Tokyo Sarin Attack 1995

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The Tokyo Incident

- 3 million workers and students arrive into Tokyo via the subway
- Monday morning 0755 on March 20, 1995 during rush hour
- The terrorist group organized the release of Sarin into 5 subway cars on 3 separate subway lines

Timeline of Attack

- 0755 Diluted form of Sarin released
- 0816 St. Luke's ED alerted
- 0828 First subway victim arrived to ED
  - » **C/O eye pain and dim vision**
- 0920 approx. 500 additional patients had arrived; Hospital director activated hospital's disaster plan
- Total patients at St. Luke's ED = 640
- More than 100 doctors & 300 nurses and volunteers available to provide health care

The Incident

- Largest documented civilian exposure to nerve agent
- Total of 12 commuters killed *
- 2 deaths in the hospital
- 5,000 persons required emergency medical evaluation
- 640 persons presented to the hospital
- * Numbers may have increased.

Sarin

- Developed in the 1930s for use in warfare by the German Dr. Gerhard Schrader
- Potent organophosphate compound
- Blocks acetylcholinesterase effects at myoneural junction
- Sarin: **S**chrader, **A**mbrose, **R**udringer, van der L**in**de

Nerve Agents

http://crdp.ac-paris.fr/cinevo_anglais/print/images/poster_north.jpg

- Are organophosphates
- Are similar to insecticides:
  - Malathion
  - Diazinon
  - Chlorpyrifos

Sarin

- Overstimulation of cholinergic receptors
- Effective in vapor form
- Lethal Dose: 1 mg
- Tokyo attack: **diluted** form of Sarin

Expected Symptoms

- Miosis
- Fasciculations
- Convulsions
- Weakness
- Respiratory insufficiency
- Decreased level of consciousness

Tokyo 1995

http://newsimg.bbc.co.uk/media/images/39504000/jpg/_39504695_attack203.jpg

http://www.semp.us/_images/biots/Biot171PhotoA.jpg

http://www.npa.go.jp/hakusyo/h16/hakusho/h16/image/ph200025.png

Most prominent signs and symptoms of 111 moderate and severe cases

• Miosis	110 patients	99%
• Headache	83 patients	74.8%
• Dyspnea	70 patients	63.1%
• Nausea	67 patients	60.4%
• Eye pain	50 patients	45%

How did the Sarin Victims Arrive to St. Luke's Hospital?

- 640 patients to the hospital
- 64 (10%) arrived by ambulance
- 35 (5.5%) arrived by minivans belonging to the Fire Defense Agency
- **541 (84.5%)** arrived by nonmedical vehicles

Cases

- Of the 641 patients seen at St. Luke's International Hospital on the day of the disaster, five were in critical condition.
- Three patients had cardiopulmonary arrest and two were unconscious and had respiratory arrest soon after arrival.
- Of these five critically ill patients, three were successfully resuscitated and able to leave on hospital day 6.
- One of the patient who had cardiopulmonary arrest did not respond to cardiopulmonary resuscitation (CPR) and died with findings of very bizzare miosis.

Decontamination of the Nerve Agents

- **Outdoors is best**
- **Usually near ER**
- **Copious water**
- **Special drain considerations**
- **Hypochlorite not necessary**

Tokyo 1995

- Transport of sick patient out of subway
- With PPE of rescue staff
- No PPE in the hospital

http://publicsafety.com/article/photos/1129126846021_chemical1.jpg

Tokyo: Hospital Response

- 5,500 victims
- 641 presented to St. Luke's International Hospital
- No decontamination was the norm
- No EMS involvement for most patients

Tokyo Events – Video Hospital Receiving Area

Nerve Agents - Therapy

- Blocks the enzyme acetylcholinesterase
- Protection: PPE, evacuated, undress, avoid cross contamination, off gassing?
- Decontamination
- Airway, ventilation, supportive care, (seizure control, suctioning, IV fluids)
- Antidotes (atropine, obidoxime, HI-6)
- Anticonvulsants (valium, midazolam)

Usual Treatment

- **Decontamination**
- Anticholinergics
  - Atropine sulfate
- Reverse block of acetylcholinesterase
  - 2-pyridine aldoxime methiodide (2-PAM)
- Supportive treatment
  - Ventilatory support
- Rescuscitative
  - CPR, intubation

Categorization Of Victims- Triage

- MILD – only eye signs or symptoms
  - » 528 patients (82.5%)
  - » Released after 12 hrs of observation
- MODERATE – presence of systemic signs without needing mechanical ventilation
  - » 107 patients (16.7%)
- SEVERE – require emergency ventilation
  - » 5 patients (0.78%)

Examples When Early Detection Can Make a Difference

- Radiological: Radionuclides- N-95 respirators, type of decontamination, delay of decontamination early trauma care
- Chemical:

- Mustard gas: Isobutyl rubber protection versus latex gloves
- Sarin gas versus Soman or Tabun: Half-life, antidotes versus mass ventilation --- Tokyo: Lack of PPE , difficulties with early detection

Key Points

- Detection, awareness
- PPE, protection
- Decontamination
- Mass treatment, proper triage of a chemical incident
- Chemical versus radiological versus biological triage
- Supportive Care and Antidotes

Technology Example: Europe

Origin: Military Light Armored Vehicle (LAV) – Fuchs -

http://www.uebersetzerportal.de/bilder/fuchs-spuerpanzer.jpg

Technical Capabilities

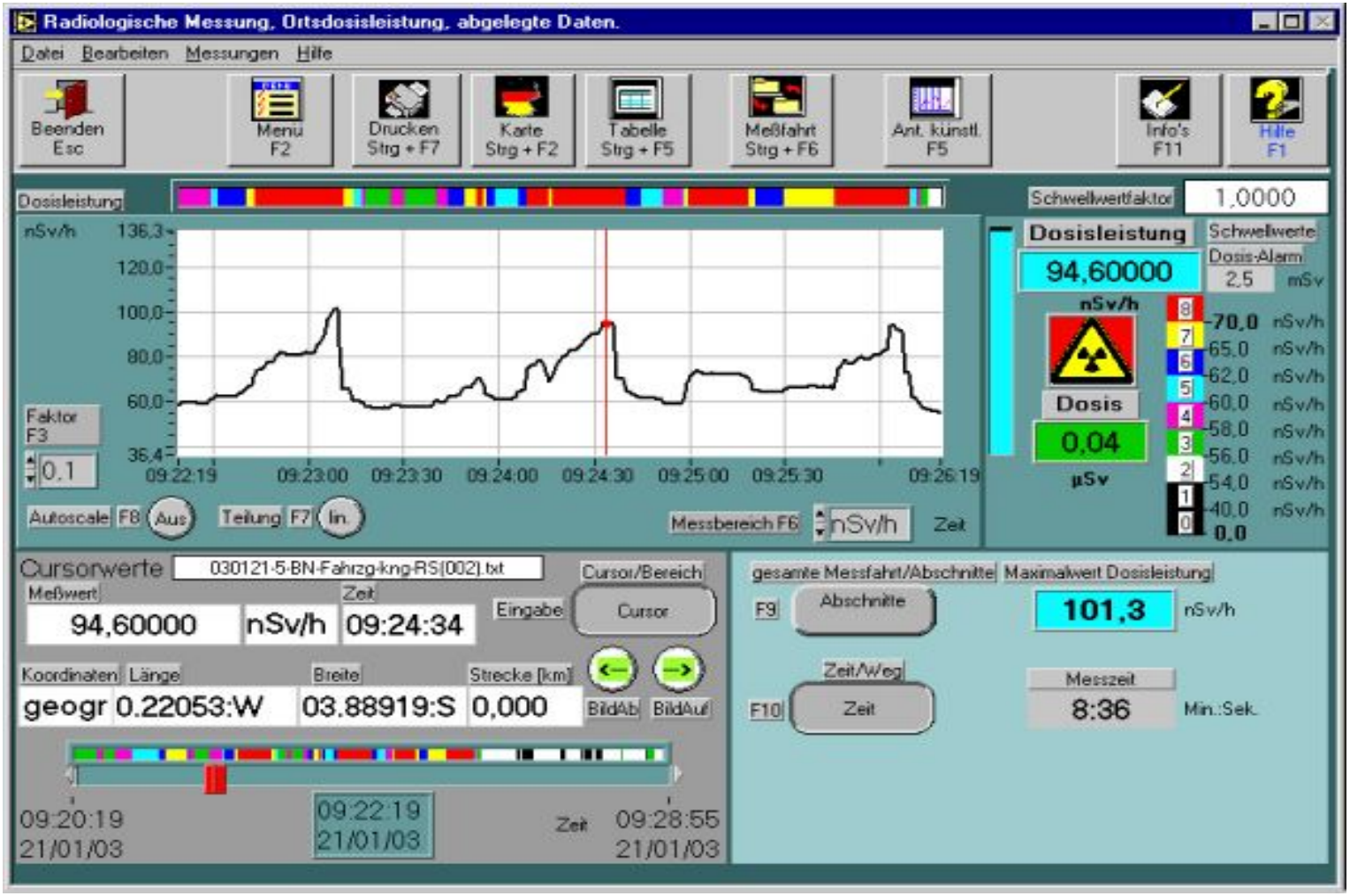
- Automatic and continuous measurements (online measurements) in conjunction with geopositioning and sotrage of data –online graphic visualization-
- Measurement and transmission of meterological data
- Soil, water and air sampling
- Data transission to central dispatch

Standardized CBRN Explorers

- Uniformly equipped “CBRN Explorers” assure more timely and consistent analytic capabilities in all geographic areas during HAZMAT disasters.
- In the **United States** the fire departments’ HAZMAT teams and other agencies own a great variety of different nonstandardized analytical CBRN tools across the country

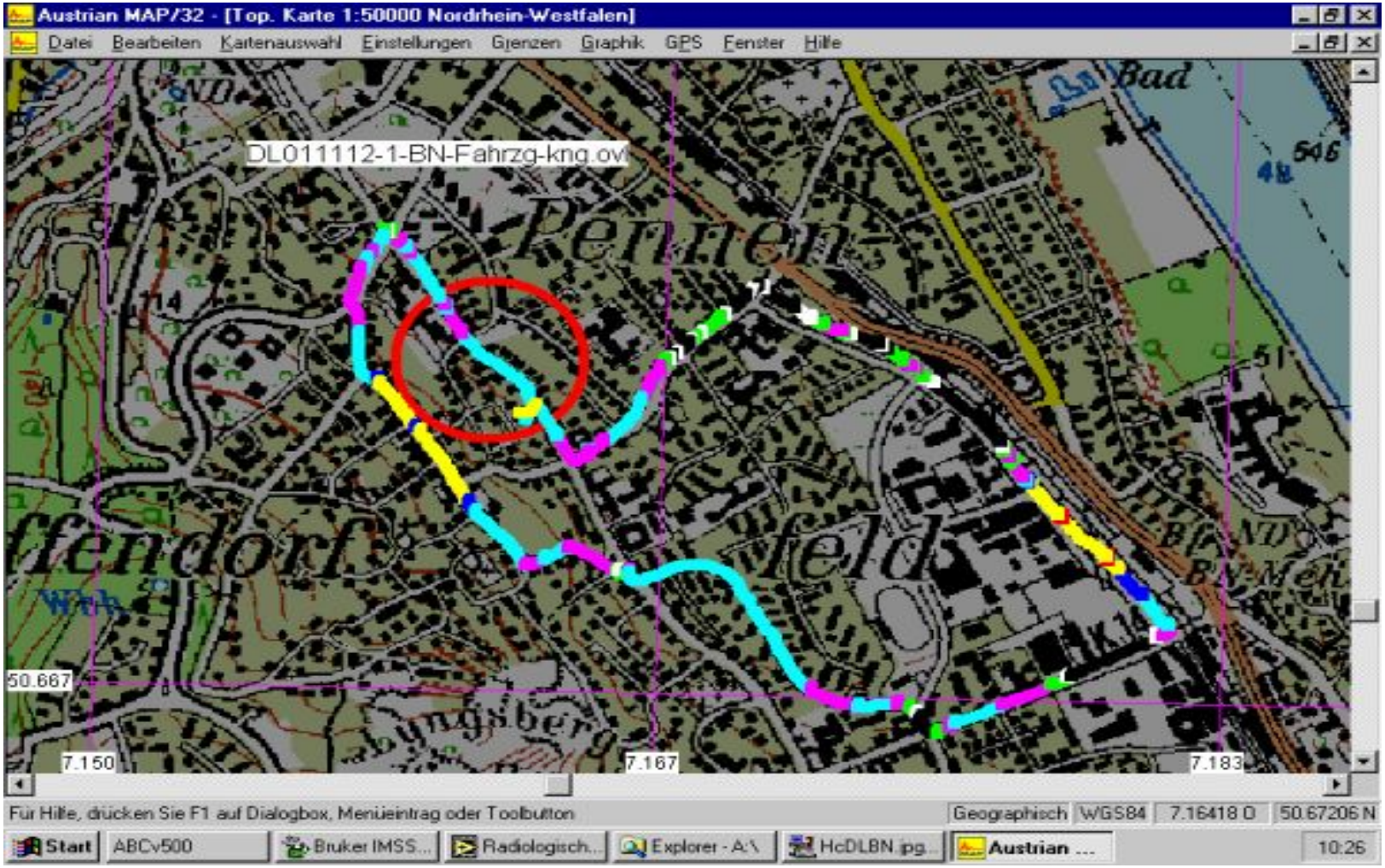
Dose Rate- Time (Location)

Rad-xy-Diagramm600



http://www.bbk.bund.de/cln_007/nn_400552/SharedDocs/Bilder/ABC-Schutz/RadxyDiagramm600.html

Mapping of a Dose Rate with GPS



http://www.bbk.bund.de/cln_007/nn_400552/SharedDocs/Bilder/ABC-Schutz/Karte_20ODL_20Bonn600.html

Examples Chemical Detection

Photoionization detector (PID), Ionmobility spectrometry (IOS): Measurement of HAZMAT and chemical warfare agent

http://www.bbk.bund.de/cln_007/nn_400552/DE/02__Themen/08__ABCSchutz/01__ABCErkundung/02__Messtechnik/05__Ionenmobilitaetsspektrometer/Ionenmobilitaetsspektrometer__node.html__nnn=true

Ionmobility Spectrometry: Rapid Alarm and Identification Device (RAID 1)

CWA

- Lewisite
- Sarin, Soman, Tabun, VX
- Sulfur and nitrogen mustard

Industry:

- Ammonia, cyanide, chlorine, chlorinated halogens, acetic acid, SO2, Toluene diisocyanate

Problems in Tokyo

- Delay in confirmation of the nature of toxic substance
- No personal protective equipment at hospital entrance
- Delay in organizing a mass casualty plan
- Poor ventilation in waiting area of ED
- Secondary contamination of medical staff

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Summary

- For nerve agents avoidance of exposure is an important issue.
- Evacuation of closed environment is a key measure.
- Personal protective equipment
- Decontamination prevents further exposure and ongoing absorption with further toxicity.
- Supportive care saves lives.
- Antidotes: Atropine, obidoxime, benzodiazepines