German Technical Cooperation

Haze Guide

Information and recommendations to deal with haze from forest and land fires

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Based upon the experiences of the forest/land fire and the haze events in autumn 1997, GTZ Indonesia has taken measures to protect its staff from hazardous effects of haze and to improve its organisational response to such threats. A haze emergency coordinator (HEC) has been appointed to collect and analyse data on the haze development, to improve information flow and to give guidance for a coordinated corporate reaction. As an outflow of these activities, this „Haze Guide" aims at giving information and recommendations to people at risk from haze exposure.

1. What is haze?

Haze originating from large-scale forest and land fires is characterised by a high concentration of particulate matter, which, among other effects, reduces visibility.
Particulate matter consists of carbon bodies of different sizes, ranging in diameter from 0,001µm to 100 µm. In forest fire haze smaller particulates predominate, as the majority of the larger particles fall out of the atmosphere between the source and receptors.

2. How are the particulates in the haze measured?

There are two standard methods to measure particulate. One method is to measure the total amount of particles in the ambient air given as Total Particulate Matter (TPM), synonymous with Suspended Particulate Matter (SPM) in µg per m^3. The other uses a selective method that only measures the particles smaller than 10 µm (dp), called PM10. The units can be converted into each other, assuming that 90% of the SPM in the forest fires haze is PM10 (PM10 = 0.9*SPM)

3. What is the impact of haze on the human health?

While breathing, particulates are retained according to their size within the respiratory system.
Larger particles are deposited in the upper respiratory tract, while smaller particles penetrate deeper into the lungs, where they are retained for a long period of time. According to the ISO, particles with a diameter smaller than 4.5 µm are called respirable (ISO-Resp.).
The smaller the particles are, the more surface they offer for other pollutants to adsorb on.
That's why the smaller particles generally contain more harmful chemicals and consequently are of primary concern to the health agencies.
Short-term health effects from particulates include respiratory, eye, and skin irritations. Sneezing, runny nose, eye irritation, dry throat and dry cough can occur at air pollution levels slightly above the standard. With increasing pollution levels, the symptoms are likely to aggravate into breathlessness, bronchitis, and asthma, reduced lung function in children, and cardio-vascular disorders.
Persons with existing respiratory or cardiac disorders, children, and the elderly are likely to be more severely affected by haze.
Long-term effects are of high concern, if the small particles are loaded with carcinogenic compounds. Once carried into deep into the lungs, these compounds are retained and accumulate.

4. What is the air pollution threshold for particulates?

This guide is based upon the US-Environmental Protection Agency (EPA) standard and threshold system for air pollutants. This system comprises besides PM10 four other major pollutants, which are monitored and each translated to an index value. The highest index value is reported as the Air Pollution Index (API), similar to the Pollutant Standards Index (PSI) for the region of measurement. While the API ranges from 0 to 500, only values below 100 (standard index) are considered healthful.

In the following table, only short-term standards for particulates are taken into account.

PM10 Concentration	API/PSI	Pollution Level	Air Quality Description
0 – 50 µg/m³	≤ 50	Standard	Good
51 – 150 µg/m³	≤ 100	Standard	Moderate
151 – 350 µg/m³	≤ 200	Alert	Unhealthful
351 - 420 µg/m³	≤ 300	Warning	Very Unhealthful
421 – 500 µg/m³	≤ 400	Emergency	Hazardous
501 – 600 µg/m³	≤ 500	Significant Harm	Hazardous

Table 1: Threshold and indexes for PM10, 24 hours average concentration (short-term EPA-standards)

Example: Exposure to a 24-hour average PM10 concentration between 351 and 420 µg/m³ equals a "very unhealthful" air pollution level.

5. How can I assess the particulate pollution level at my location?

Because an increase in the particles in the ambient air reduces visibility, you can roughly estimate PM10 concentrations from visibility (in km) and relative humidity (in %):

PM10 (µg/m3)		VISIBILITY in km													
		10	5	4	3	2,5	2	1,5	1	0.7	0.5	0.4	0.3	0.2	0.1
Rel HUMIDITY	50%	48	95	119	158	190	238	317	475	679	950	1188	1584	2375	4751
	60%	48	96	120	159	192	239	320	479	684	959	1198	1597	2395	4791
	70%	49	97	121	161	194	242	323	484	691	968	1210	1614	2420	4838
	80%	36	71	89	119	142	178	238	356	509	712	890	1186	1780	3559
	85%	29	58	72	95	114	143	191	286	409	572	716	954	1430	2861
	90%	21	42	52	70	85	105	140	211	301	420	526	701	1052	2103
	95%	13	25	32	25	50	62	83	124	177	248	311	414	622	1244

Table 2: Correlation PM10 (µg/m3) with visibility (km) and relative humidity (%) [Ref.: Hoyningen-Huene]

N.B.: This table reflects only statistical value, which can differ considerably from actual PM10 concentrations. However, this method is sufficient for rough estimates.

To get the data on visibility and relative humidity, you can either consult the internet at http://wunderground.com/global/ID.html (Click at your location for detailed meteorological data) or contact the closest meteorological station (see Appendix 1 and 2). As the API is derived from the 24-hour average concentration, it is advisable to assess the local PM10 concentration from several measurement each a day (Table 2), to form the daily PM10-average and finally read off the pollution level/API-index from Table 1. The meteorological data from internet are updated 2 or`3 times a day; please check regularly (morning, noon, evening) for updated data and collect them. The meteorological stations generally measure every hour. Please contact them in the morning and ask for the data from the previous day.

Example: API for Medan on 27th October 1997:

Time (of measurement)	*Visibility (rounded value)*	*Rel. Humidity (rounded value)*	*PM 10 Concentration (according to Table 2)*
6 am	*1.0 km*	*90 %*	*211 µg/m3*
9 am	*1.5 km*	*85 %*	*191 µg/m3*
12 am	*0.5 km*	*90 %*	*420 µg/m3*
3 p.m.	*0.5 km*	*95 %*	*248 µg/m3*

The daily PM10-average out of these four measurements is 268 µg/m3. This value corresponds to an API-Index of 101 to 200 (Table 1), meaning the pollution has reached the „Alert"-Level

⇒ If the particulate concentrations are at or exceed unhealthful levels for more than two days, (more than 150µg/m³ as the daily average) or you have the subjective impression of a significant haze, contact the Haze Emergency Coordinator (HEC).

Beside your own monitoring activities, the HEC continuously monitors the haze occurrence and its development in Indonesia. Whenever he detects significant haze or it has been reported from projects, he immediately informs all related persons and institutions. In addition to the assessment of the regional pollution level via meteorological data, the HEC arranges a measurement campaign, conducted by the GTZ's regional deputies for air pollution measurement or he seeks more detailed information from measurement campaigns of other institutions. As soon as the HEC has supplementary data on the haze related air pollution level in your location, you will be informed.
Meanwhile, continue monitoring the air pollution level and inform the HEC continuously on the haze development in your location. Your own participation is an important contribution to ensure an immediate and adapted response on the situation.

6. What to do if I have haze induced health problems?

The current haze related health problems are generally mild and can be treated easily. Eye irritation can be relieved with common saline eyedrops that can be purchased from the pharmacy or medicine shop. Those who use contact lenses and experience eye irritation are advised to discontinue their use temporarily. Mild sneezing, runny nose, dry throat, and dry cough can be relieved by tablets or cough mixture, obtainable from any pharmacy. Persons - especially children and others in high-risk groups - whose symptoms persist or worsen should consult a physician or go to a recommended hospital.
Consult a physician immediately if you or a family member experience breathlessness, asthma, or other severe symptoms.

7. What preventive measures are recommended to minimise adverse health effects?

If the PSI exceeds the daily standard level of 100, persons with chronic heart and lung problems, as well as children and the elderly, should avoid outdoor activities and physical exertion. If symptoms occur, a physician should be consulted.
Reducing or temporarily halting participating in outdoor sports and other vigorous activities is advisable for healthy persons at pollution levels from "unhealthful" to "very unhealthful" (PSI 101 to 300).
When the PSI reaches the hazardous level (PSI 301 to 400), those with existing health problems, children and the elderly should stay indoors and avoid all unnecessary physical exertion. Others should avoid unnecessary outdoor activities.
If the PSI exceeds 400, everyone should remain indoors, keep windows and doors closed, and avoid all unnecessary physical exertion. To reduce particulate concentrations inside rooms, use air conditioning non-stop and clean/exchange the filters more frequently than normal. At 'hazardous" PSI levels it is recommended to use respirators (special masks) during all unavoidable outdoor activities.
Ordinary surgical-type do not prevent the inhalation of fine particles. If necessary, the GTZ Office in Jakarta will distribute suitable respirators.
Help your body cope with the "stress situation" of exposure to particulates by consuming healthy food, rich in vitamins, and - of course - by not smoking.
[Recommendations following the Haze Action Plan of the Environmental Ministry Singapore]

LOCATION	ADDRESS	PHONE / FAX
Balikpapan *(STAMET)*	Bandara Sepinggan Balikpapan	ph.: 0542-66886 ext. 2113 / 2116 fax: 0542-34054
Banjar Baru *(STAKLIM)*	Jl. Unlam III No. 3 Banjarbaru 70714 Kalimantan Selatan	ph.: 0511-92218 , 95198 fax: 0511-94053
Batam	Bidang Meteorologi Bandara Hang Nadim, Batam	ph.: 0778-761415 or 761414
Bengkulu *(STAMET)*	Bandara Padang Kemiling Bengkulu 10051	ph.: 0736 – 51064
Bengkulu *(STAKLIM)*	Jl. Ir. Rustandi Sugianto Pulau Bai, Bengkulu	ph.: 0736-51251
Bukittinggi *(Stasiun Pemantau Atmosfir Global)*	Tromol Pos No. 16 Bukit Tinggi 26100 Sumatra Barat	ph.: 0752-22789
Jambi *(STAMET)*	Bandara Sultan Taha Jl.Sukarno-Hatta P.O.Box 138, Jambi	ph.: 0741-23245
Medan *(STAMET)*	Bandara Polonia, Medan	ph.: 061-565777 ext. 174
Medan *(STAKLIM)*	Kasulag Tata Usaha, Staklim Kls I, Sampali Jl. Meteorologi raya, PS XII Sampali, Medan	ph.: 061-614631 , 628002
Padang *(STAMET)*	Bandara Tabing, Air Tower No.3, Padang	ph.: 0751-56035
Palangkaraya *(STAMET)*	Jl. Adones, Palankaraya	ph.: 0536 –22871 fax.: 0536 - 23588
Palembang *(STAMET)*	Jl. Raya Palembang KM 10,5, Alang Alang Lebar, Palembang	ph.:0711-410358 fax.: 0711-412015 , 417274
Palembang *(STAKLIM)*		ph./fax.: 0711-810831
Pariaman *(STAKLIM)*	Staklim Sicincin Jl. Raya Padang - Bukittinggi km. 5 Sicincin 25584	ph.: 0751-675100
Pekanbaru *(STAMET)*	Bandara Simpang Tiga, Pekanbaru	ph.: 0761-23139 fax:0761-25914
Pontianak *(STAMET)*	Bandara Supadio-Pontianak	ph./fax: 0561-21142
Samarinda *(STAMET)*	Bandara Temindung Jl. Pipit No. 150, Samarinda	ph./fax: 0541-41160

If your location is not mentioned, please ask Information (phone: 108) for the closest meteorological/ climate station (STAMET/STAKLIM) or the next airport.

1. ***Internet:***

The Internet offers a variety of information on forest fires, haze and air pollution in general. Beside your own netsearch, the following addresses are very informative:
(As these addresses change frequently, they will be updated regularly)

⇒ **http://www.wunderground.com/global/ID.html**
At this home page you can find daily updated meteorological data for most locations in Indonesia. Click at your location to gain detailed data (including visibility, rel. humidity, temperature, condition, etc.). *N.B.: Java/ Sumatra/ West-Kalimantan's local time is plus 7 hours Universal Time (UTC), East-Kalimantan's plus 8 hours.*

⇒ **http://www.gov.sg/metsin/hazed.html**
Monitoring of Widespread Smoke. Haze and Forest Fires in the Region Singapore and Indonesia, (daily regional smoke/ haze map)

⇒ **http://smd.mega.net.id/iffm/FCM.html**
Daily updated map of hotspots in Kalimantan/Sarawak from Integrated Forest Fire Management Project (IFFM/GTZ), link to IFFM homepage and various forest fire and haze related topics.

⇒ **http://www.gov.sg/metsin/noaa.html**
Latest NOAA Satellite Image Night &Day, daily updated at 14.00 UTC;
link to ASEAN-modified GMS Satellite Image

⇒ **http://bmg.cbn.net.id/english/wind.htm**
Daily updated map on wind stream lines

⇒ **http://jwocky.gsfc.nasa.gov/indonesia.html**
Daily updated NASA/TOMS Satellite images on the aerosol/smoke index in Indonesia

⇒ **http://www.geocities.com/HotSprings/2188/haze.html**
Website, which has been set up as a result of the haze event in 1997. It offers extensive links to haze and forest fire related sites including information on air pollution and its health aspects.

⇒ **http://rcsg2.ust.hk/~rcdlam/**
Working page on Indonesia Forest Fire and El Niño, University Hongkong. Beside various links to Reports on El Nino and Satellite Pictures it offers links to haze related home pages, e.g.:

* Ministry of Environment Singapore (http://www.gov.sg/env/sprd), daily updated PSI-Readings and links to Haze Action Plan Singapore, Various Reports on Haze, PSI etc.
* Malaysian Meteorological Service (http://www.kjc.gov.my/people/environ/environ.htm): Information on Current Status of Air Quality in Malaysia
* Meteorological Service Singapore (MSS) (http://www.gov.sg/metsin/): various weather information and forecasts
* Indonesia Meteorol. Service (http://www.cbn.net.id/commerce/bmg/english/bmgindex.htm)

⇒ **http://www.ccc.nottingham.ac.uk/~evzakn/pm10.html**
Web site on airborne particulate matter (PM), effects on health, monitoring equipment

⇒ **http://www.geocities.com/Rainforest/2701/haze.htm**
Various reports on the haze event 1997

2. ***Press reports***
3. ***Studies on Haze***

⇒ Final report of Dr. Hanke's study on haze (December 1997), distributed to GTZ-projects
⇒ EUFREG reports

For further information or questions, please contact the HEC
c/o Haze Emergency Coordinator Dr. Dieterle, SMCP-Project

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