06.02.2023-19.03.2023) (URL-2)

The earthquake caused a significant aftershock activity (Figure 4). This aftershock event includes 2 Mw≥6.4 aftershocks and their focal and source parameters are also given in Table 1. The Mw 6.7 aftershock nucleated around this mainshock focus about 10 minutes after the first mainshock. Since the first main shock rupture started in the Narlı Segment and progressed northward along this segment, it can be suggested that the Mw 6.7 aftershock occurred as a result of a southward rupture (Figure 3). The Mw 6.4 magnitude aftershock that occurred on February 20, 2023 was caused by a rupture along the Antakya Fault Zone (Figure 3).

Although there is a separate seismicity for each province in the affected region after the Kahramanmaraş earthquakes that occurred in the Eastern Anatolian Fault Zone (EAFZ), large earthquakes that may occur in another region vary in terms of structure, ground, design, application, etc. It can affect a very wide area with multipliers. First of all, knowing the seismic activities in the region and their effects in the historical and instrumental process will shed light on the present and the future. Figure 4 shows the 3 m offset and damage to buildings on the highway and railway in the region during the Pazarcık earthquake of February 06, 2023. Existing figures provide important information about the intensity of the earthquake in the region. When the damages observed on the ground of the region with the Pazarcık earthquake are evaluated from a geotechnical point of view, the structure, lithology, thickness, underground water level, etc. When factors are evaluated with ground movement, they can directly affect structural damage.

Figure 4. During the 06 February 2023 Pazarcık, Kahramanmaraş, Turkey earthquake, the 3 m offset on the highway and railway and the damage to the buildings can be seen in the region.

In field observations, "soil liquefaction" occurs during an earthquake because of groundwater on sandy and silty soils, and as a result, bearing capacity losses may occur, and high value settlements may occur because of liquefaction. While this grounds behaviour directly affects the structural design of the buildings, it can cause the

structures to tilt, sink into the ground and even collapse. In addition to liquefaction, the damages that may occur due to soils can also vary depending on the hysterical behaviour and damping capacity of the soils. The seismic waves that move from the bedrock to the surface after the ground movement can change in terms of wave frequency and amplitude according to the characteristics of the soil layers. Soil layers, according to their properties, amplify some waves while attenuating some frequency waves. In measurements made in layers close to the surface, the amplitude increases in earthquake waves are defined as soil amplification. This amplitude increase plays an important role in the design of structures or the damage area of existing structures. After the Kahramanmaraş earthquake, the effects of soil liquefaction and soil amplification were investigated from a geotechnical point of view in the examinations and observations made in the region.
In the field investigations after the Kahramanmaraş earthquakes, it was observed that the surface fractures offset the roads and these offsets reached the dimensions that could change the land boundaries in some places. 06.02.2023 according to AFAD records. The magnitude of Mw 7.7 in the earthquake that occurred in Pazarcık at 04:17 Turkey time was between 1.4-3.0 m. Lateral displacements varying between 1.8-6.0 m were measured in the earthquake that occurred in Elbistan with a magnitude of Mw 7.6 at 13.24 (https://www.afad.gov.tr/ 06 FEBRUARY 2023 Earthquakes and Aftershocks, Field Observations, Structural Damages and Forward-Looking Evaluation Report Containing Recommendations Karadeniz Technical University, Karadeniz Technical University). Both earthquakes occurred as a left thrust in accordance with the trend of the East Anatolian Fault line.

RESULT AND DISCUSSION

Typical disaster waste problems and impacts can be listed as follows: In these guidelines, disaster waste means solid and liquid waste from a disaster (URL-9). Common examples include: concrete, steel, wood, clay and tar elements from damaged buildings and infrastructures; home stuff; parts from power and telephone networks such as utility poles, wires, electronic equipment, transformers; parts from water and sewage distribution systems; natural debris such as clay, mud, trees, branches, bushes, palm tree leaves; chemicals, dyes and other raw materials from industries and workshops; waste from relief operations; damaged boats, cars, buses, bicycles; unexploded ordnance (eg landmines); waste from disaster settlements and camps, including food waste, packaging materials, faeces and other waste from relief supplies; pesticides and fertilizers; household cleaners; paints, varnishes and solvents; and health waste. For the purposes of these guidelines, disaster waste does not include: human corpses, animal carcasses, fecal material and urine discharged into functioning toilets or polluted land. It is clear that human corpses need to be handled sensitively that respects local culture and communities and is handled elsewhere (Mogan et al., 2006).

Table 1. Typical disaster waste problems and impacts (UNEP/OCHA 2011)

Issue	Typical human and environmental effects
Building debris not collected from damaged buildings	Disabled access and restricted rehabilitation and rebuilding activities. Since the site is already considered a landfill, waste tends to attract more waste.
Unsuitable dumping and/or proliferation of cluttered landfills	Potential human health and injury risks from landfills very close to residential areas, especially from hazardous materials. Destruction of valuable land. Impacts on drinking water resources and damage to valuable fisheries. Additional costs if waste needs to be transported later. Increase in disease vectors (flies, mosquitoes, rats, etc.). Risk of collapse of waste piles. Fire risk. Risk of being cut from sharp materials, including used syringes.
Collapse of municipal solid waste services, including possible loss of experienced waste managers	Lack of collection service and uncontrolled dumping of waste.
Uncontrolled discharge of healthcare waste from hospitals and clinics	Serious health risks to residents, including the spread of disease and infection, for example from used syringes; Odor problems.
Exposure to asbestos layer in demolished structures or reuse of asbestos for reconstruction	Health risks associated with inhalation.

Types of hazards and waste characteristics for earthquakes
Structures collapse "in situ", meaning floor slabs collapse on top of each other, trapping waste within damaged buildings and structures. This can lead to difficulties in separating hazardous waste (eg asbestos) from non-hazardous waste (*eg.* general building debris). Destroyed buildings can overlap between streets, making access

difficult for search and rescue and relief operations. Since normally all building contents become waste, the amount of waste is higher than other types of disasters (UNEP/OCHA 2011).

Disaster waste management framework

For waste to pose a risk to human health or the local environment, three conditions must be met: (1) it must be dangerous (ie toxic to human health) or present a hazard; (2) there must be a route or "path" where the hazardous waste can affect a "receiver", for example a person or a water source (3). Where these three risk factors are present, waste can have a negative impact and should be considered a potential priority. In this framework, disaster response and preparedness can be divided into four phases (UNEP/OCHA 2011).

STAGE 1: Immediate and Short-Term Actions

Phase 1 addresses the most serious waste issues needed to save lives, alleviate suffering, and facilitate rescue operations. Other considerations at this stage are secondary. Use the tools and checklists outlined below to support your work.

0-72 hours: urgent actions:

Usually initiated within hours of the disaster event: Create a hazard ranking using the steps below to identify the most urgent priorities. Identify waste problems. Identify the geographic presence of waste through information gathered from government sources, the GIS, news, and local agencies. - Characterize the waste. Measure the composition and quality of waste streams and landfills/landfills identified, albeit superficially, through site visits and waste sampling/analysis (UNEP/OCHA 2011).

Use the above data in the waste map of the affected area. The map will be a valuable tool throughout the process and can be updated as information becomes available. Evaluate the waste. Let the prioritization of action be developed. This requires using the framework outlined above: determine where the waste is, also whether there is a "path" and a "receiver". Prioritize actions. Each identified waste stream and/or problem is given a "common sense" ranking based on the following as a guide:

The guidelines consist of four parts:

1. Introduction and overview.
2. General guidance is divided into the immediate response phase, the medium-term phase, and the long-term phase. Second, it contains information about emergency planning.
3. Key aspects that are important throughout the process – *eg*. health and safety.
4. Tools and checklists to implement the guidance provided.

Appropriate disposal sites will be determined for the disposal of different types of waste collected during the emergency phase. If an existing disposal site exists, it should be quickly evaluated for environmental suitability prior to use. Where an existing disposal site is not available, a temporary disposal site or designed landfill should be identified and established. See Annex IV for more details. No waste will be accepted into the temporary storage site without being evaluated and authorized by a competent authority. - Main streets will be cleared to provide access to search and rescue efforts and relief supplies. Any DW transported should remain in the emergency area if possible. It should not be transported outside until the appropriate disposal site(s) has been determined. - All available equipment and stakeholders should be used. Animal-pulled wheelbarrows and wooden carts can be used where excavators, trucks and shovels are not accessible. - If hospitals and clinics are affected by the disaster, they should be encouraged to separate their infectious and/or medical waste, store it separately and transport it to temporary special treatment or disposal sites. Whatever resources that are available to address the issues identified in the above analysis as most pressing should be marshalled (UNEP/OCHA 2011).

After 72 hours: short-term actions

It is usually initiated within days of the disaster event: If people remain in the disaster area, their household waste should be collected if possible. At this stage, a quick DW assessment should be done to inform further decision making. Precise data is not required, but reasonable ideas should be provided on the status of waste management, access to disposal sites, the ability of local authorities to handle the situation and the need for any international assistance (UNEP/OCHA 2011).

Other considerations:
Waste from Internally Displaced Persons (IDP) camps should be managed in coordination with general solid waste management services and thus integrated with local waste collection services. • Ownership of waste, especially reusable waste, is an important issue that needs to be clarified to avoid future disputes. The output of these actions should be a series of actions to understand the key DW issues and address the most pressing of them (UNEP/OCHA 2011).

PHASE 2: Medium-Term Actions
The second phase forms the basis of a disaster waste management program to be implemented in the medium-term phase. It also continues to address key issues such as the location of a disposal site for different types of waste, waste collection, transportation and facilitating logistics for reuse/recycling activities. Efforts here build on the initial Phase 1 assessment but go deeper with an emphasis on longer-term solutions. Required actions normally include:
Continue to assess disaster waste (scope of waste generation, locations, waste types, regulatory understanding, etc.). Assess the location of medium-term temporary disposal and waste separation sites for unsorted rubble and municipal waste. This may require upgrading or improving existing landfill sites. Consider requirements for closing existing landfills if they pose a threat to human health or the environment. Identify and evaluate other waste management facilities in or near the affected area. Assess local capacities to handle disaster waste and identify gaps/needs for additional assistance (UNEP/OCHA 2011).

Operations
Create temporary storage areas for debris and normal waste. See Annex IV or label 6 of the online DWM Guidelines www.eecentre.org. Start collecting and transporting waste and debris to expand this in later stages. Prepare practical advice and guidance for local authorities on workarounds to minimize the environmental and health impacts of disaster waste.

Planning
Implement a communication plan that focuses on opportunities (i.e. reuse and recycling), risks (i.e. human health risks) and collection plans for affected communities. Develop a plan for medical waste. This may require the construction of a temporary incinerator for healthcare waste. Develop a specific plan for the collection and treatment of hazardous waste (including asbestos). Consult affected communities on issues related to public health, waste, livelihoods, and the environment. Determine exit strategies and handover options for the disaster waste management systems planned to be installed (UNEP/OCHA 2011).

Communication and reporting
Communicate findings quickly and regularly to local authorities, the United Nations Resident Coordinator, the UN Disaster Assessment and Coordination teams, the Joint UNEP/OCHA Environment Agency and other international response mechanisms as appropriate. Electronically document assessment results, recommendations, and mitigation measures implemented. The outputs of these planning actions include data and information for designing a disaster waste management plan that is implemented during the recovery phase.

STAGE 3: Long-Term Actions
The Third Stage includes the implementation of the disaster waste management projects designed in the Second Stage and the continuous monitoring and evaluation of the disaster waste situation. Key actions: Develop and implement a communication plan for key stakeholders to ensure that the disaster waste management program is aligned with community expectations and needs. Purchasing or repairing necessary waste management facility, machinery, and equipment. Train waste management operators if necessary. Support the implementation of disaster waste human contracting systems by supporting waste management operators/operators or local authorities. Transfer disaster waste management systems to a normalized and improved solid waste management system. The output of this phase should be the handling of all disaster waste through disposal, incineration, reuse, or recycling (UNEP/OCHA 2011).

STAGE 4: Situation Planning
The fourth stage is not exactly part of the emergency response. But intervention helps bridge the gap between recovery and long-term development and is therefore a significant investment. Contingency planning can be carried

out in the long-term phase or as a pre-disaster preparedness measure. The aim is to develop a Disaster Waste Management Contingency Plan (DWMCP) to assist communities in predetermining appropriate management options for a disaster. A plan that identifies cost-effective disaster waste management options and resources can save money, increase control over waste management, and improve administrative efficiency. The plan can also be used as a source document in technical and financial assistance negotiations. An effective DWMCP addresses issues far beyond initial extraction and must include a strategy for recycling and reusing materials (including composting). A DWMCP has many possible components, including: Establishing state coordination; Identifying possible types of waste and debris; Determination of estimated amounts of waste and debris; List applicable national and local environmental regulations; Inventory available capacity for waste and debris management and identify waste and debris monitoring mechanisms; Pre-select temporary waste and rubble storage areas and identify opportunities for safe temporary storage of hazardous waste; Identifying equipment and administrative needs; Negotiate contracts in advance.

Developing a communication plan; Establishing a disaster debris prevention strategy: Establishing a debris removal strategy; Identifying hazardous materials and putting forward recommendations for hazardous waste management; Recycling options, Waste-to-energy options, Disposal options, Open write options (UNEP/OCHA 2011).

Program sustainability

It is important to have an exit strategy from the long-term stage to ensure sustainability. The key to this is local participation in all activities, including: Providing technical capabilities: local capacities should be built so that sufficient technical capacity remains to maintain any waste management system after the project is completed; Financially self-sufficient: any waste management system must continue to operate beyond the long-term improvement phase with fees and/or public sector funds to ensure sustainability.

Effective handover is also important. Options include Private sector handover, where the installed system is transferred to a private sector company operating as a for-profit service. This may be a direct transfer to the existing management team or may follow a bidding process; public sector handover, where the system is handed over to the local government or other government agency for ongoing operations as part of a public sector service; community-based organization (local NGO) where the system is taken over by a local NGO to continue operations with national or international funds; or public/private hybrid transfer, where a public sector entity can function as a commercial entity providing services back to the public sector or directly to the market (UNEP/OCHA 2011).

It is accepted as the earthquake of the last century together with the earthquakes originating from Kahramanmaraş and their aftershocks. The loss of property and economic loss due to the earthquake is as high as the damage caused by the earthquake. Disaster management of such a large and effective earthquake has been seen to be very difficult. It has been observed that it is very difficult to carry out search and rescue works in the desired short time by using all the facilities of the state in Turkey, to remove the debris caused by the earthquake and to provide the expected assistance to the people and organizations damaged by the earthquake. On the first day, even estimating the effects and dimensions of the earthquake was difficult. The dimensions of the event were realized within the first week. In-kind, cash and personnel/equipment aids from nearly 100 countries were accepted by responding positively to international calls for help that were not needed in the great earthquakes that occurred before. Instead of the rules to be followed in disaster management, it has been tried to give all the facilities to search/rescue works and to meet the needs of the people in the region in parallel. The effort given to these works has sometimes reached the level of slowing down the works in the region, and programs have been prepared for the purpose of ensuring coordination to prevent this. It was ensured that the search and rescue works were completed with the most intensive service within the first month. In the first month, the removal of the wreckage was only included in mandatory situations. During and after the search and rescue efforts, the needs of the victims were tried to be met, and all provinces of Turkey were mobilized for this work. Within a period of six months, the earthquake debris, which was effective in a very wide area, was removed. During the debris removal works on the one hand, the determination of permanent places for the people of the region and the construction of suitable houses were started. While some houses were handed over to the victims within a six-month period, a program and work was carried out for the delivery of housing for all victims within a year. Before the effects of the economic crisis that occurred all over the world due to Covid-19 were overcome in Turkey, studies to eliminate the economic effects of the earthquake started after the first 5 months. While the priority was given to these studies during the execution of the search and rescue works, while the activities for the control of solid wastes were carried out primarily within the framework of short-term activities, while the debris-removal studies were carried out, it was carried out more strongly. With the completion of the debris removal works, the reconstruction of the region and the general needs of the earthquake victims, the activities for the residence areas have been accelerated. A great success has been achieved by carrying out studies that did not seem possible for many countries of the world.

REFERENCES

1. AFAD, Afet ve Acil Durum Yönetimi Başkanlığı, Deprem ve Zarar Azaltma Genel Müdürlüğü, http://www.deprem.gov.tr/;
2. Duman, T.Y., Çan, T., Emre, Ö., Kadirioğlu, F.T., Başarır Baştürk, B., Kılıç, T., Arslan, S., Özalp, S., Kartal, R.F., Kalafat, D., Karakaya. F., Eroğlu Azak, T., Özel, N.M., Ergintav, S., Akkar, S., Altınok, Y., Tekin, S., Cingöz, A. ve Kurt, A.İ., 2017, Türkiye Sismotektonik Haritası Ölçek 1:1.250.000. Maden Tetkik ve Arama Genel Müdürlüğü, Özel Yayın Serisi-34, Ankara. ISBN: 978-605-9516-19-8;
3. Emre, Ö., Duman, T.Y., Özalp, S., Elmacı, H., Olgun, Ş. ve Şaroğlu, F., 2013, Açıklamalı Türkiye Diri Fay Haritası, Ölçek 1:1.250.000. Maden Tetkik ve Arama Genel Müdürlüğü, Özel Yayın Serisi-30, Ankara. ISBN: 978-605-5310-56-1;
4. EMSC, European-Mediterranean Seismological Centre, http://www.emsc-csem.org/;
5. Erol AO, Çekinmez Z, (2014) Jeoteknik Mühendisliğinde saha Deneyleri Orta Doğu Teknik Üniversitesi Ankara 2014 Yüksel Proje Yayınları No: 14 -01;
6. Morgan O, Tidball-Binz M, Van Alphen D, (Editors) 2006 Management of Dead Bodies After Disasters: A Field Manual for First Responders. World Health Organization (24 May 2006). ISBN-13 978-9275126301;
7. UNEP/OCHA (2011) Disaster Waste Management Guidelines. United Nations Office for the Coordination of Humanitarian Affairs Environmental Emergencies Section. Published in Switzerland, January 2011 by the Joint UNEP/OCHA Environment Unit Copyright Joint UNEP/OCHA Environment Unit. https://www.unocha.org/sites/unocha/files/DWMG.pdf;
8. URL-1.https://www.afad.gov.tr/kurumlar/afad.gov.tr/35429/xfiles/turkiye_de_afetler.pdf.Retrieved June, 2023;
9. URL-2.https://www.sbb.gov.tr/wp-content/uploads/2023/03/Turkiye-Recovery-and-Reconstruction-Assessment.pdf Retrieved June, 2023;
10. URL-3https://www.afad.gov.tr/kurumlar/afad.gov.tr/Mevzuat/Kilavuzlar/IRAP-KILAVUZ_tum_v7.pdf Retrieved June, 2023;
11. URL-4. https://www.kmev.org.tr/kopyasi-tarihimiz. Retrieved June, 2023
12. URL-5https://www.frmtr.com/cografya/1046026-illerimiz-ve-ozellikler-tum-iller-tek-tek-ve-ayrintili-3.html Retrieved June, 2023;
13. URL-6https://www.sbb.gov.tr/wp-content/uploads/2023/03/2023-Kahramanmaras-and-Hatay-Earthquakes-Report.pdf Retrieved June, 2023;
14. URL-7 https://www.ksu.edu.tr/default.aspx?DId=64516). Retrieved June, 2023;
15. URL-8.https://www.subu.edu.tr/sites/subu.edu.tr/files/2023-04/Kahramanmaras%CC%A7%20Deprem%20Raporu_12.04.2023.pdf Retrieved June, 2023;
16. URL-9. https://hsgm.saglik.gov.tr/depo/Yayinlarimiz/Rehberler/hsgm-deprem-Cevre-sagligi-rehberi.pdf Retrieved June, 2023;
17. Wells, D.L., Coppersmith, K.J., 1994. New empirical relationships among magnitude, rupture length, rupture width, rupture area, and surface displacement. Bull. Seismol. Soc. Am., 84(4):974–1002;