Protecting Healthcare Workers: Lessons Learned From Sg Kim Kim Chemical Incident

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Jabatan Kesihatan Negeri Johor

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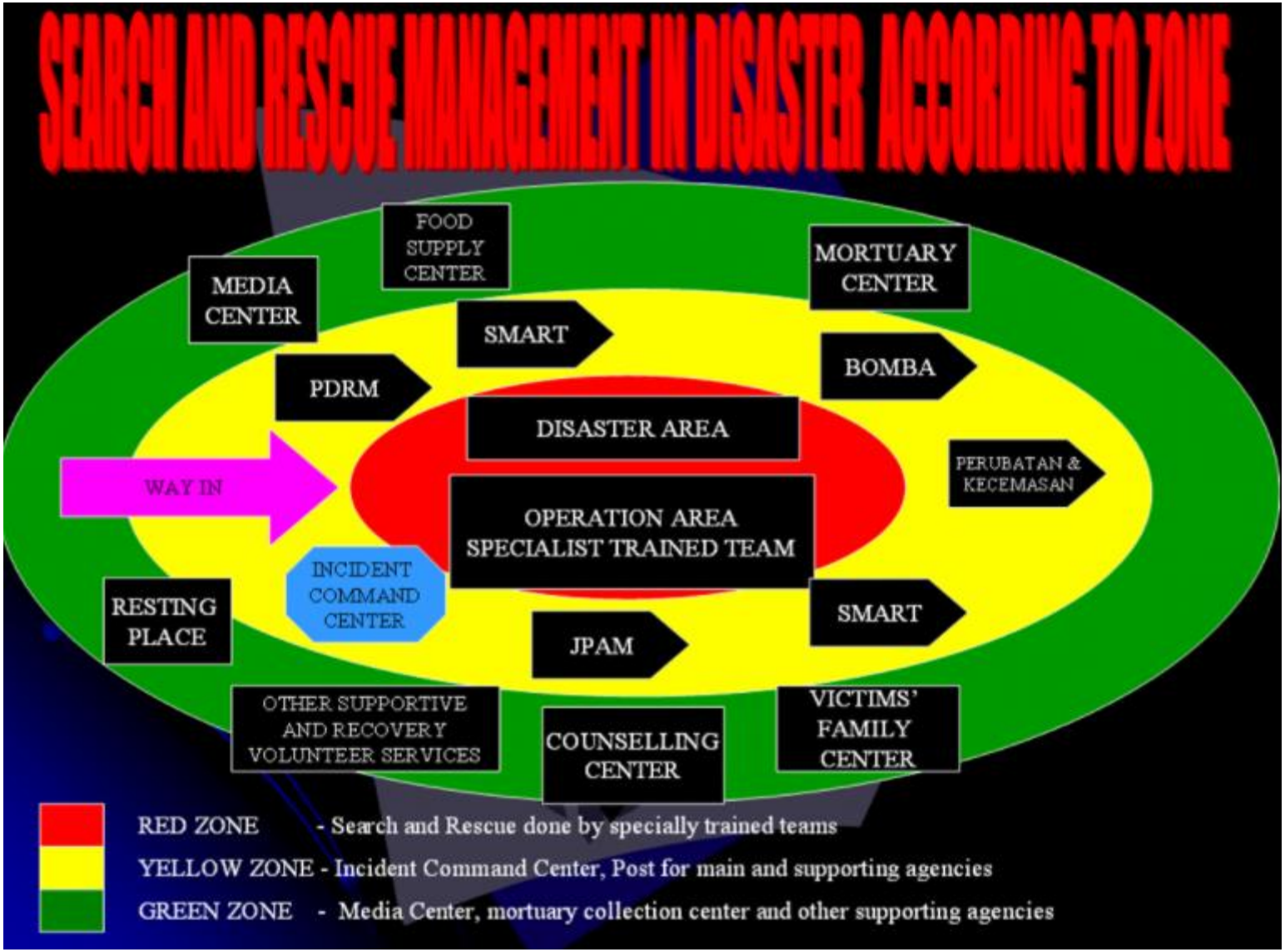
AOEMM Technical Update

Outline

- Introduction
- Occupational health elements in managing disaster
- The Sg Kim Kim Incident
- Health Surveillance Programme
- Lesson Learnt

Response Phase: Role(s) of Agencies in Disaster Management



Source: Malaysian Civil Defence Dept

Table 2: Summary of the roles and responsibilities of agencies according to DRM Cycle - state level

List of agencies	DRM cycle				
	Pre-disaster			Post-disaster	
	Prevention	Mitigation	Preparedness	Response	Recovery
Agencies at State Level					
1. State Police			✓	✓	
2. Malaysia Armed Force (ATM)			✓	✓	
3. State Fire and Rescue Department (JPBM)			✓	✓	
4. State Civil Defence Force (APM)			✓	✓	
5. State Health Department			✓	✓	
6. Malaysian Maritime Enforcement Agency (MMEA)				✓	
7. **State Public Works Department**	✓	✓	✓	✓	✓
8. State Department of Social Welfare			✓	✓	
9. State Department of Information				✓	

Noraini O C & Khairul Hisyam K. 2018, Disaster Risk Management In Malaysia: Issues And Challenges From The Persepctive Of Agencies. *Journal of the Malaysian Institute of Planners.* 16(1) Page 105 – 117

Table 3: Summary of the roles and responsibilities of agencies and non-governmental organizations (NGOs) according to DRM Cycle - district level

List of agencies	DRM cycle				
	Pre-disaster		Post-disaster		
	Prevention	Mitigation	Preparedness	Response	Recovery
Agencies at District Level					
1. District Police			✓	✓	
2. District Office			✓	✓	✓
3. District Fire and Rescue Department (JPBM)			✓	✓	
4. District Health Department			✓	✓	
5. District Social Welfare Office			✓	✓	
6. District Department of Environment			✓		
7. Malaysia Armed Force (ATM)			✓	✓	
8. Regional Malaysian Maritime Enforcement Agency (MMEA)				✓	
9. Local Authority			✓	✓	
10. District Civil Defence Force			✓	✓	

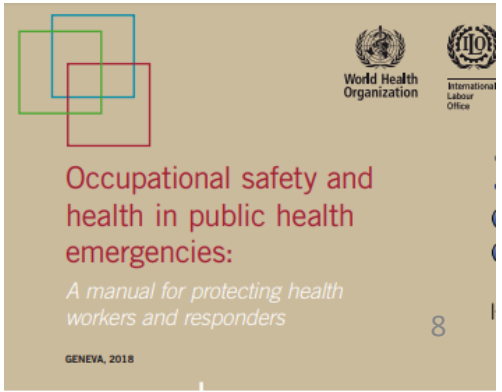
Noraini O C & Khairul Hisyam K. 2018, Disaster Risk Management In Malaysia: Issues And Challenges From The Persepctive Of Agencies. *Journal of the Malaysian Institute of Planners.* 16(1) Page 105 – 117

Akta Keselamatan dan Kesihatan Pekerjaan 1994 (OSHA 1994)

- Majikan mempunyai tanggungjawab untuk menjaga keselamatan, kesihatan dan kebajikan pekerjanya (Seksyen 15).
- Pekerja juga mempunyai tanggungjawab untuk mengikut arahan majikan dalam semua aspek keselamatan dan kesihatan (Seksyen 24)

Occupational Health Elements in Managing Disaster

1. Selection of the right persons with qualifications and skills for the required job
2. Training requirements for OSH management during disaster response
3. Communication with workers involved in emergencies
4. Psychosocial support and counselling / include social protection of workers
5. Health monitoring & surveillance -where necessary




Gunung
Ledang
National Park
Endau
Rompin
National Park
Mersing
Muar
Kluang
Gunung Panti
Recreational
Park
Batu Pahat
Senai Airport (JHB)
Kota Tinggi
Kulai
Gunung Pulai
Recreational
Forest
Desaru
JOHOR BAHRU
Danga Bay
Pasir Gudang
Kukup
SINGAPORE
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Introduction to Industrial Area Pasir Gudang, Johor

Pasir Gudang is an industrial town located in Mukim Plentong, Johor Bahru District

3 private hospital in the area.
Nearest Government Hospital –Hospital Sultan Ismail 17-20km

1 HC - KK Pasir Gudang, 2 Community HC (KD Pasir Putih, KDTanjung Langsat)

Around 2,005 Registered factories, - 250 are chemical based

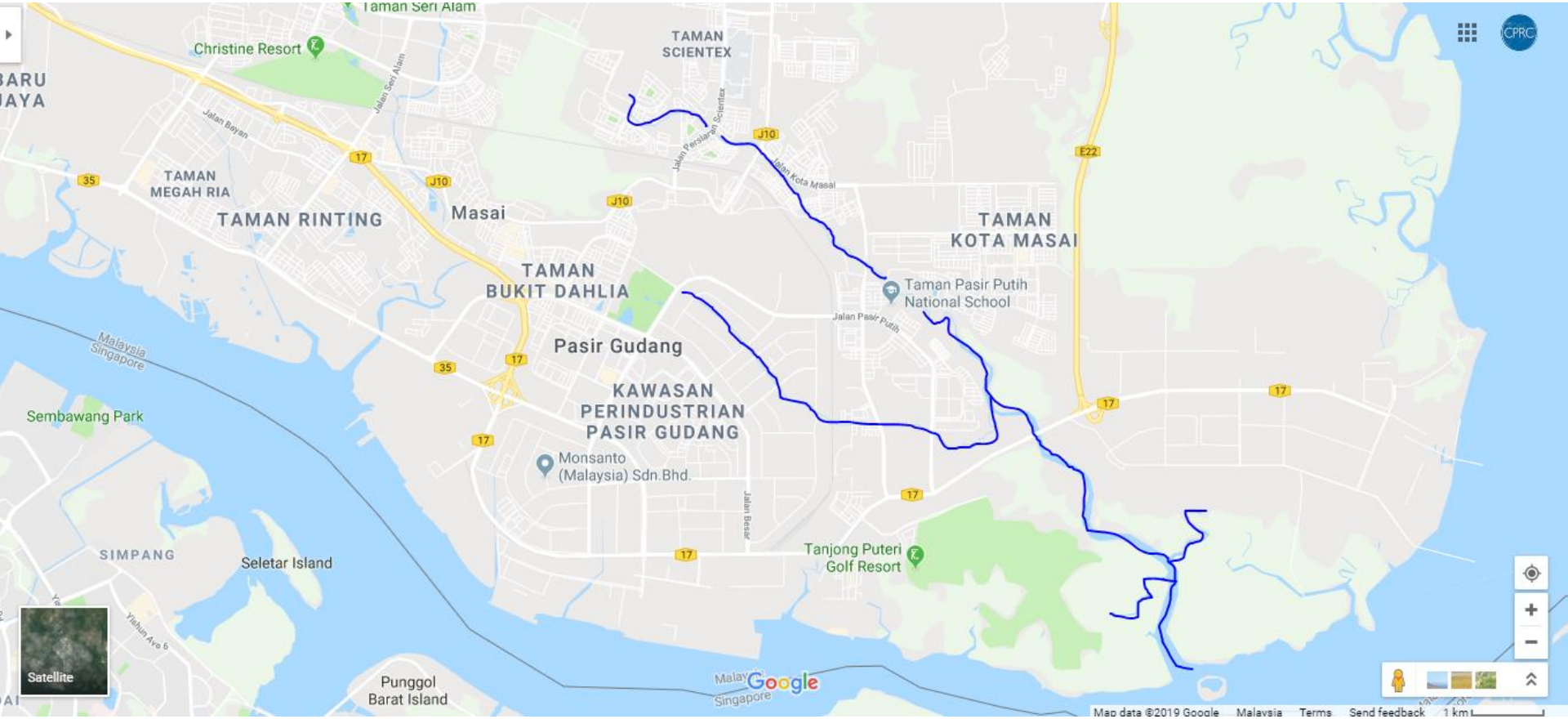
Area

- Total 359.57 km^2(138.83 sq mi)

Population

- Total 533,868

Location of Sg Kim Kim



Chronology of Acute Chemical Incident

Notification : Received on 7 March @ 10.00am

D1: 07-03-2019 (Thursday)
2 Schools involved

- Actual chemical smell began 5 am
- 45 students were affected
- News of chemical dumping

Medical Responders:

- Medical Team: KK Pasir Gudang
- Team from ETD HSIJB
- PG Emergency Mutual Aid (PAGEMA)

Medical responders collapsed on field when supporting DOE
Offending chemicals were identified by HAZMAT

- Acrolein / Acrylonitrile / Benzene / Hydrogen chloride

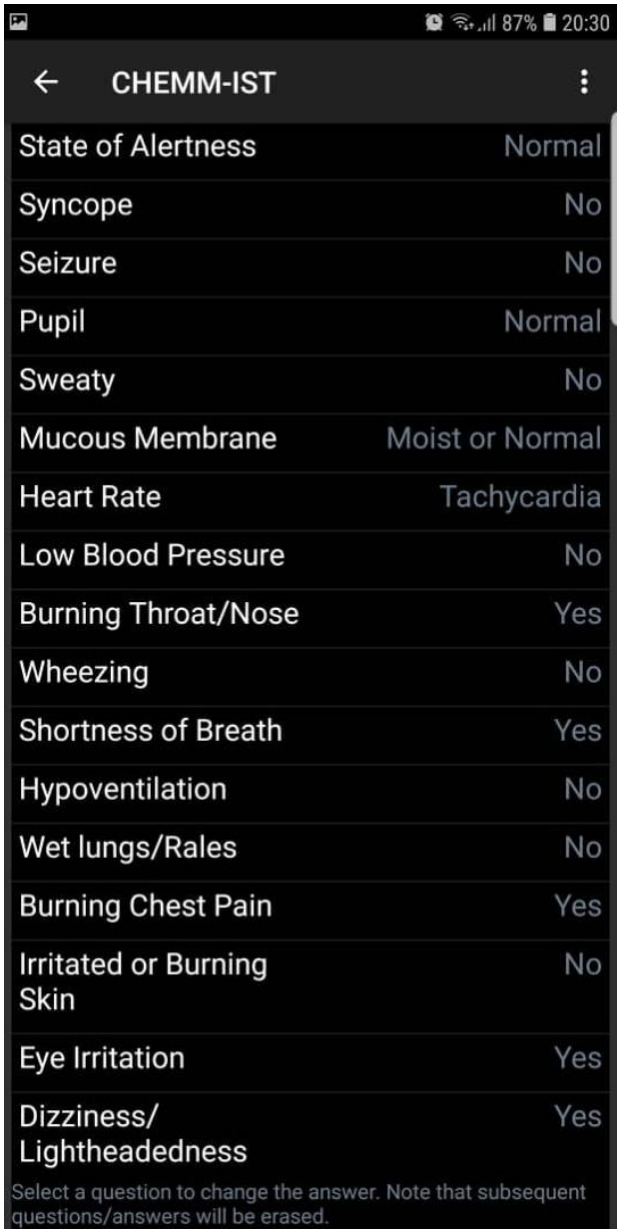
ETD staff has respiratory symptoms

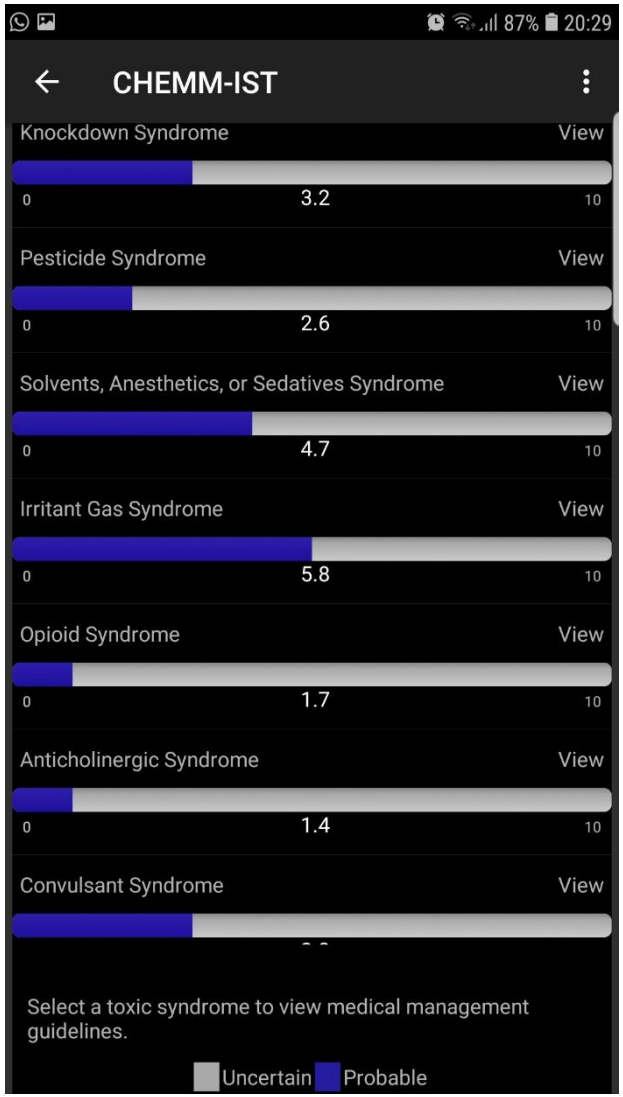
- Glove change color / smell of chemical from patients clothes

Ambulance transporting patients has chemical smell

Early Attempt of Hazard Identification

- Use of WISER app to determine offending chemical
- Use toxidromes: irritant gas syndrome
- Inaccurate – search yield ammonia and chlorine





Dump site – estimated between 20 to 40 metric tonnes was dumped

Chemical Involved: Acrylonitrile

Classification	10 min	30 min	1 h	4 h	8 h	End Point (Reference)
AEGL-1 (nondisabling)	1.5 ppm (3.3 mg/m^3)	1.5 ppm (3.3 mg/m^3)	NR[a]	NR[a]	NR[a]	No-effect level for notable discomfort (ocular irritation) in human subjects, 4.6 ppm for 8 h (Sakurai et al. 1978; Jakubowski et al. 1987).
AEGL-2 (disabling)	8.6 ppm (19 mg/m^3)	3.2 ppm (6.9 mg/m^3)	1.7 ppm (3.7 mg/m^3)	0.48 ppm (1.0 mg/m^3)	0.26 ppm (0.56 mg/m^3)	No-effect level for fetal toxicity (fetal body weight) in rats, 12 ppm for 6 h (Saillenfait et al. 1993a).
AEGL-3 (lethal)	130 ppm (280 mg/m^3)	50 ppm (110 mg/m^3)	28 ppm (61 mg/m^3)	9.7 ppm (21 mg/m^3)	5.2 ppm (11 mg/m^3)	No-effect level for lethality (30-min, 1-h, and 8-h $BMCL_{05}$) in rats (Dudley and Neal 1942; Appel et al. 1981a).

[a] Not recommended. Absence of an AEGL-1 value does not imply that exposure at concentrations below the AEGL-2 value is without effect.

Chemical Involved: Acrolein

TABLE 1-1 Summary of AEGL Values for Acrolein

Classification	10 min	30 min	1 h	4 h	8 h	End Point (Reference)
AEGL-1 (Nondisabling)	0.030 ppm (0.070 mg/m^3)	0.030 ppm (0.070 mg/m^3)	0.030 ppm (0.070 mg/m^3)	0.030 ppm (0.070 mg/m^3)	0.030 ppm (0.070 mg/m^3)	Very slight eye irritation, "annoyance" and discomfort in humans (Weber-Tschopp et al. 1977)
AEGL-2 (Disabling)	0.44 ppm (0.92 mg/m^3)	0.18 ppm (0.41 mg/m^3)	0.10 ppm (0.23 mg/m^3)	0.10 ppm (0.23 mg/m^3)	0.10 ppm (0.23 mg/m^3)	10-15% decrease in respiratory rate in humans (Weber-Tschopp et al. 1977)
AEGL-3 (Lethal)	6.2 ppm (14 mg/m^3)	2.5 ppm (5.7 mg/m^3)	1.4 ppm (3.2 mg/m^3)	0.48 ppm (1.1 mg/m^3)	0.27 ppm (0.62 mg/m^3)	1 h (10-min, 30-min and 1-h values) or 4 h (4-h and 8-h values) no-effect level for death in rats (Ballantyne et al. 1989)

Chemical Involved: Benzene

SUMMARY TABLE OF PROPOSED AEGL VALUES FOR BENZENE in ppm (mg/m^3)						
Classification	**10-Minute**	**30-Minute**	**1-Hour**	**4-Hour**	**8-Hour**	**Endpoint (Reference)**
AEGL-1 (Nondisabling)	130 (420)	73 (240)	52 (170)	18 (58)	9.0 (29)	Highest level available without AEGL-1 effect in humans. 110 ppm for 2h no subjective symptoms (Srbova et al., 1950)
AEGL-2 (Disabling)	2000* (6500)	1100 (3600)	800 (2600)	400 (1300)	200 (650)	Highest level without AEGL-2 effect (CNS depression, i.e. reduced activity in animals). 4000 ppm for 4h. Molnar et al., 1986.
AEGL-3 (Lethal)	See below¶	5600* (18,000)	4000* (13,000)	2000* (6500)	990 (3300)	Highest reliable NOAEL for mortality in rats. 5940 ppm for 4h. Molnar et al., 1986.

Chronology of Acute Chemical Incident

- D2
  - ill medical responders admitted
  - Ambulance decontamination
  - Staff use R95 masks
- D5
  - School reopen -2nd wave
  - partial decon to students performed
  - Ground Command Centre opened at nearby Community Hall
- D6
  - Escalaton – more school involved
  - Operation elevated to state level
  - Psychosicoal First Aid mobilized

Chronology of Acute Chemical Incident

- D7
  - Rapid Response Team moblised from other districts
  - 111 schools closed
  - River cleaning commenced
- D8
  - Medical base Moved to Stadium Tertutup Pasir Gudang
  - More organized medical base
  - Decon to patients arrival
- D12
  - Escalaton – more school involved
  - Operation elevated to state level
  - Psychosicoal First Aid mobilized


THE Star graphics
First wave of toxic pollution on March 7
Total: 103 victims
Dumping location under a bridge in Kota Masai on March 6
SK Ta... Pasir Putih
Second wave on March 11
Total: 106 victims
SMK Pasir Putih
Kota Masai
Taman Pasir Putih
PASIR GUDANG
Sungai Kim Kim
Taman Tanjung Puteri Resort
SMK Tanjung Puteri Resort
Third wave on March 12
Total: 260 victims
Sungai Kim Kim
To Straits of Johor
SK Tanjung Puteri Resort

PKOB (Pusat Kawalan Operasi Bencana 12 March 2019)

Multiple agencies enggagement

Resource submission at operation room

Meeting with relevants authorities

Information sharing by other agencies

Information sharing Johor state health department

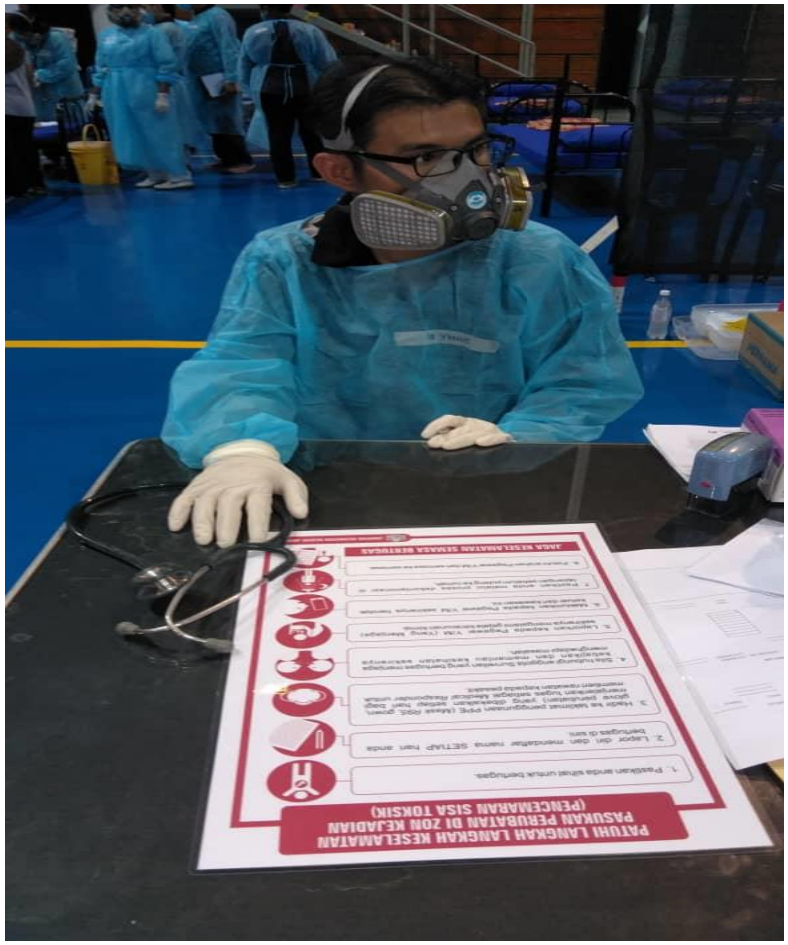
Multiple agencies enggagement

Multiple agencies enggagement

Information sharing other relevant authorities

Involvement of Other Agencies & Volunteers

Risk Comm to Workers



PATUHI LANGKAH LANGKAH KESELAMATAN PASUKAN PERUBATAN DI ZON KEJADIAN (PENCEMARAN SISA TOKSIK)

1. Lapor diri dan mendaftar nama SETIAP hari anda bertugas di sini.
2. Hadir ke taklimat penggunaan PPE iaitu *Mask R95, gown, glove* perubatan yang dibekalkan setiap hari bagi menjalankan tugas ;
   a. Tugas utama sebagai *Medical Responder* ialah memberi rawatan kepada pesakit.
   b. Maklumkan kepada pegawai Y/M (Yang Menjaga) SEKIRANYA anda dikehendaki bertugas sebagai anggota PASUKAN PENYELAMAT di zon bahaya dan memakai PPE yang dibekalkan oleh Bomba/HAZMAT.
3. Sila hubungi anggota Surveilan yang bertugas menjaga kebajikan dan memantau kesihatan sekiranya menghadapi masalah.
4. Laporkan kepada Pegawai Y/M sekiranya mengalami gejala keracunan kimia.
5. Maklumkan kepada Pegawai Y/M sekiranya hendak keluar dari kawasan ini.
6. Pastikan anda melalui proses dekontaminasi di lapangan sebelum pulang ke rumah.
7. Patuhi arahan Pegawai Y/M dari semasa ke semasa.

JAGA KESELAMATAN SEMASA BERTUGAS

JABATAN KESIHATAN NEGERI JOHOR

Risk Comm to Public

Decontamination For Chemical Exposure At Stadium Pasir Gudang

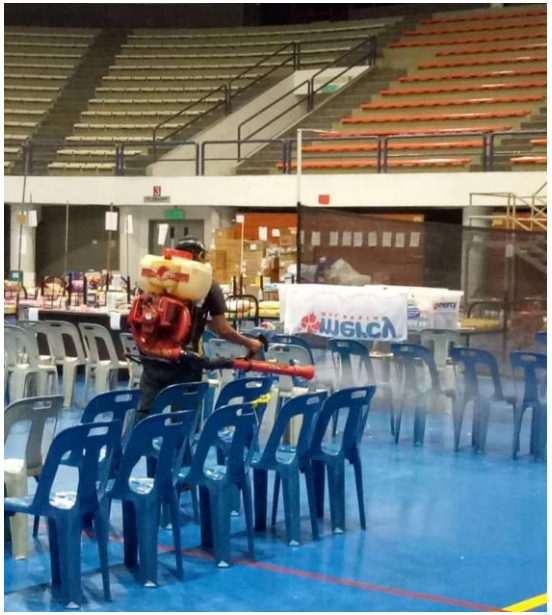
Registration of victim at counter

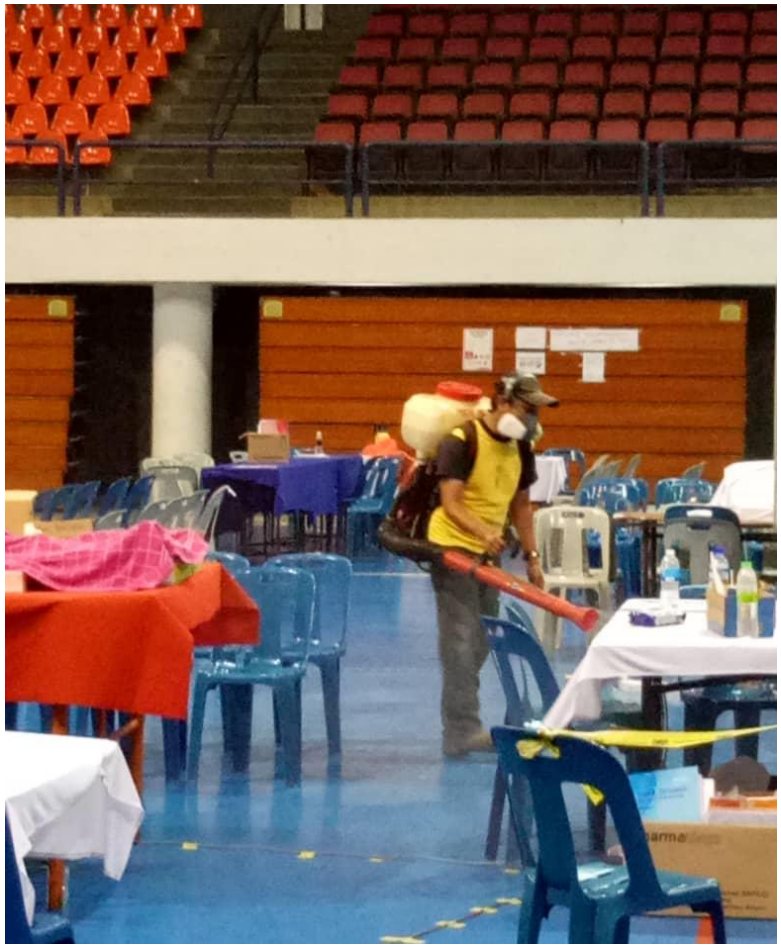
Screening for chemical detection

Decon setting by HAZMAT

Victim given t-shirt and sarong

After action nocturnal clean-up





- Continuous operation with moblised team from other districts
- River cleaning progressing
- PFA mobilization
- Occupational Health Surveillace to responders

- **D14: 20 March 2019 (Thursday)** State Govt declared stand down after river cleaning completion
- Schools reopen **24 March 2019**
- Health Dept State CPRC stand down **4 April 2019**
- Occupational Health Surveillace to continue 1, 3, 6 months after exposure

Sungai Kim Kim in 2012 (left) and 2017. Both photos were taken from the bridge to the Tanjung Langsat commercial area.

https://www.freemalaysiatoday.com/category/nation/2019/03/15/sungai-kim-kim-pollution-started-years-ago-says-ecologist/

PPE Use

PYSCHOLOGICAL FIRST AID(PFA) RESPONDER

Psychology First Aid(PFA) team debriefing

Psychology First Aid(PFA) team debriefing

Psychology First Aid(PFA) Support for responder

Psychology First Aid(PFA) Support for

Psychology First Aid(PFA) Support

PFA Support for responder

Health Surveillance Programme

Health Surveillance Programme Team

Health Surveillance Programme Team at PKOB

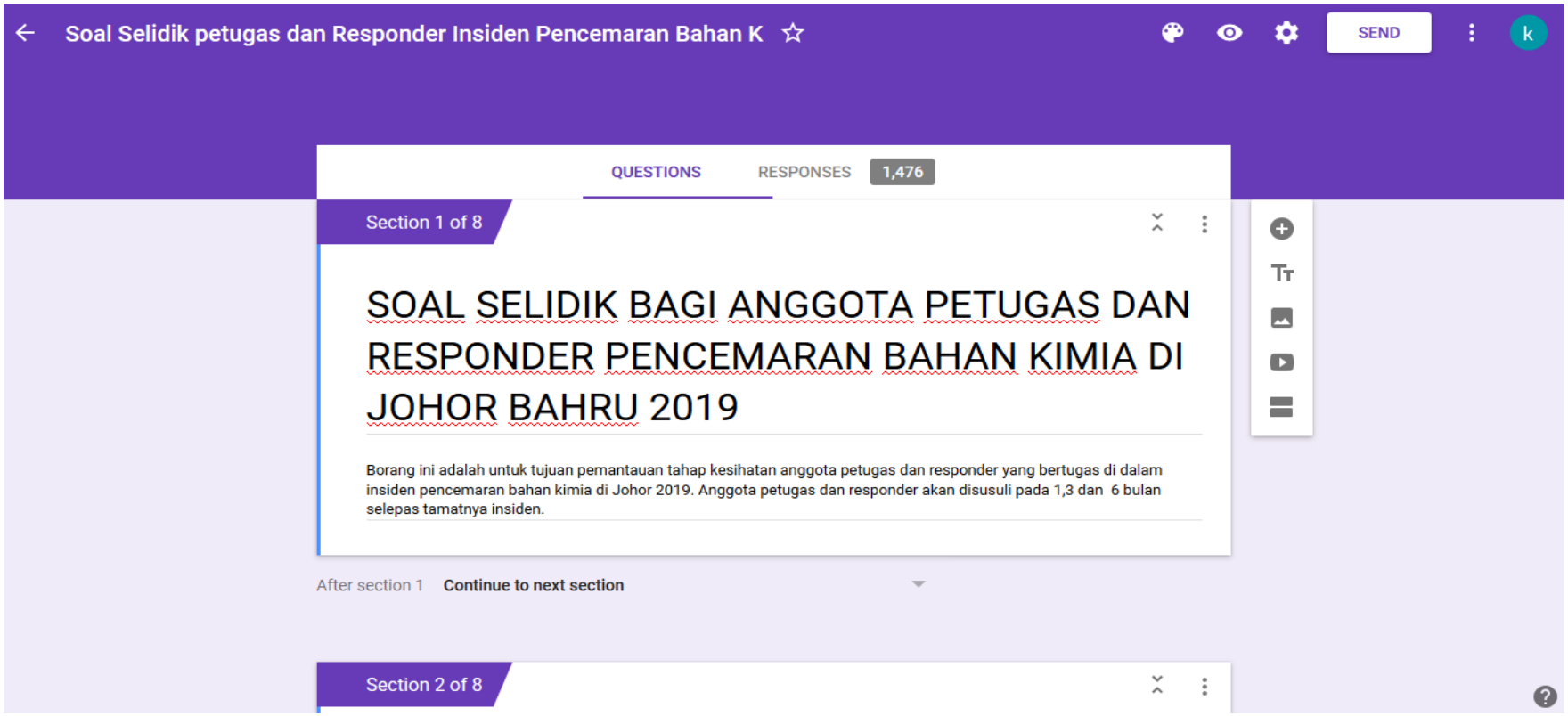
Health screening for responder

Steps in designing and implementing an occupational health surveillance programme (Baker & Matte 1992)

- Assessment of workplace hazards
- Identification of target organ toxicities for each hazard
- Selection of test for each “screenable” health effect
- Development of action criteria
- Standardisation of data collection process
- Performance of testing
- Interpretation of test results
- Test confirmation
- Determination of work status
- Notification
- Diagnostic evaluation
- Evaluation and control of exposure
- Record keeping

Baker EL, Matte TP. Chapter 13. Surveillance of occupational illness and injury. In: Halperin W, Baker EL, Monson RR, eds. Public health surveillance. New York: Van Nostrand Reinhold, 1992:178–94

GOOGLE e-FORM FOR HEALTH SURVEILLANCE



Lesson Learnt

Prepardness Phase

- Developing SOPs
- Selection of responders
- Training
- Stockpiling
- Networking intra /inter agency

Lesson Learnt

Response Phase

- Early hazard identification
- Communication / Sharing information to responders
- Enforce safety rules
- Job rotation of medical responder
- Rapid procurement of PPE
- Seek help if needed

THANK YOU