



Preventing Toxic Substance Exposures in the Workplace

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Case 1 Maduramicin poisoning

- Male, 52 years old, pack worker of pesticide.
- Double lower limbs weakness, palpitation, dyspnea for 5 days.
- At first, at emergency department, than be transferred to ICU the next day for critical condition.
- Past medical history: normal.

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Physical Examination

- T 37.4°C, P 98/min, BR 22/min, Bp 154/76 mmHg.
- Clear consciousness, poor spirit, sweat.
- Liver area, kidney area percussion pain(+).
- Chest, waist, abdominal and gastrocnemius muscle tenderness.
- Myodynamia of the upper limbs IV, lower limbs II.
- Muscle tension is lower.
- Tendon reflexes (+), sensory disturbances(+), pathological signs(-).

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Laboratory Tests

Item	15/Aug	16/Aug
WBC (×10 ⁹ /L)	26.3	24.4
Neutrophil(%)	88	89
Blood myoglobin(ng/L)	> 4045	> 4045
Creatine kinase (CK)(U/L)	131000	207913
Creatine kinase isoenzyme (CK-MB)(U/L)	2743	20970
Lactate dehydrogenase (LDH)(U/L)	11563	13250
Aspartate aminotransferase (AST)(U/L)	4668	5210
Blood urea nitrogen (BUN)(mmol/L)	22	18.99
Inosine (Cr)(mol/L)	210	197
Troponin I (ng/ml)	0.1	

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Auxiliary examination

- Pathology diagnoses
Rhabdomyolysis
- Blood gas analysis :
metabolic acidosis.
- Urine routin:
Protein(+++), occult blood(+++),aceton body
(++++)
- Myoglobin>4045ng/L
- CTnl 0.05ng/ml(normal level 0.06 ng/ml)

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Treatment

- ICU for 30 d
- glucocorticoid
- hemofiltration,plasmapheresis
- Occupational Disease Hospital
- Drug:brain protein hydrolyzate
citicoline,compound Danshen
- Acupuncture
- EMG(25/Sept.) :Peripheral neuropathy

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What happened to him?

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History of Occupational Exposure

- Work for Veterinary Drugs factory.
- Maduramicin Ammonium Premix two weeks ago.
- Pack worker.
- Protection
 - dusk proof mask
 - His clothes ,arm and face directly contacting the premix powder.
 - He often soaked with sweat because of hot weather.

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Polyether ionophoric antibiotics

- Non-nutritional additives (medicated feed additives)
 - good growth promoting agent.
- Monensin, salinomycin, lasalocid, maduramicin, Hainanmycin.
- Across the cell membrane, affecting Na^+ , K^+ , Ca^{2+} , ion transport

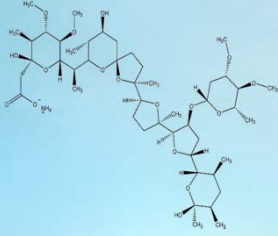
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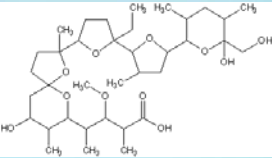
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Chemical Construction



Maduramicin



Monensin

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Coccidiosis cause intestinal inflammation , autointoxication death .

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Polyether antibiotics half of the oral lethal dose for different animals (LD₅₀) mg/kg

animals	Monensin	Salinomycin	Lasalocid	Maduramicin
chicken	284	150	75-112	...
mouse	70-96	50	146	35
rat	28.6-40.1	70-100
horse	2-3
human

Yang GX(2000)

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- ### Maduramicin
- American Cyanamid Company (Cyanamid) was developed it in the early 1980s.
 - Accidental ingestion by humans has resulted in muscle weakness, polyneuropathy, myonecrosis and rhabdomyolysis, and acute renal failure; fatalities have been reported.
 - The survey of 545 farms across the country, show that 96.3% of the farms in the diets maduramicin prevention of coccidiosis .
 - [1]齐雪茹,王建华. 河北畜牧兽医,2003.
 - [2]沈建忠,钱传范. 畜牧兽医学报,1999.
 - [3]万恩怀,张述芳. 畜牧与兽医,2006.
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Polyether antibiotics half of the oral lethal dose for different animals (LD50) mg/kg

animals	Monensin	salinomycin	lasalocid	maduramicin
chicken	284	150	75-112	...
mouse	70-96	50	146	35
rat	28.6-40.1	70-100
horse	2-3
human

Yang GX(2000)



Maduramicin Cumulative toxicity

表3 蓄积毒性试验剂量与中毒程度的关系

品 种	日 龄	给药方式	给药天数 t/d	给药剂量/mg·kg ⁻¹		
				急性中毒	亚急性中毒	慢性中毒
AA 鸡 ^[17]	28	拌料	10	30.0	/	/
江村黄鸡 ^[17]	63	拌料	10	30.0	/	/
肉仔鸡 ^[2]	/	拌料	14	25.0-50.0	15.0-20.0	/
罗斯肉仔鸡 ^[8]	14	拌料	14	/	10.0	5.0 ^①
AA 鸡 ^[9]	1	拌料	42	/	7.0-9.0	/
海布罗肉仔鸡 ^[13]	1	拌料	32	/	/	5.0
AA 鸡 ^[14]	10	饮水	32	/	12.0-16.0	8.0
AA 鸡、华南麻鸡、K ₉₉ 黄鸡 ^[15]	14	饮水	10	/	10.0-15.0	5.0

注：①表示该剂量组给药天数为25 d。



Our work and life are safety?



Case 2 lead poisoning

- Male, 45y
- Dizziness, headache, abdominal pain, fatigue for 4 m
- 2012/10-2013/09, Grinding lead into powder using disintegrator and then put into bag
- Work for 15h/d, 6d/W
- 2013 /06
 - Treatment given eliminating lead for 4 courses
- Work for 1m again, stomach ache, no stool for 6 days
 - blood lead 540ug/L-609ug/L
 - eliminating lead for 2 course, blood lead 430 ug/L





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Environmental pollution incidents

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Hunan Wugang

- 2008/08/23
- 1958 persons
- Bpb excessive 1354 persons
- Wugang illegal production of refined manganese processing.
- 2008/11 Stop product

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- 2009/08
- 1016 children
- 851 Bpb • 166↑moderate,severe toxic
- Abdominal pain,irritability,malnutrition, stunting
- Shaanxi Dongling Company,2006y, 100,000t Lead and zinc smelting project
- within 1000 meters,1396 resident move

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Shanghai Kangqiao child lead poisoning

- 2011/09
- 1306 children Bpb,49 cases excessive,1-3 years old.
- 3 enterprises
江森自控國際蓄電池有限公司
新明源汽車配件有限公司
康碩廢舊物資利用有限公司
- 12/17 Lead-acid batteries enterprises closed down





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Preventing Exposures

What we can do?

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Three Step



- The first step "active strategies"*
- Secondary poisons prevention*
- Tertiary poisons prevention*

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The first step "active strategies"

- Management Control
 - laws, regulations, standards
- EU chemical management
 - Registration, Evaluation, Authorization and Restriction of Chemicals(REACH)
 - 2008/06/01
 - Replace and update 40 multiple regulations, the most important in EU regulations.
 - Registered , evaluation ,license , limits

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Chinese chemical management

- From 1980s
- 65 chemical safety management
- 126 about classification of hazardous chemicals, storage, transport, packaging and signs and other safety standards, emission standards relating to the control of chemical contaminants and occupational health standards.
- Public security, transportation, quality control, environmental protection, customs, railway and other multi-sectoral management.

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Chinese chemical management

序号	分类	名称
1	生产	《安全生产法》
2		《安全生产许可证条例》
3		《使用有毒物品作业场所劳动保护条例》
4		《危险化学品生产企业安全生产许可证实施办法》
5		《作业场所安全使用化学品公约》
6		《国务院关于进一步加强安全生产工作的决定》
7		《工作场所安全使用化学品的规定》
8	管理	《危险化学品安全管理条例》
9		《危险化学品登记管理办法》
10		《危险化学品安全使用许可证实施办法》
11		《剧毒化学品购买和公路运输许可证件管理办法》
12		《常用危险化学品的分类及标志》
13		《危险化学品生产储存建设项目安全审查办法》
14		《危险货物分类和品名编号》
15	环境保护	《环境保护法》
16		《新化学物质环境管理办法》
17		《国务院关于落实科学发展观加强环境保护的决定》、
18		《关于加强有毒化学品进出口环境管理登记工作的通知》
19		《化学品环境风险防控“十二五”规划》
20		《国务院关于加强环境保护重点工作的意见》
21		《化学品首次进口及有毒化学品进出口环境管理规定》

Management Control about Chemical

- Sectoral legislation
- Management responsibilities unclear
- Registration system is not perfect
- Preventive idea is not enough
- Risk assessment for management of chemicals circulation is not perfect
- Chemical Information Systems of the public is defective
- Management punishment is not enough

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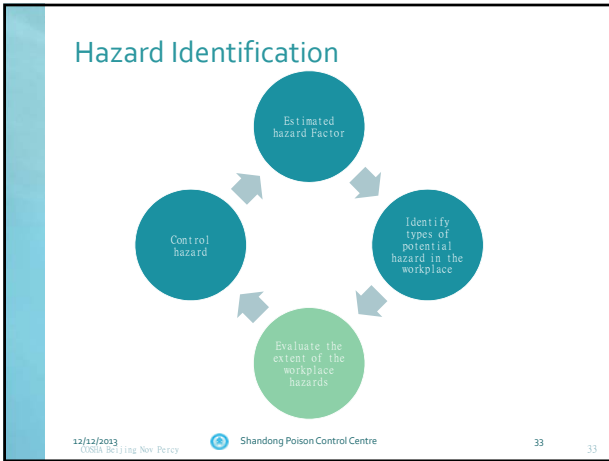
Management Control

	Hazard Identification		Safe handling and use
	Safety labels		Waste Treatment
	Safety Data Sheet		Contact monitoring
	Safe storage		Medical supervision
	Secure transmission		Training and education

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Occupational Exposure Limits

A few seconds to several days → A few months to several years

acute → **chronic**

PC - TWA (Permissible concentration - time weighted average, 8 hours average, 40 hr week)
 PC - STEL (Permissible concentration - short term exposure limit, 15-minutes)
 MAC (Maximum allowable concentration)

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Occupational Exposure Limits

classification	Total	MAC	TWA	STEL
Sical factors				
Chemical factors	330	56	284	286
Dust	47	-	70	70
Biological factors	1	6 × 10 ⁷ (spores / m ³)		
Physical factors	9			

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Detection of occupational hazards in the workplace

- Detective method
- Direct measurement
- Electronic Measuring Instruments (instantaneous direct reading)
- Gas detection tube (using color display - large error Affected by environmental and other contaminants)

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Assess risk factors for inhaled hazardous chemicals

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Workplace Mark

NFPA704

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Chemical Safety labeling (GB15258-2009)

SMIC
化学品安全标签标准格式

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Chemical Safety labeling (GB15258-2009)

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Chemical Safety labeling (GB15258-2009)

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Material Safety Data Sheet

◆ 16 parts

1. 化学品及企业标识
2. 危险性概述
3. 成分、组成信息
4. 急救措施
5. 消防措施
6. 泄漏应急处理
7. 操作处置与储存
8. 接触控制/个体防护
9. 理化特性
10. 稳定性和反应活性
11. 毒理学资料
12. 生态学资料
13. 废弃处置
14. 运输信息
15. 法规信息
16. 其他信息

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Transport

同時必須以木架

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Get to use

- Large barrels (fifty gallons or more) chemicals should be transported using a cart , it must be fixed perfect before moving

對於人工搬運桶裝化學品時

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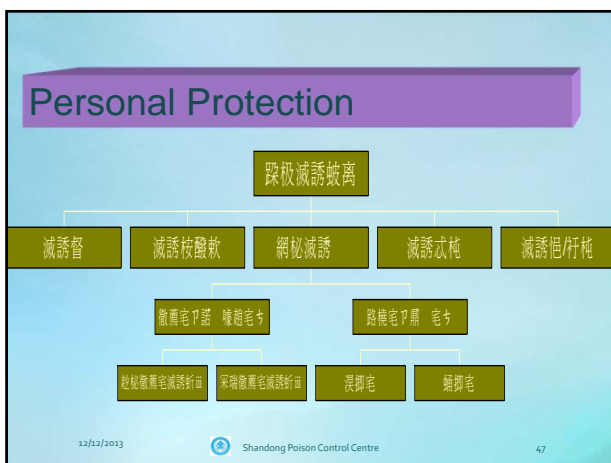
Store

- Deposit inflammable
- Deposit corrosion

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Leak

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Selection factors for respiratory protective equipment

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Common respiratory protective equipment

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A level B level C level D level

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Protective gloves

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Protective boots

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Education and training

- Training and education have more influence on behaviour than any other
- Include
 - general awareness of toxic substances
 - emergency response situations
 - respiratory protection and use





图40 通过培训和教育使工人们清楚地了解危险化学品并能防止中毒事故的发生

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Poison

- Acute Hazards
- Chronic Hazards
- Long-term harm(Carcinogenic, teratogenic, mutagenic)



- ▲ irritate
- ▲ allergy
- ▲ hypoxia
- ▲ toxicosis
- ▲ Carcinogenic
- ▲ teratogenesis
- ▲ Mutagenic

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图4 左图显示——敞开盖子的容器释放出有毒蒸气
右图显示——加盖容器，可以降低工人与毒气接触造成的损害

图7

图8 毒性化学品对眼睛有刺激作用

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Personal Hygiene




图11 在危险化学品工作场所中，应制定严格的个人卫生习惯

图12 勤洗手，特别是接触化学品后

图13 个人防护服使用后应进行清洗

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First Aid

图 56 使用危险化学品时应在最靠近使用场所的地方设置紧急淋浴和眼冲洗设施

图 43 将事故中受伤者转移到非污染地区

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Operation control

- Alternative
- Change Process
- Isolation
- Ventilation
- Personal Protection
- Healthy(work and personal)

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Secondary poisons prevention

- Early detection, early diagnosis and appropriate treatment by occupational health examination using special screen method to find contraindication, suspected poisonings and suspicious toxic disease and to remove from hazardous work earlier.
- To prevent the exposed poison from progressing to a more serious, irreversible or chronic stage and to restore the victim to his/her former state of health.

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Occupational Health Examination Institution in Shandong(175)

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Occupational Health Examination

➤ Aim

- Early detect occupational disease or suspected occupational diseases or abnormalities
- To discover occupational contraindication
- Evaluate the relationship between health and occupational hazards of workers

➤ Type

- Before post At post
- Leaving post At emergency

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Tertiary poisons prevention

- To minimize the effects of the toxic agent, decontamination and first aid treatment
- Specific antidote therapy while workers poisoning
- Diagnosis, treatment and rehabilitation to prevent death or permanent disability.
- Educating victims and their relatives about how to make the most of the remaining potential for healthy living, including the avoidance of unnecessary hardships, restrictions and complications.

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Occupational Disease Diagnose Institution in Shandong



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New Occupational Diseases Cases in Shandong(2006-2010)

年份	塵肺	急性職業中毒	慢性職業中毒	物理因素所致職業病	生物因素所致職業病	職業性皮膚病	職業性眼病	職業性耳鼻喉口腔疾病	職業性腫瘤	其他職業病	合計
2006	750	42	76	2	3	9	2	58	2	10	954
2007	1275	49	124	11	5	10	-	85	4	11	1574
2008	848	33	66	20	6	14	3	60	9	9	1068
2009	956	21	62	23	9	14	1	84	4	8	1182
2010	688	33	64	8	31	5	18	61	5	8	921
合計	4517	178	392	64	54	52	24	348	24	46	5699

Basic Duties for Provincial Chemical Poisoning

- Medical treatment for sudden poisoning
- Technical guidance for sudden poisoning
- Intoxication detection
- Diagnosis and clinical treatment
- Poisoning Information
- Technical Training

Thanks for your attention!