AKIBAT ERUPTSI MERAPI 2010

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Diselenggarakan atas kerjasama
Program Magister Pengelolaan Bencana Alam (MPBA-UGM)
Himpunan Ahli Teknik Hidraulik Indonesia (HATHI)
Multimodal Sediment Disaster Network (MSD-Network)

Yogyakarta, 21 Februari 2011
PROSIDING
Simposium Gunung Merapi

Kajian Perilaku, Dampak, dan Mitigasi Bencana Akibat Erupsi Merapi 2010

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Kata Pengantar

Gunung Merapi merupakan salah satu dari beberapa gunung api di Indonesia yang sampai hari ini dilihat paling aktif, dengan jenis bahaya yang dapat dibedakan menjadi bahaya primer yaitu bahaya erupsi (awan panas, aliran pyroclastic, hujan material), serta bahaya sekunder (aliran lahar dingin). Erupsi yang terjadi pada akhir tahun 2010, yaitu antara 26 Oktober sampai dengan 5 November 2010, telah menyisakan berbagai dampak negatif, baik yang menyangkut kehidupan masyarakat di sekitar Gunung Merapi yang terkena dampak bahaya primer, maupun aktivitas perekonomian tidak saja pada masyarakat di kawasan yang terkena terjangan lahar dingin, namun juga masyarakat pengguna infrastruktur yang terkait (jembatan, jalan raya, dan sebagainya).

Banyaknya kawasan permukiman dan lahan pertanian yang rusak akibat dampak erupsi merupakan hal yang kompleks dalam upaya mengembalikan masyarakat ke tempat tinggal asalnya maupun untuk beraktivitas di lahan pertanian. Bahkan untuk mencarikan lahan sebagai tempat hunian sementara pun dirasakan menemui banyak kendala, baik secara teknis (aman dari bencana aliran lahar dingin), maupun secara sosial. Demikian juga dengan rusaknya infrastruktur jalan, jembatan, sawah, permukiman dan lain-lain akibat terjangan aliran lahar, sungguh merupakan hal yang perlu diantisipasi mengingat besarnya tumpahan material dari hulu sungai di wilayah Gunung Merapi (lebih dari 140 juta m$^3$).

Dalam rangka meninjau perkembangan fenomena tersebut, Program Magister Pengelolaan Bencana Alam (MPBA-UGM), bekerjasama dengan Himpunan Ahli Teknik Hidraulik Indonesia (HATHI) serta Multimodal Sediment Disaster Network (MSD-Network), merasa perlu untuk menyelenggarakan Simposium Gunung Merapi, dengan tema "Perilaku, Dampak, dan Mitigasi Bencana Akibat Erupsi Merapi 2010". Simposium ini dimaksudkan sebagai wahana saling bertukar pengetahuan tentang beberapa hasil kajian teknis dan non-teknis, terkait fenomena perilaku dan dampak bencana akibat erupsi Merapi 2010, serta gagasan mitigasinya berkelanjutannya pada arah ke depan.

Atas kerjasama yang baik dan bantuan dari semua pihak dalam menyukseskan Simposium Gunung Merapi, panitia mengucapkan terima kasih.

Yogyakarta, 21 Februari 2011

Ketua Panitia

Dr. Ir. Joko Sujono, M.Eng.
Sustaining Community Disaster Preparedness: Self-Evacuation Drill Against Volcanic Disaster

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ABSTRACT: A self community-based evacuation drill program has been developed since year 2008 at four sub-villages surrounding Mt. Merapi area. During the 2010 eruption, two sub-villages at Glagaharjo Village, Sleman Regency, i.e. Kalitengah Lor and Kalitengah Kidul were totally destroyed by pyroclastic flow. However, the communities at these sub-villages were evacuated safely. It is essential to find out how this self-evacuation works during the eruption, and how to ensure the sustainability and applicability of this program. This paper presents a review and evaluation of self-evacuation drill activities in order to assess the lesson learned and provide recommendations for community disaster preparedness. Based on the analyses, there is a variety of participants’ understanding on the evacuation procedures, posters and evacuation maps used in the evacuation drills. In general, younger participants have better understanding than the older participants do. The development of disaster preparedness organization at village/sub-village level helps to enhance the disaster preparedness and public awareness that may reduce the casualties when disaster occurs. Moreover, the evacuation drills need to be carried out regularly to improve the community awareness on disaster risk management.

1 INTRODUCTION

Evacuation is one of the means to avoid dangers during a disaster situation. In the case of a volcanic eruption, evacuation is perceived as a must action since in many volcanic eruptions the dangers can be very severe that the only way to avoid danger is through evacuating from the danger area. In an extreme eruption, there is almost nothing to do but to evacuate (Keller and Blodgett, 2008). Accordingly, the population at risk should be advised well in advance about the evacuation routes and the location of evacuation shelter prior to a volcanic eruption (Smith and Petley, 2009). Some structural countermeasures can be constructed to reduce the level of the damage, yet these countermeasures cannot adequately protect the community. Therefore, there is a necessity to implement a proper evacuation in volcanic disaster risk management.

Community-based disaster preparedness and public awareness are essential factors that may reduce the number of casualties in most of the disaster occurrence. This may be due to the fact that the community is able to conduct independent preparedness and evacuation since the assistance from outside community, i.e. local authorities, SAR, Red-Cross, may take some time and is often too late. It is hoped by conducting evacuation drills, the community could remember the previous disaster occurrence, appreciate the importance of anticipation, act appropriately and save their properties and lives.

Several evacuation drills have been conducted by local governments, universities, international organizations and NGOs located in Mt. Merapi area. Likewise, some materials regarding evacuation activities were provided either at local community or at local governments. Fathani and Legono (2010) have proposed a self-evacuation drill program for community resilience at Mt. Merapi area. This program was implemented at four sub-villages surrounding Mt. Merapi which focused on four main activities i.e. (1) review the previous evacuation drill programs and existing standard operating procedures (SOP); (2) select the targeted villages or sub-villages, and the possible parties to be involved; (3) establish and disseminate the evacuation drill materials (SOP, evacuation map, poster) and disaster preparedness organization at sub-village level; and (4) implement evacuation drill.

During the 2010 Mt. Merapi eruption, two sub-villages (Kalitengah Lor and Kalitengah Kidul) at Glagaharjo, Sleman Regency were totally destroyed by pyroclastic flow. Figure 1 shows the condition of Kalitengah Kidul before and after the 2010 eruption. However, before the eruption occurred, the communities at these sub-villages had evacuated safely, and no victim was reported. It is essential to find out how this “self-evacuation” could work during Mt. Merapi eruption, and how the sustainability of this program can be ensured. This research presents the review and evaluation of self-evacuation drill activities in order to assess the lesson learned and provide recommendations for community disaster preparedness.
2. DETERMINATION OF TARGETED AREAS, PROCEDURES AND ASSESSMENT TOOLS

2.1 Location of Evacuation Drill Program

Selection criteria to identify the targeted villages/sub-villages have been discussed and then determined by public consultation meetings. The selection criteria have been revised a few times by considering the existing SOP and review on previous evacuation drills. The selection criteria for targeted area are the area should be located at volcanic hazard zone (pyroclastic flow and debris flow), the existence of sand mining activities, the existence of sabo facilities and early warning system (Legono et al., 2008) and based on the approval from the local government.

The possibility of evacuation drills implementation has been investigated by Universitas Gadjah Mada (UGM) in several recommended areas. The most important consideration of selecting targeted area is the area should be located at Hazard Zone III and the local community is willing to implement self-evacuation drill. There are four selected sub-villages as targeted area for this program, located in Magelang, Boyolali and Sleman Regency. Figure 2 shows the location of Participatory Rural Appraisal survey on community awareness in disaster management (Sujono and Legono, 2010) and evacuation drill program conducted by local government, Forum Merapi, and four sub-villages as model area is shown in point circle.

Figure 2. Location of PRA-Survey and evacuation drill implementation surrounding Mt. Merapi (2008-2010)

Kerjasama MPBA-UGM, HATHI, dan MSD-Network
2.2 Evacuation Drill Procedures

In developing self-evacuation drill activities, three levels of alert were adopted, namely caution (waspadja), warning (stiga) and evacuation (awas). Caution (waspadja) is the level one alert. This stage will show the signs that the source of danger (volcano) is in active condition. In this stage, the actions include carrying out coordination among disaster preparedness members, informing the current situation and the actions they should take, and updating the list of vulnerable and potential group, cattle, vehicles, etc.

Warning (stiga) is a level-two alert. In this stage, the vulnerable people (elderly, kids, pregnant women, and handicapped person) will be evacuated to the temporary evacuation shelter by some vehicles provided by the local officers. Additionally, the potential groups are asked to gather at the assembly point in order to wait for the order to evacuate once the situation gets worse. The vulnerable people are transported from their houses to the nearest assembly points and then to the temporary evacuation shelter. Officers will inform the status change of volcano and ask the local community to increase their preparedness and awareness on the volcanic activities.

Potential groups should help the officer evacuating the vulnerable group to the temporary shelter. Afterward, they should stay in the village and keep aware for evacuation in case evacuation (awas) alert starts. Evacuation (awas) is a level-three alert. In this stage, everybody has to evacuate since the eruption may take place at any time. Using their own vehicles (motorcycles) and additional cars/trucks provided by the officer, the potential groups are supposed to evacuate.

According to Lindell and Perry (2004), experiences of previous disasters and evacuation could affect the intention in participating or responses to the next disasters. Therefore, questions on previous disasters and evacuations were taken into account during assessing the participants' points of view of the evacuation drills.

2.3 Assessment Tools

As the study in this research aims to examine the lessons learned from evacuation drill activities, there is a need to introduce assessment methodology. The assessments consider three groups of variables in the analysis, i.e. evacuation drill program, population, and respondents' responses (their perception and knowledge on volcanic disaster and evacuation drill). The assessment tools, that will be used in the section of analysis, include (a) observation on the person in charge and participants of evacuation drill, (b) statistical analyses in participants' points of view. Population in this evacuation drill program means the participants during evacuation drills, which consist of village officers, person in charge (evacuation officer), and local community.

3 ANALYSIS AND DISCUSSIONS

3.1 Evaluation on the Implementation of Evacuation Drill Program

The disaster preparedness organization has been established to provide a clear task demarcation among the person in charge (evacuation officer) and to increase the motivation and confidence to conduct the evacuation by their own capability (Fathi and Legono, 2010). The coordinator of evacuation is supported by a deputy coordinator and assisted by five coordinators i.e. coordinator for data updating, security, transportation, logistics and first aids. If the head of sub village or coordinator of evacuation during the evacuation activity is absent; other officers will take necessary action to evacuate all residents under the guideline stated in the SOP. By establishing this organization, it is hoped that sustainability of community-based disaster preparedness could be achieved.

The implementations of evacuation drill based on the SOP were generally performed smoothly by the local people. Based on the observation, some of the villagers have less awareness on the importance of this activity, for example, some participants did not follow the procedures stated on the poster and even some of the villagers did not participate in the drill. Thus, the evacuation simulation should be held regularly so that the villagers can understand what they are supposed to do when disaster strikes. After the evacuation drill implementation, it is expected that the local people can carry out evacuation independently. Therefore, the villagers must remember the procedures of evacuation.

Transportation means for evacuation are motorcycle, car, and truck. Vulnerable group will be picked up at their houses, transported to assembly point with cars and trucks and then to temporarily evacuation shelter. For potential group, those who were using their own vehicles should gather at assembly point first, and then go to temporary evacuation shelter, so that officers can collect their data.
3.2 Evaluation on Participants Points of View

The evaluation based on the participants’ points of view will concern in the following issues: evacuation procedure, poster, evacuation map, and transportation. The evacuation map developed by local community in Kalitengah Lor (3.5 km from the summit) is shown in Figure 3. In order to obtain the data, questionnaire surveys were carried out in December 2009 at two different sub-villages (Kalitengah Kidul in Sleman Regency and Jamburejo in Magelang Regency) on residents who previously experienced the evacuation drill activities.

The surveys were carried out based on purposive random sampling on the two sub-villages. Purposive random sampling means a process where a sample is selected randomly based on the knowledge of the group to be sampled, i.e., age, sex, geographical distribution and vulnerable/non-vulnerable people. The respondents were selected based on the list of residents who participated earlier in the evacuation drill.

Realizing that carrying out a survey at village level could be difficult due to some illiteracy problem and some hesitance of the respondents to fill the answers by themselves, in this survey there were some interviewers who visited the respondents from house to house. The interviewers helped to explain the meaning of each question to the respondents and to fill the questionnaire sheet. Therefore, some potential unclear information or questions could be avoided through the assistance of the interviewers.

These two sub-villages were selected as they represent different geographic locations and experience of the previous eruption. Total number of respondents from both sub-villages is 51 respondents with 26 respondents from Kalitengah Kidul and 25 respondents from Jamburejo. The questionnaire addresses the following issues: general demographic characteristics (gender, age, occupation, and education) and specific questions related to evacuation drills (evacuation procedure, poster, evacuation maps, transportation, and temporary evacuation shelter).

![Evacuation Map of Kalitengah Lor Sub-Village, Glagaharjo Village, Sleman Regency (modified on September 2009)](image)

Figure 3. Evacuation map of Kalitengah Lor Sub-Village, Glagaharjo Village, Sleman Regency (modified on September 2009)
Since the number of respondents in the survey was limited, the results may not be able to represent all of the population. Hence, the results of the analyses in this section have to be crosschecked with a further study or confirmation.

The respondents in Kalitengah Kidul sub-Village consist of 42% male and 58% female. The large number of female respondents was due to the time of the surveys which were carried out in the afternoon where some male respondents were still at their work as sand miners and farmers. The respondents of Jamburejo Sub-Village consist of 52% male and 48% female. In term of education level, most of the respondents in both sub-villages attended elementary school level with only some people experienced junior high school. Hence, the respondents have capacities to read at least basic sentences/messages. This is related to the posters and maps used for the evacuation drill activities that the messages should be as simple as possible (less technical words) so that the respondents understand the meaning.

In term of experiences of previous disasters and evacuation, many respondents in Kalitengah Kidul mentioned that they experienced previous disasters. Only few people have no experience on disasters and previous evacuation. Similar figure is also found for respondents from Jamburejo. This means the respondents of both sub-villages have had enough exposures (experience and information) on previous disasters and evacuations.

This research records the mean values of answers by respondents in each sub-village. The mean values of respondents based on the sub-village and gender are illustrated using the radar chart as follows (Figure 4 and 5). The answers to the questions range from 1 to 4, showing the value from “very difficult to understand” to “very easy to understand”.

It could be inferred from the figures that the male participants are rather optimistic than female participants. This could be because either male participants have more understanding on the tools (posters and evacuation maps) or they stay outside more than the female participants. The further detailed analyses of the data were mainly carried out based on the sub-village, gender (sex), age, education and the group (vulnerable – non vulnerable). Some selected results which illustrate some patterns are discussed in the following sub-sections.

**Figure 4. Respondents’ responses on evacuation procedure, poster and evacuation map based on sub-village.**

**Figure 5. Respondents’ responses on evacuation procedure, poster and evacuation map based on gender.**
3.2.1 Evacuation Procedure

The evacuation procedure was prepared beforehand to guide the evacuation officers in arranging the evacuees before moving to the evacuation shelter. Two questions were used to measure the participants’ understanding on the evacuation procedure: “opinion on the followed evacuation procedure” and “understanding on the message conveyed by the evacuation officers”. Both respondents in Kalitengah Kidul and in Jamburejo Sub-Village think that the current evacuation procedure tends to be “easy to understand”. This is shown by the mean values of both respondents of 3.0 and 2.9, respectively. These values indicate that the participants of the evacuation drills could understand the evacuation procedure conveyed by the officers during the drill.

As for the opinion on the messages during the evacuation procedure, both respondents in Kalitengah Kidul and Jamburejo Sub-Village shared similar opinion that the message was “easy to understand” (average mean value of 2.9). Relationship between age and the evacuation procedure is found negative. This means the older a person is, the less he or she understands the evacuation procedure. This result is quite common in other areas that old people (> 60 years), who also belong to vulnerable group, tend to have less understanding on the knowledge of disasters. However, the gap of understanding is not much different.

Even for the information provided by evacuation officers, some old people feel to have problem in understanding the message. In contrast to age, the relationship between education and understanding evacuation procedure is found flat. This means there is no difference in understanding among those who have different academic background. This finding is quite surprising since normally, higher educated people have better understanding of any knowledge. It could be due to the fact that the data do not represent the figure of the population as described earlier or it could be simply that higher educated people or the other people have different ways in perceiving the risks.

3.2.2 Evacuation Poster

This section evaluates how the participants thought about the poster used to share the knowledge for evacuation purposes. Two closed-questions were asked to the participants related to the posters: “opinion on the content of the poster” and “opinion on the symbol used in the poster”. The other question is an open type question: “participant suggestion on the quality of the poster”. In questions related to poster, it is clear that the respondents in Kalitengah Kidul has “easy understanding” on the content of the poster. Similarly, they also stated that they can understand the symbols/pictures used in the poster. On the other hand, the respondents in Jamburejo seem to understand less the message of the poster and the symbols/pictures used in the poster.

In term of gender, it is clear that the male respondents could understand the message and the symbol/pictures of the poster better than the female respondents (2.9 as compared to 2.7). This finding is common, as the male respondents are normally more exposed to information from outside, including the evacuation posters.

The relationship between age and the participants’ understanding on the content of the poster shows that the older the participants the lower their understanding of the poster is. Therefore, for old people, poster may not serve as an effective tool for disaster education. On the other hand, young people or adults may still like to use poster to learn.

3.2.3 Evacuation Route and Assembly Points

This section evaluates the participants points of view of the evacuation maps used in the evacuation drill. Four closed questions were asked to the participants related to the evacuation map: “opinion on the content of the map”, “symbol and pictures used in the map”, “learning the map prior to the drill” and “opinion on the location where the evacuation map is located”. It turns out that there is almost equal number among participants who understand the contents of the maps and some other participants who do not understand the map. For example, in Jamburejo Sub-Village the responses of the participants on the contents of the map and the symbols/pictures used in the map fall in 2.6 and 2.4, respectively. These values mean that almost half of the participants do not have clear understanding on the contents of the maps.

Similar figures are also obtained from participants based on their gender. The male respondents tend to understand the evacuation maps better than the female respondents. Many respondents in Kalitengah Kidul reported that they did not use the evacuation map as their consideration while evacuating. Even so, most of them (92%) suggest that the current location of the evacuation map is good enough (see Figure 6). The next question is then, how to increase the awareness of the participants to the current evacuation map. It is suggested that the evacuation map needs to be revised periodically when necessary by the local community.
3.2.5 Evacuation Shelter

Temporary evacuation shelter was evaluated based on two questions: "evacuation from home to assembly point, then to shelter" and "opinion on the shelter facilities". There is no difference in term of difficulties to reach to assembly point and to temporary evacuation shelter in the two sub-villages. There is a little difference found among their opinions on the sufficiency of the temporary evacuation shelter. Respondents in Kalitengah Kidul thought that the facilities in the temporary evacuation shelter is "sufficient" while the respondents in Jamburejo Sub-Village thought it is between "sufficient" and "not sufficient". These include lack of sanitation and capacity. This difference may be solved by involving the residents in designing the evacuation shelter. Previously, the temporary evacuation shelter was provided by the government and NGOs.

3.3 Lesson Learned

During the evacuation drill activities, it has been realized that preparation held a very important role. Preparation includes developing of evacuation materials (SOP, evacuation map and poster), establishing disaster preparedness organization at sub-village level and coordinating with relevant agencies (regency and village officers).

Standard operating procedure (SOP) has been realized as a central to guide the evacuation officers in conducting the drill. As previously there was no SOP at sub-village level, the making of SOP at sub-village level is an achievement that can be done continuously to make this sustainable. Developing a SOP with the involvement of local community made the communication to the evacuees become easier. Additionally, this step also involves the process of developing the evacuation map and poster. Socialization prior to carrying out an evacuation drill is important and will increase the awareness the evacuation officers and the evacuees. This also includes the coordination with the agencies involved when carrying out the evacuation. Provision of poster and evacuation maps is important to increase community awareness prior to or during the evacuation. Finally, a continuous evaluation needs to be done in assessing disaster preparedness, public awareness and readiness to face a volcanic disaster. The proposed idea for sustaining a self-evacuation drill at village and sub-village level is shown in Figure 8. Replication of similar self-evacuation drills program at another location is highly possible.
Figure 8. Cycle of sustaining a self-evacuation drill against volcanic disaster at village/sub-village level.

4 CONCLUSIONS

Based on the analyses, several points can be concluded as follows. There is a variety of participants’ understanding of the evacuation procedures, posters and evacuation maps. In general, younger participants have better understanding in using the evacuation materials than older participants do. In term of gender, male participants have better understanding on evacuation materials. On the other hand, the education is not exactly correlated with the level of understandings. Besides, between the vulnerable and non-vulnerable group, there is not much difference on their understandings on evacuation materials.

The establishment of disaster preparedness organization at village/sub-village level is very important in order to develop standard operating procedures, evacuation map, poster, and to communicate the scenario with local community. The involvement of local people as the evacuation officers also increases their capacities in dealing with the disasters and their awareness.

Based on the conclusion above, the following recommendation is proposed to improve the quality of disaster risk management in Mt. Merapi. Given the different understanding among the participants, evacuation drills need to be carried out regularly (at least once in a year) to improve the community’s awareness at the current model area and at other locations. This could be done through introducing the evacuation for specific purposes, i.e. evacuation for sand miners, evacuation for teachers and students. Additionally, this drill has to be conducted with the existence of local disaster preparedness organization. In the real evacuation situation, the officer that have been assigned earlier are expected to carry out their roles in helping and managing the evacuation.

Since the understanding on current tools, i.e. posters and maps are different among participants, it is important to identify other tools that can be done to increase community awareness. Introducing disaster mitigation games that involve active participation of the participants could be one of the options to increase disaster preparedness and public awareness.

Further information of evacuation should be provided to the vulnerable people. This has been noted from their lack of ability to absorb the information on evacuation procedure, and to utilize the poster and maps. Raising awareness could be done long before a disaster strikes for the vulnerable people. As younger participants have better understanding of the evacuation procedure, in a family where there are some young family members, the understanding could be better than family without young family members, i.e. only elderly. A special attention, prior to real evacuation or evacuation drill, should be done. This can be achieved using the current policy of appointing local evacuation officers to empower and to assist the elderly. In this sense, the officers’ role is to increase the capacity of the elderly people.

References


Sertifikat

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Yogyakarta, 21 Februari 2011

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