

An outbreak of Diffuse Lamellar Keratitis
(DLK) related to waste gas and an
improperly mounted air conditioner.

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No financial interest in any product

- Five patients, in the middle of eleven patients, at a satellite surgery center developed Diffuse Lamellar Keratitis (DLK).
 - Three patients had minimal inflammation
 - Two patients had moderate central involvement (Grade 3) with delayed return to normal visual function.

Investigation

- As the same equipment, staff, reusables, medications and solutions were in use in our main surgery center, the major focus was on air quality.
- The outbreak occurred two days after a tornado caused street flooding , malfunction and noxious odor from a nearby waste treatment facility

The staff was asked to identify any unusual factors the day of the outbreak.

- The laser technician had noted a “rotten egg” odor from the air ducts.

Air duct in laser room



- The pre-op nurse had an abnormal cough, noted by the surgeon, during the time interval in question

Air duct in Pre-op



- One week later a single blast of a “sulfuric” odor was noted from the suspected air conditioner duct as the unit turned on.

Instrument Prep Area



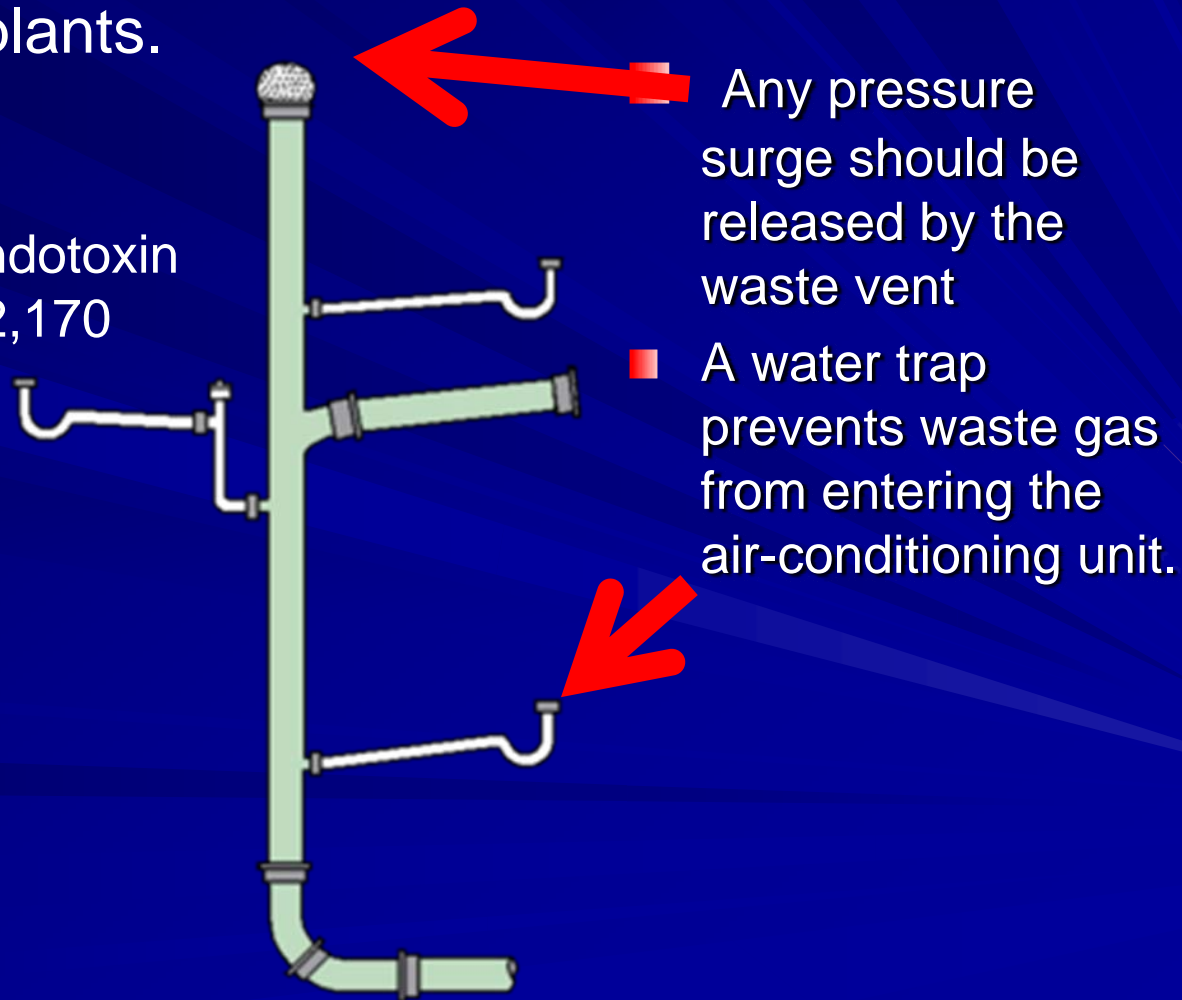
Initially the suspected cause was noxious waste gas, known to contain significant endotoxin and sulfur compounds.

Health effects among workers in sewage treatment plants.

The amount of airborne endotoxin varied between 3.8 and 32,170 ng/m³.

Rylander R.

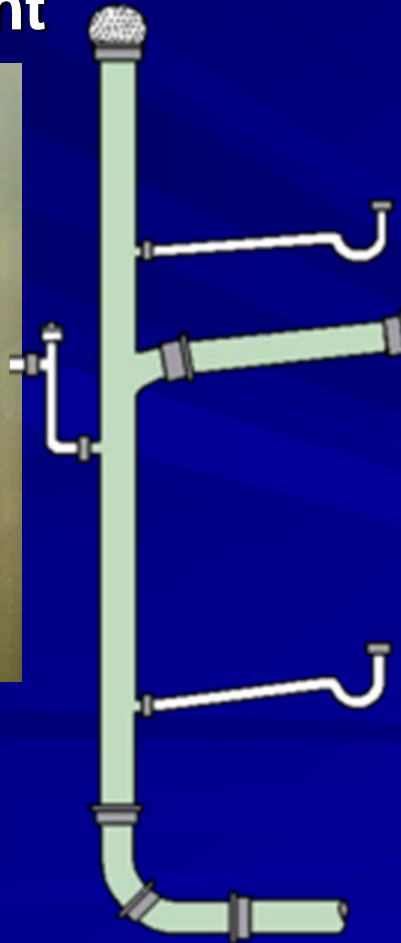
Occup Environ Med. 1999
May;56(5):354-7.



An initial inspection was negative

A remote air conditioner did not meet code:

- It was more than 20 feet from the drainage waste system
- did not have a proper vent



Water heater

Airborne endotoxin assays two weeks after the outbreak were normal.

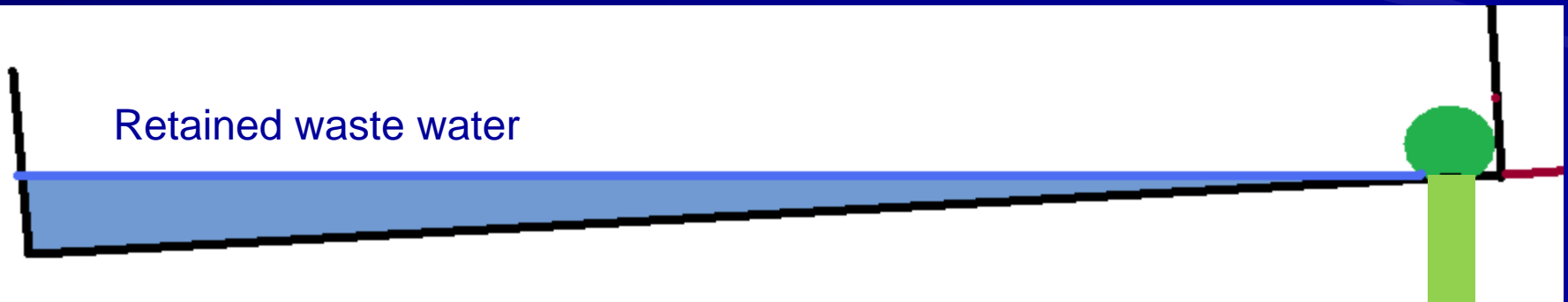
ENDOTOXIN ANALYSIS

Location:	1: Sioux city (7-21) fan on	2: Sioux city (7-18) 24 hours	3: Sioux city (7-18) 1-hour
Comments (see below)	A	A	A
Lab ID-Version†:	2533739-1	2533740-1	2533741-1
Sample Type:	Dust sample	Dust sample	Dust sample
Measurement:	1 sample	1 sample	1 sample
1 EU* conversion:	0.091 ng	0.091 ng	0.091 ng
Reporting Unit:	EU/sample	EU/sample	EU/sample
RESULT:	0.064	0.034	< 0.025

- New external sewer vents were installed at one week



Internal inspection after the OR unit was removed showed rusting of the drainage pan consistent with an improper reverse slant, away from the water trap.



The abnormal unit drained in the middle, making it easy to tilt in the wrong direction during installation



A new air-conditioner system was installed
and no further episodes occurred.



Volatile organic compounds associated with microbial growth in automobile air conditioning systems

Curr Microbiol. 2000 Sep;41(3):206-9. Links

Rose LJ, Simmons RB, Crow SA, Ahearn DG.

Department of Biology, Georgia State University, Atlanta, GA 30303, USA.

- **Biofilms of *M. mesophilicum* on aluminum evaporator components produced mainly dimethyl disulfide.**
- **Reduction of retained moisture in the air conditioning system is advised for remediation of the noxious odors.**

Conclusion

- We found improper installation of an air conditioner with retained waste water and secondary noxious odor , consistent with bacterial endotoxin as the cause of our cases of DLK.

