Chemicals Management & Land Remediation Summit

05 – 07 October 2015

Health and Environmental Impacts of Chemical Production, Use and Trade

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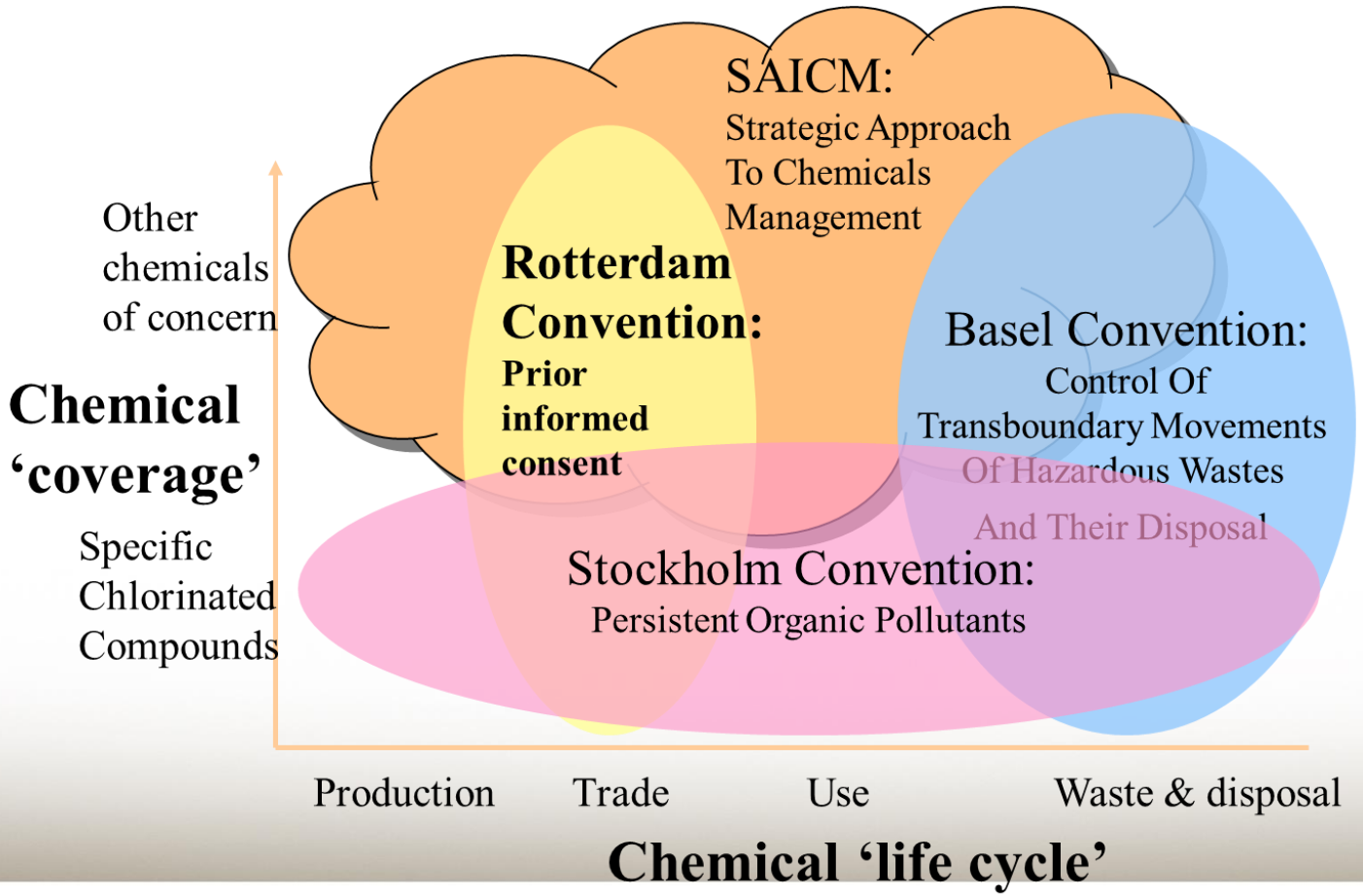
DEA: Hazardous Chemicals Management

Outline

1) Production, Uses & Trade Chemicals
2) Inorganic Fertilizers
3) Pesticides
   a) Rodenticides , Highly Hazardous Pesticides & Illegal/street pesticides
4) Pharmaceuticals : Veterinary drugs & Human Medicines
5) Ozone depleting substances & PCB's

Chemicals of Concern



Chemical industry is crucial component of economic development

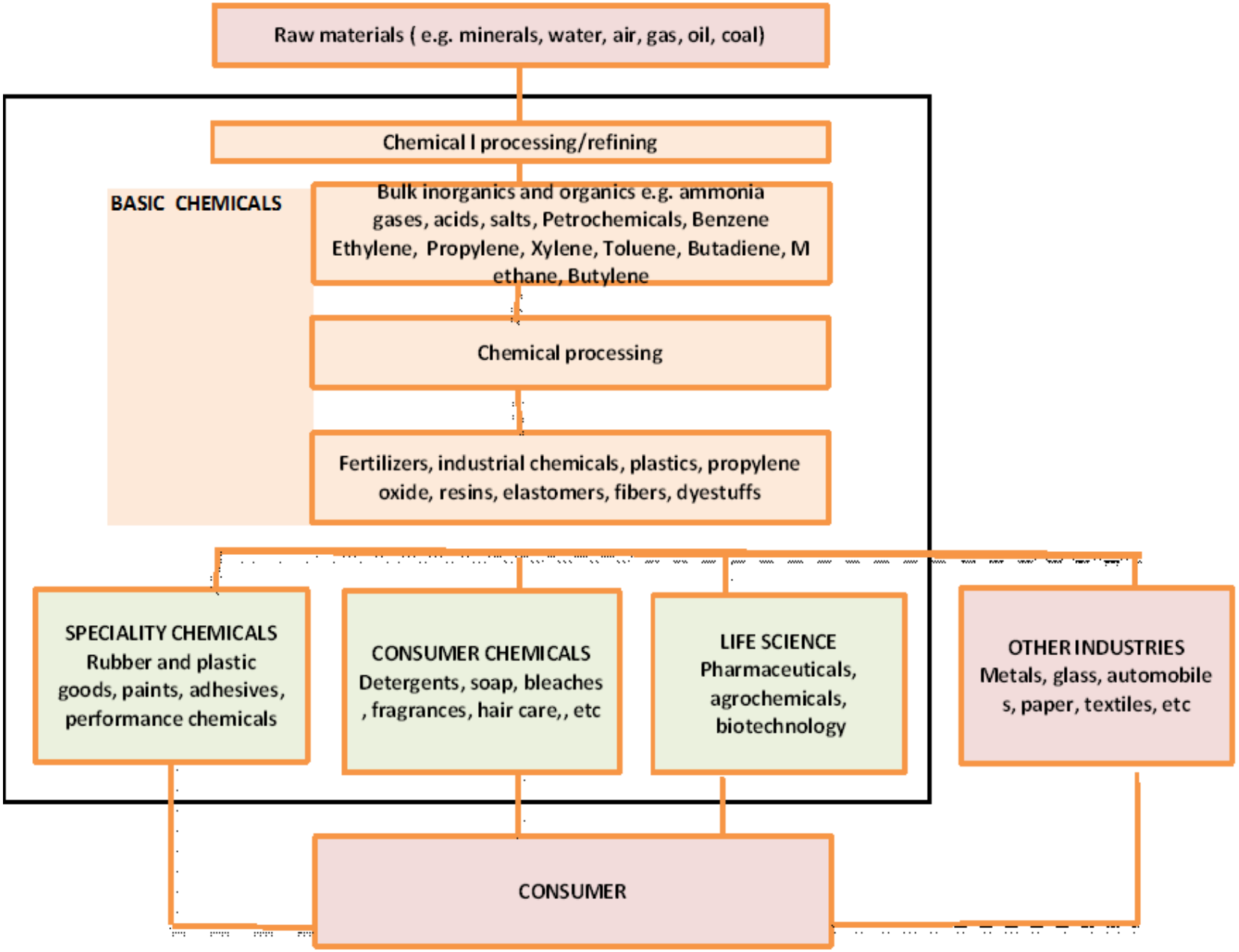
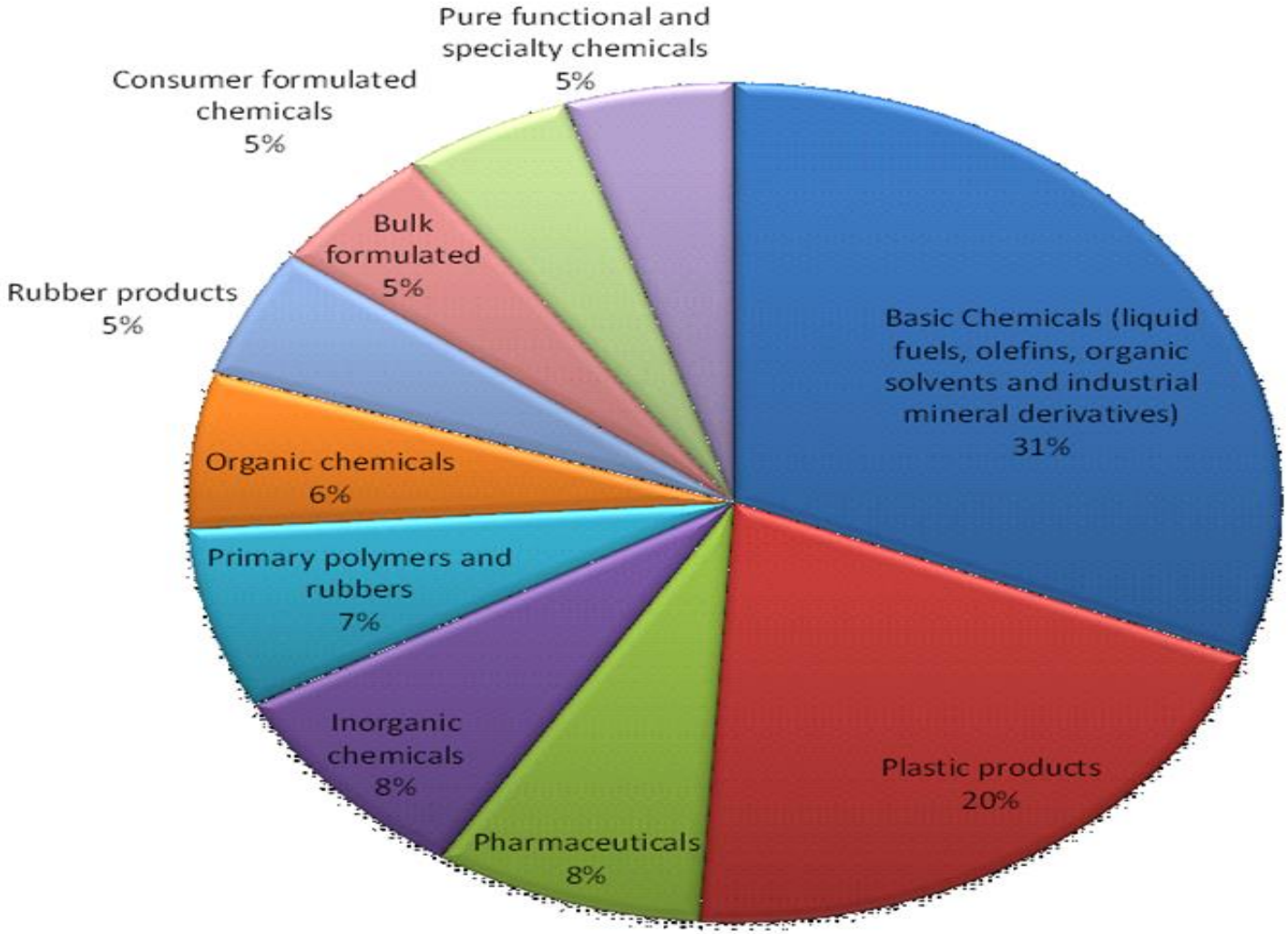


Figure 1: The General structure of the chemical industry. Source: OECD 2001

Over 600 mil tonnes chemicals produced. More than 140 000 chemicals not evaluated. SELF REGULATED BY INDUSTRY



Global per capita production & consumption of chemicals and total demand for chemicals has increased drastically.

1) Increased Communicable (HIV/AIDS, STIs, TB, etc) & Non-Communicable diseases (Hypertension, Diabetes, depression/stress, mobidity from accidents)

2) Synthetic Chemicals

- Inorganic Fertilizer – alleviation of food security
- Pesticides
- Human and veterinary medicines

3). Rapid Urbanization AND Greater demand for **Transportation fuel & energy sources**, petrochemicals & speciality chemical products

Serious Incidents occurring with chemicals

1) Poisoning from industrial and and agricultural chemicals are top 5 leading cause of deaths:
   - 1 million deaths
   - 14 million Disability Adjusted Life Years.

2) Scope of unintended industrial accidents involving chemicals continues to grow rapidly

Major Public Health Challenges …

- Microorganisms becoming extremely resistant to available existing antibiotics, especially Gram - Negative rods (e.g. E.coli, Salmonella, Klebsiella spp, Acinetobacter spp)
- The availability of new antibiotics becoming extremely dry (incentives for pharmaceutical companies to develop and manufacture new antibiotics limited)
- New antibiotics ONLY available for treating Gram –Positive infections (NO NEW Gram – Negative in next 15-20yrs)

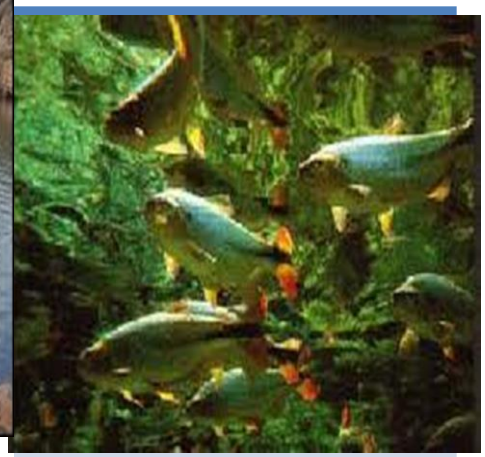
Rate of antibiotics resistance

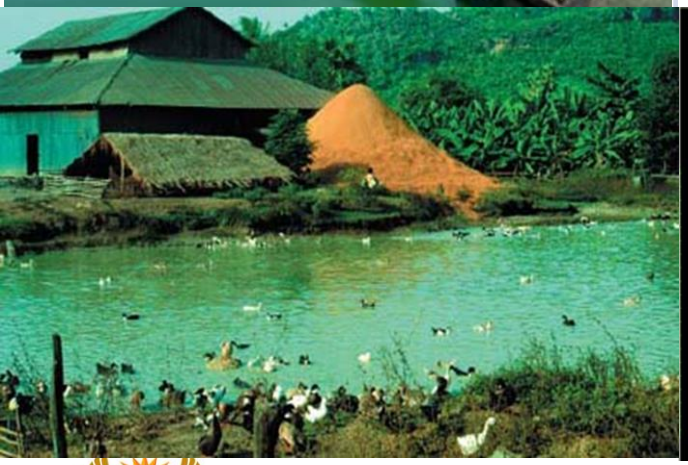
- South Africa faces a quadruple burden of diseases with **HIV/AIDS**, **other infectious diseases** and **communicable diseases**. Highest number of HIV infected people in the world (2009) – 5.6 of its 50 million infected.

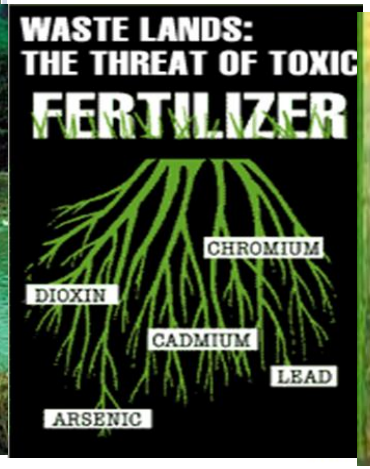
2010	Methicillin resistant Staphylococcus aureus (MRSA)	all tertiary hospitals
2012	Vancomycin resistant enterococci (VRE)	sensitive to Vancomycin
2011	Extended spectrum beta-lactamase (ESBL) producing Gram Negative bacteria	Cephalosporins & penicillin
	Carbapenemase producing Enterobacteriaceae (CPE)	Colistin
	Klebsiella pneumonia resistance to all available antibiotics	

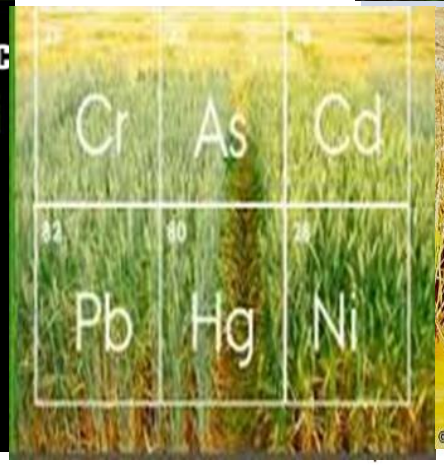
Environmental Impact of Inorganic Fertilizers

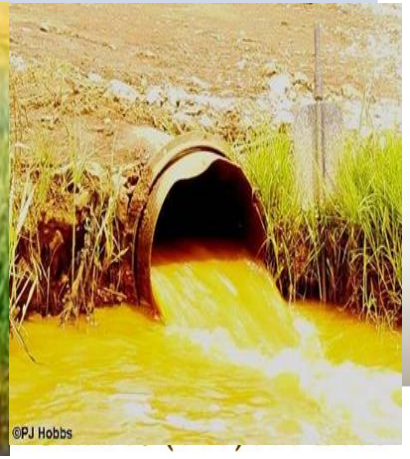
A dead African buffalo (Syncerus caffer) found in a reservoir with a dense bloom





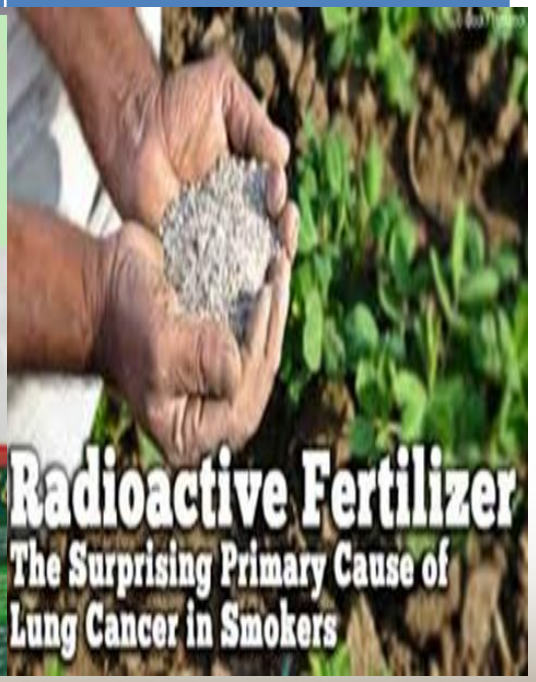




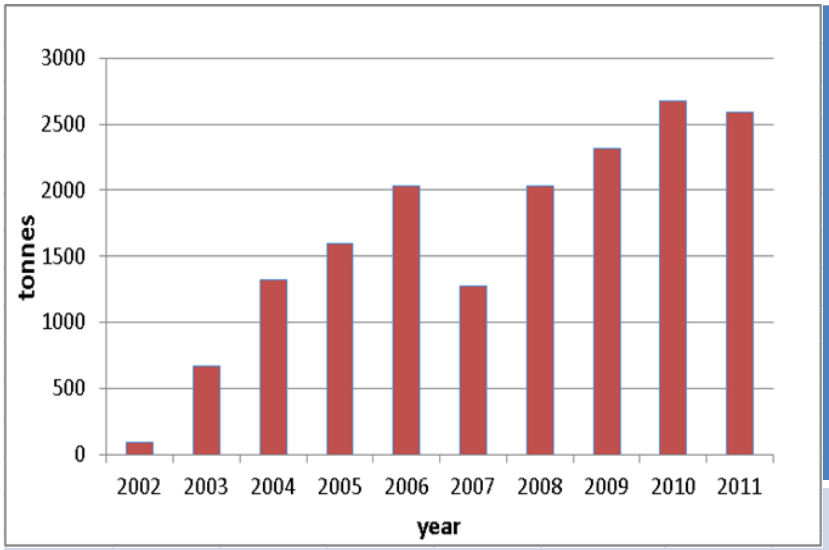


Health Impact of Inorganic Fertilizers

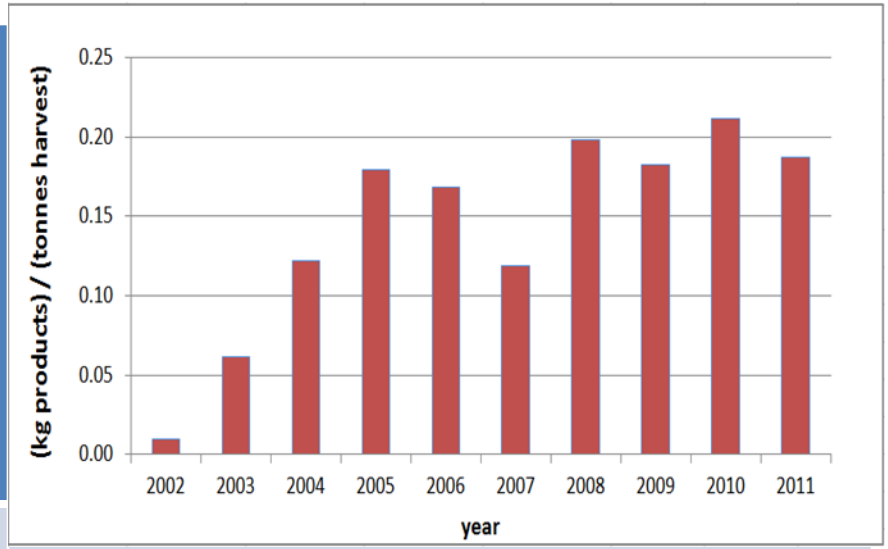
Fertilizer from industry to running to water	Kidney diseases	Lung cancer



Pesticides use and trade

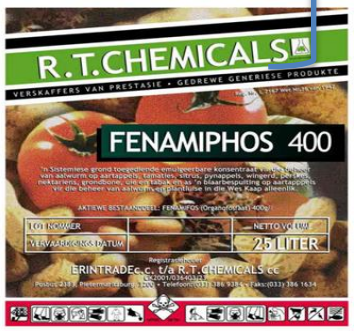


Steady increase of pesticide imports …

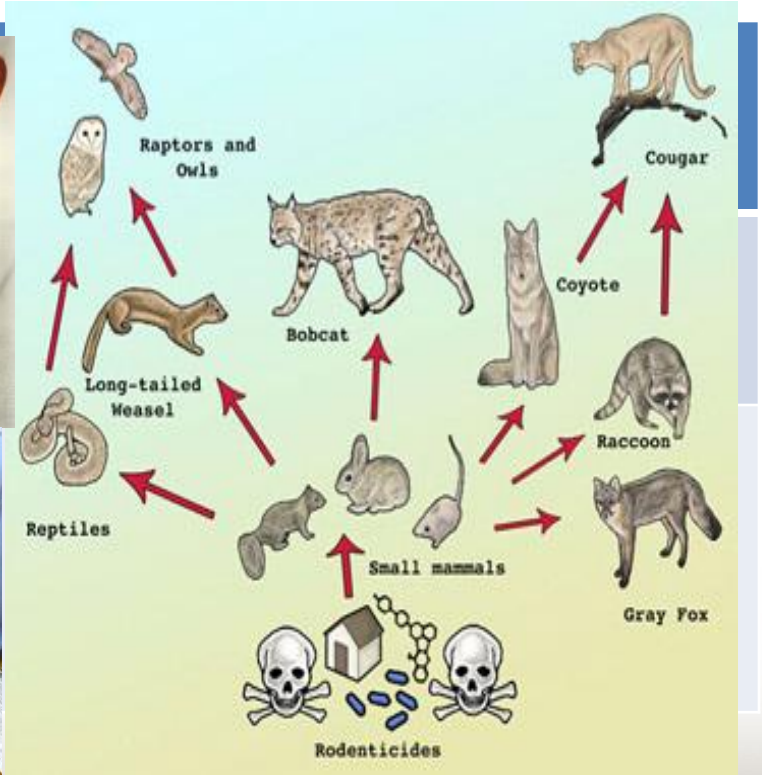


… but also increased pesticide use per unit agricultural production

Environmental Impact

Pesticide	Environmental Effects
	**Death of fish, aquatic species** 
	**Risk of fish kills increased over time** (here the total toxic load for fish)  
	Leaching, persistence and bio-accumulative 
	

Anticoagulant Rodenticides – Environmental impact

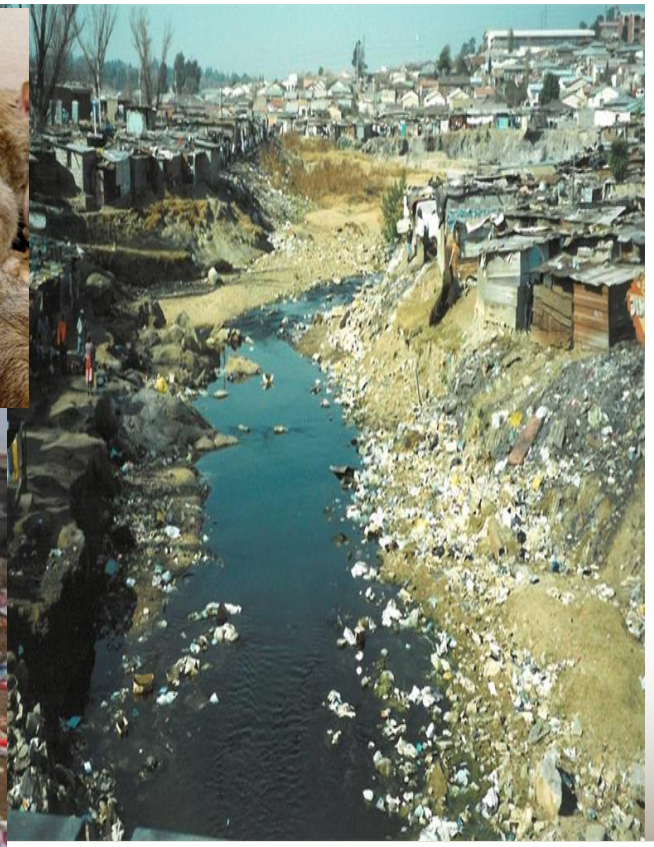


Where do you dispose dead rats?

Causes of Rodents

Poor sanitation
Informal settlements & overcrowded building

Illegal dumping of food, wood piles and debris



Diseases transmitted by rats

1. Foot and Mouth Disease - Causing losses to livestock faming and export of red meat.
2. Salmonella - Carrier of bacteria leading to Salmonells
3. Tuberculosis - Carrier of TB bacteria
4. E.Coli - Carrier of bacteria and passed through feaces

Diseases transmitted by rats

4. Leptospirosis - Death of prisoners at Pollsmor Prison, Babies-Alexandra & Diepsloot

5. Wounds and deformation of body

Illegal street pesticides

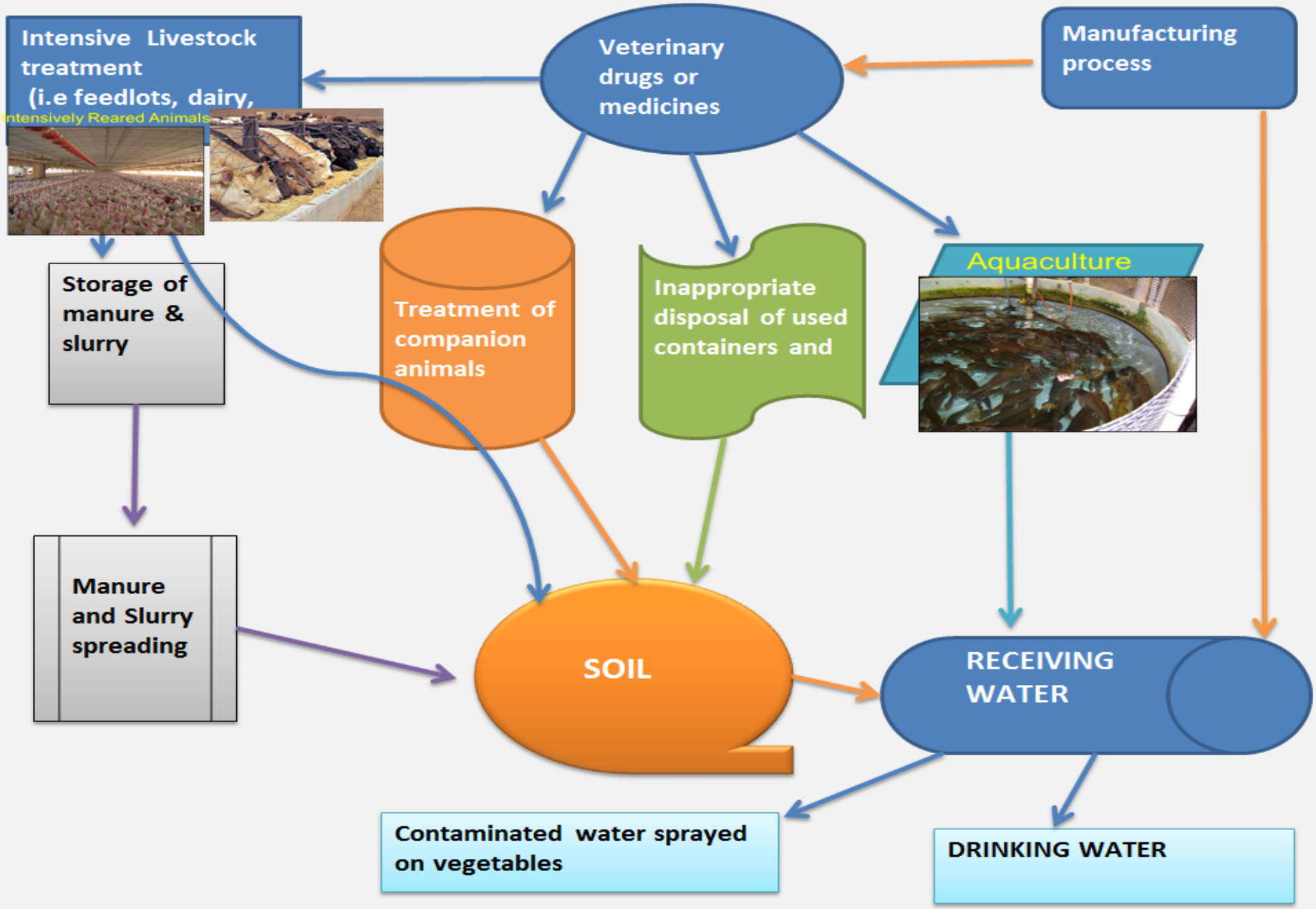
Pharmaceuticals

1) Human and Veterinary pharmaceuticals and their metabolites are detected in soil, foodstuffs and water sources:
2) Environmental and human health impact:
   - Endocrine disruption impact
   - Increased resistance for commensal and pathogenic bacteria
3) Rivers reservoirs for antibiotic resistance:

Food safety
E. coli
Salmonella
Campylobacter
Enterococci

Water Safety
E. coli
Salmonella spp
Mycobacterium tuberculosis
Staphylococcus aureus
Streptococcus pneumoniae
Steptococcus pyogenes
Vibrio cholerae

Veterinary pharmaceuticals can enter the environment via different pathways



Analgesics & Nonsteroidal anti-inflammatory Agents

Diclofnec	Highest levels detected in cattle Toxic to vulture population
Phenylbutazone	**Highest level detected**

Ibuprofen
Propyphenazone
Indonethacin
Phenazone
Acetylsalicylic acid
Ketoprofen

mostly detected in water ways and municipal effluent

Inhibits prostagladin production

IN-FEED ANTIMICROBIALS USED AS GROWTH PROMOTANTS FOR FOOD PRODUCING ANIMALS

In -feed Antibiotic Spectum	PREMIXES	Broiler Production : COMPOUNDING	Aquaculture Production	Beef & Swine Production: Feedlot
				
1. Macrolides 2. Pleuromutilins 3. Tetracyclines 4. Fluoroquinolones 5. Sulphonamides 6.Penicillins	1. Macrolides 2. Ionophores 3. Quinoxalines 4. Polypeptides 5. Streptogramins 6. Glycolipids 7. Oligosaccharides 8. Phosphoric acid 9. Polymeric compounds	1. Choletetracycline 2. Doxycyclines 3. Colistin 4. Neomycin 5. Florfenicol 6. Trimethoprin 7. Sulphadiazine 8. Lincomycin 9. Fosfomysin	1. Amoxicillin 2. Azamethiphos 3. Florfenicol 4. Cypermethrin 5. Emamectin 6. Oxolinic acid 7. Hydrogen peroxide	1. Avilamycin 2. Monensin 3. Salinomycin 4. Flavophospholipol

GROWTH STIMULATING HORMONES

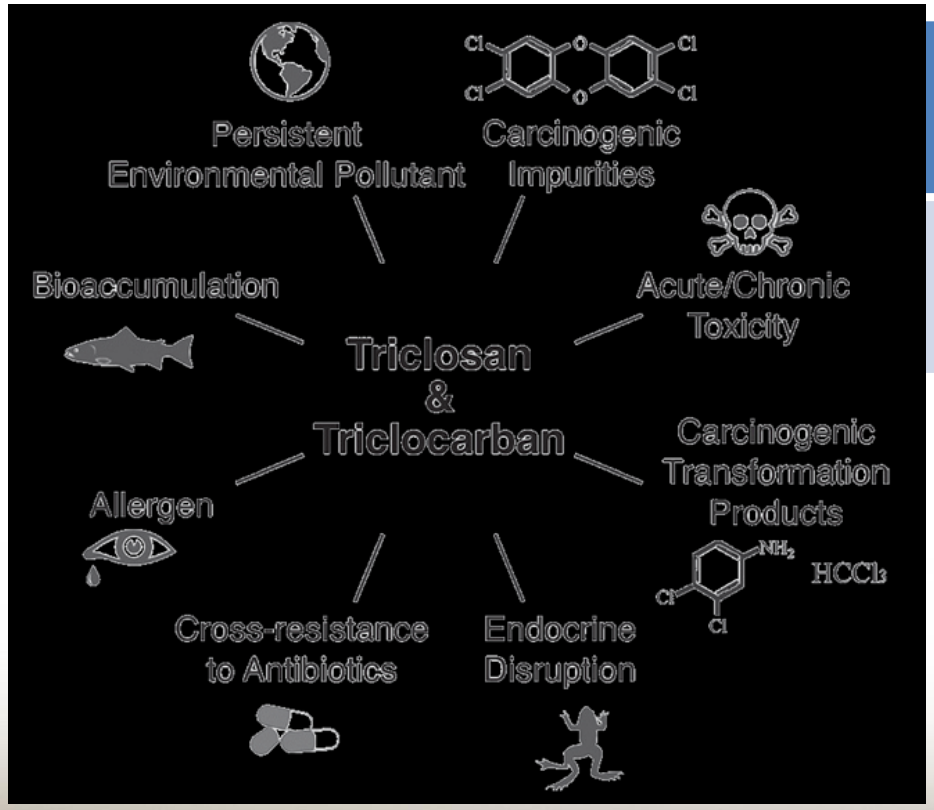
Group	Chemical	Detection Level	Human Health & Environmental Impact
Natural hormones	Diethylstilbesterol	0.02-2.57 ng/l	Cancer of uterus, poor sperm quality, testicular disruption
	Estradiol benzoate Ethinyl estradiol altrenogest Melatonin Progesterone Methyltestesterone	detection within internationally accepted limit of 10 µg/l	
Beta-Agonists	Zilpaterol	42 sites (of 46) levels ranging from 69 to 23 703 ng/l	
	Melengesterol acetate alpha-Zearalanol Beta- Trenbolone	Levels above set maximum residue limits	
Antibiotic Growth Promotants	Monensin	Y	Antibiotics, bacteria and resistance gene found in dust from feedlots. Environmental Health Perspective, February 2015
	Avilamycin	Y	
	Salinomycin	Y	
	Flavophospholipol	Y	

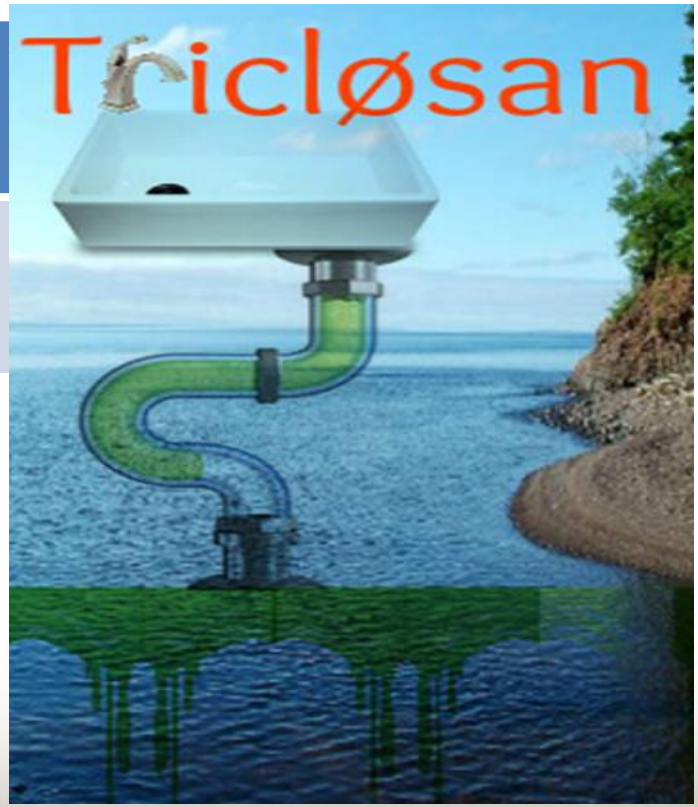
Bacteria	Multi-Resistance
E.coli	Tetracycline (95%) , Ampicillin, Chloramphenicol, Erythromycin, Cotrimoxazole, Rifampicin (94.7%)
Salmonella spp	Tetracycline (95%) , Ampicillin, Chloramphenicol, Ceftriaxone, Ciprofloxacin, sterptromycin, Sulphonamides, Nalidixic acid, Fluoroquinolones
Enterococcs spp	Tetracycline (95%), Fluoroquinolones, Enrofloxacin, Amoxicillin, Ceftriaxone, Aminoglycosides, Avoparcin (related to Vancomycin, Sulphonamide & Trimethoprim -Sulfa combination)
Staphylococcus spp	Tetracycline, Streptomycin, Methicillin, Gentamicin,
Streptococcus spp	Tetracycline, Macrolides, Lincosamide, Erythromycin, Streptogramins, Penicillins, Chloramphenicol Methicillin, Gentamicin,

Triclosan:

Widespread uses			
▪ Antibacterial soaps ▪ Toothpaste (gingivitis) ▪ Mouth wash ▪ Hand sanitizers ▪ Soap & dish-washing detergent	• Toys • Clothes • Mattresses	• Medical devices (antimicrobial sutures) • Kitchen utensils	• Cosmetics & toiletries (face wash, mascara, etc)
In most cases antibacterial soap is not necessary for safe, effective hand hygiene			

Health and Environmental Impact





Laboratory Chemicals

Human Health

Ozone depleting substances (ODS)		**Death of 20 people in maize shipment from Nigeria**
PCB		**Developmental Neurological Reproductive**

CONCLUSION

- Strengthen Information sharing, Awareness and Training of chemicals
- Training of Environmental Crime Specialist (trafficking of chemicals, smuggling, etc)
- Tools for environmental Inspectors to detect toxic chemicals

THANK YOU

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