Containing AMR in the environment

National Workshop on Development and Implementation of State Action Plan on Antimicrobial Resistance

June 10-11, 2019

Thiruvananthapuram, Kerala

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What is environmental AMR?

- **Environment** – **soil, water and air**
- Waste from different sources are being discharged into this environment
- AMR determinants present in waste – **antibiotic resistant bacteria (ARB), antibiotic resistance genes (ARGs) or antibiotic residues**
- **Continuously interplay** among AMR determinants allow resistant bacteria to multiply and spread
  - persist in the **environment**, make way into the **water** and **food chain**
- **Cellular level** – **mutations** or transfer of genetic material from other bacteria through **horizontal gene transfer** (HGT) further spreads AMR

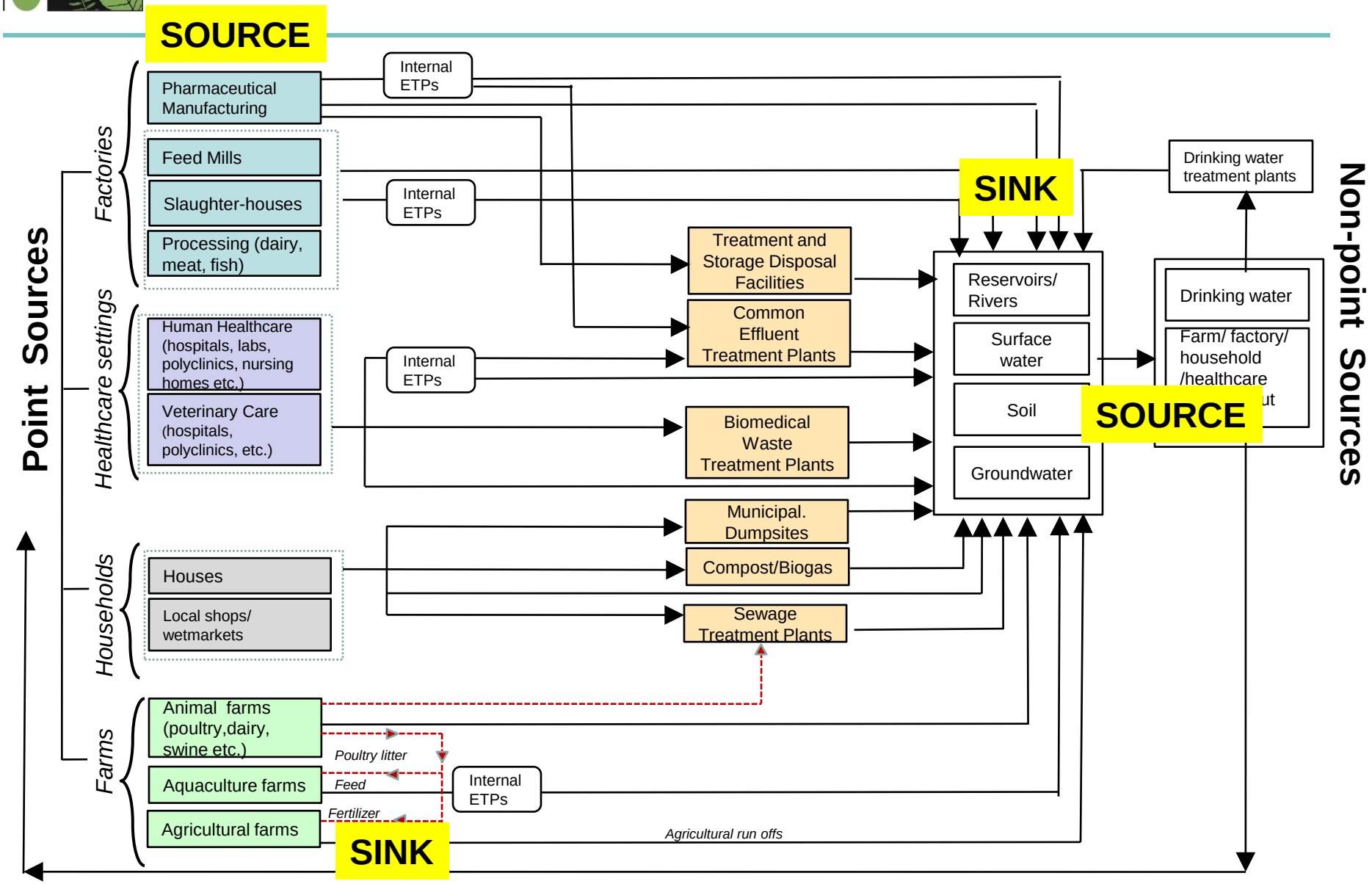
Environment is a melting pot of AMR determinants. Resistance in one bacterium can on to other bacteria, for one or for multiple antibiotics; like a chain reaction

Understanding the environment sector

Point Sources				Non-point Sources
Farms	Factories	Households	Healthcare Settings	
Waste from: Animal farms – poultry, dairy, pig, fish etc. Agriculture farms	Effluents from: Pharma manufacturing Feed mills Slaughter houses Processing units (meat, dairy) Common effluent treatment plants (CETPs)	Effluents from: Sewage treatment plants (STPs) reflecting domestic sewage and disposal of ususued, expired drugs	Hospital sewage Waste from veterinary care settings	Rivers, Reservoirs Groundwater Agricultural soil

AMR in the environment is a cross cutting issue

Linkages with other sectors



Why the environmental AMR needs to be prioritized?

- Environment is both a **sink** and a **source** of AMR determinants

- **Environment possibly a big contributor to AMR in India**
  - Largely unsanitary conditions
  - High bacterial growth
  - Among top producers of dairy, fish, poultry and antibiotics

- **Waste management is an issue**
  - Lack of AMR-centric waste management approaches

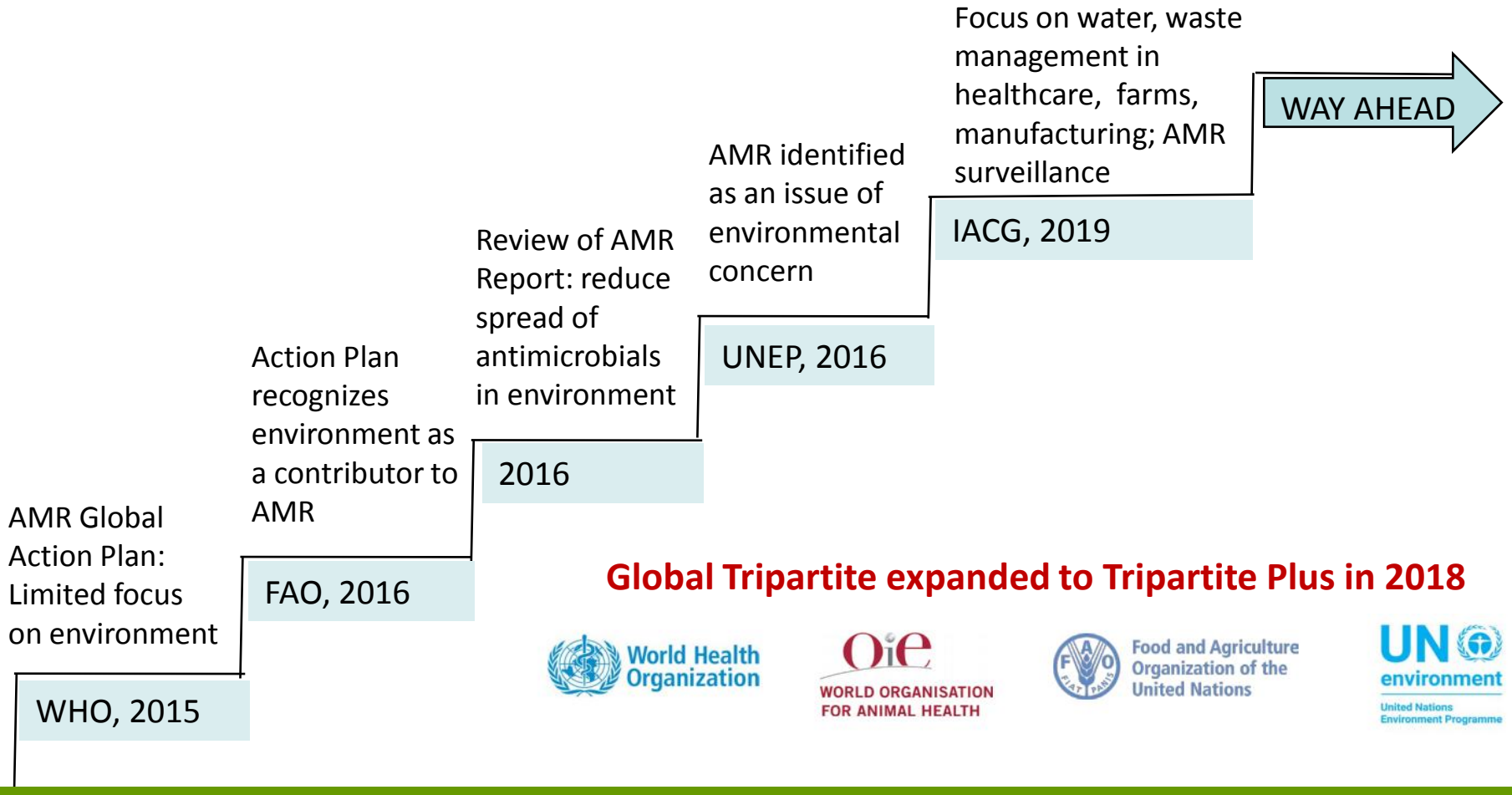
- **Limited guidance** on
  - Waste management
  - Monitoring AMR in the environment
  - Setting discharge limits of AMR determinants in waste

So far, focus has been on what is going in and not what is coming out. Time to rethink and reprioritize?

GROWING GLOBAL MOMENTUM ON AMR IN THE ENVIRONMENT

Growing global momentum on AMR in the environment

Policy



Global Tripartite expanded to Tripartite Plus in 2018

World Health Organization

WORLD ORGANISATION FOR ANIMAL HEALTH

Food and Agriculture Organization of the United Nations

UN environment
United Nations Environment Programme

Environment has largely been neglected area. Global momentum is now picking up to prioritize the environment and address the issue

Growing global momentum on AMR in the environment

Research

- Growing evidence base to understand AMR-specific **environmental routes**, **transmission**, **mechanism** and **pathways**

- Focus on **resistant bacteria, antibiotic residues, antibiotic resistance genes (ARGs) and mobile genetic elements**

AMR determinants (occurrence, mechanisms, spread)

- Waste or effluent from farms, community, hospitals, pharmaceutical manufacturing
- Sewage, wastewater and drinking water treatment plants
- Rivers, water bodies, surface water, agricultural runoffs, etc.
- Airborne transmission of ARGs

Growing global momentum on AMR in the environment

Country level progress

- **Till few years back…**
  - **Limited focus** on addressing AMR in the environment
  - NAP of developed countries talking about **research, monitoring** etc.
  - NAP of developing countries talking about **infection, prevention and control etc.**

- **Present day scenario**
  - Country level NAPs put **strong focus on tacking AMR in environment** in view of One health
  - Puts focus on **surveillance of AMR in the environment**
  - Environment Ministries/Departments slowly getting **on board**

AMR IN THE ENVIRONMENT: PRACTICE AND POLICY IN INDIA

Reduce environmental spread of AMR

NAP-AMR provides key steps to tackling environmental AMR

Objective 3.5

Reduce environmental contamination with resistant genes, resistant pathogens and antimicrobial residues

Strategic intervention and activities

3.5.1. Develop strategic interventions to reduce impact of AMR on the environment

3.5.1.1. Develop policy on registration of farms, factories, slaughter houses, wet markets, aquaculture units, food processing units, feed manufacturers, health care facilities, veterinary care facilities (**NACA**, **MoEFCC**, MoAFW, MoHFW, MoFPI, CDSCO) **M-L**

3.5.1.2. Based on environment risk assessment develop guidelines for locating farms, factories, slaughter houses, wet markets, processing units, feed manufacturers, health care facilities, veterinary care facilities; ensuring compliance by strengthening existing guidelines and enforcement strategies related to payments, benefits, etc. (**MoEFCC**, MoHFW, MoAFW, MoFPI) **M-L**

3.5.1.3. Develop policy & implementation mechanisms on extended producers responsibility for expired/unused antibiotics (**CDSCO**, DoP/MoCF) **M-L**

3.5.1.4. Develop and implement a strategy and operational plan to reduce environmental impact on AMR (**NACA**, **MoEFCC**, CPCB) **S-M-L**

- Define standards and monitor antibiotic residues and bacterial load in effluents (**S-M-L**); disinfection at treatment plant to remove bacteria (**S**); using waste from unorganized sector to generate biogas (**M**); develop necessary legislation, awareness & incentives; develop tool for environment risk assessment; develop SOPs and implement best practices (**S-M-L**)
- Include biosecurity in farmer-field school curriculum (**S**); sector-specific manuals and guidelines to improve environmental management of AMR (**M**)

Delhi Declaration on Antimicrobial Resistance

Joint declaration endorsed by 12 ministries

Commits to:

"Initiating and sustaining activities to raise awareness and knowledge about AMR to engage and encourage behavioral change in different audiences, promote evidence based prevention, infection control and sanitation programs in alignment with the Swachh Bharat Abhiyan, Kayakalp and Swachh Swasth Sarvatra initiatives of the Government of India"

Farms

Point Sources				Non-point Sources
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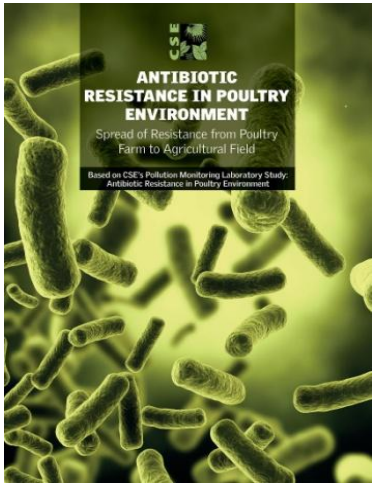
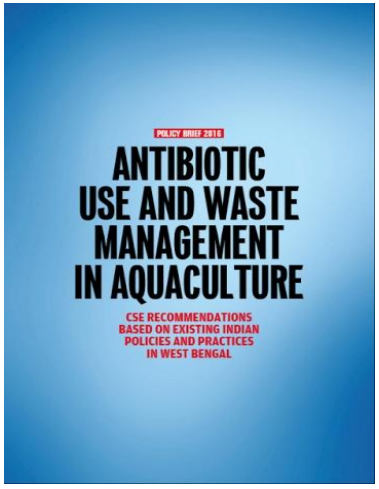
Waste disposal practices at farms

- **Disposal methods followed in poultry farms**
  - Litter and manure is mostly **spread on agricultural fields**; sometimes used **directly in aquaculture farms**
  - **No–limited biosecurity** measures; variations across different farm types
  - 2017 CSE study showed **high multidrug resistance** (MDR) **poultry farm environment; MDR is moving from farms to agricultural fields** in *E. coli*



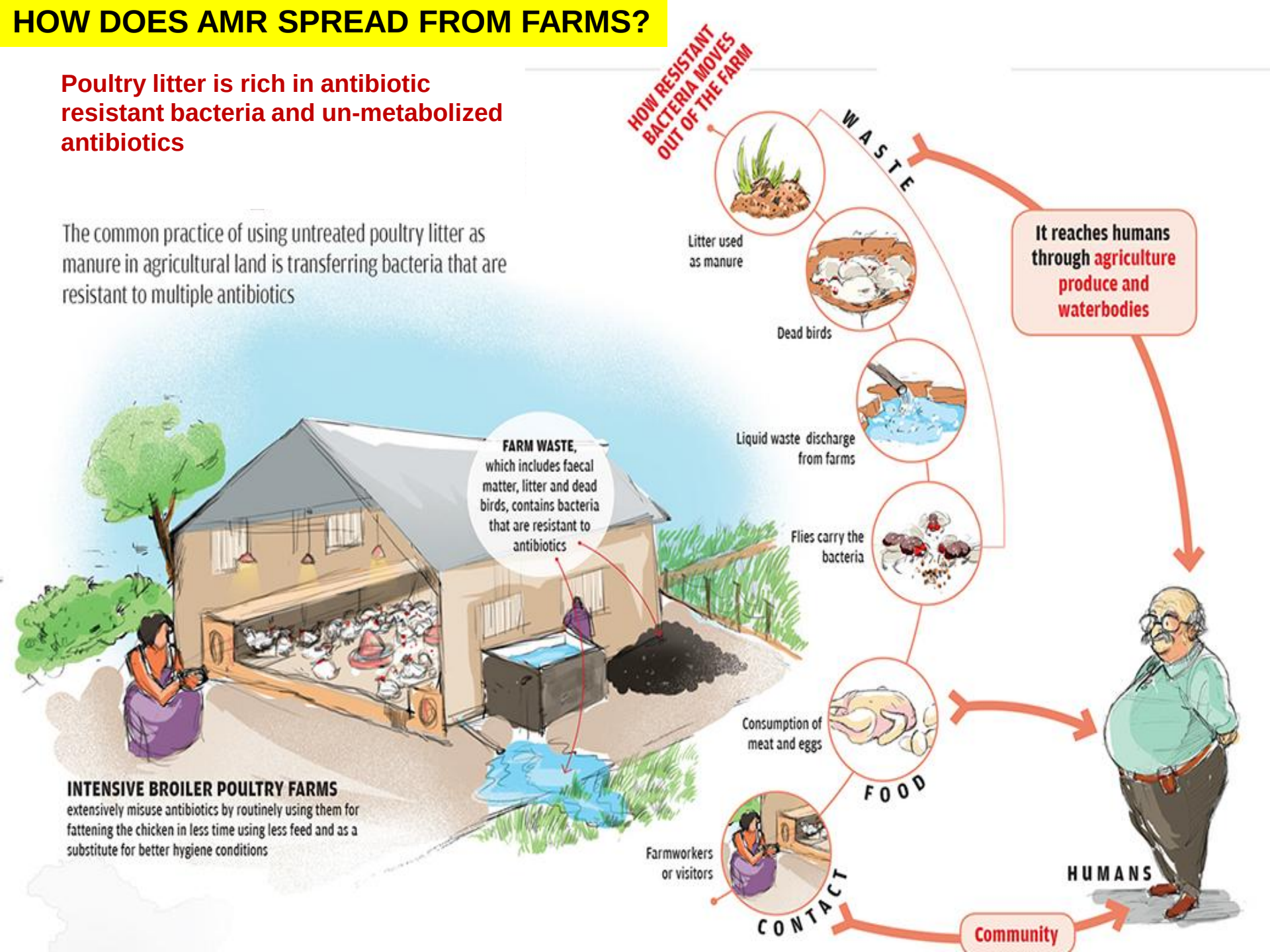
- **Disposal methods followed in aquaculture farms**
  - Discharged into **canals** (from which water was sourced) or **agricultural fields**
  - Reused in **broodstock ponds**
  - Let out in **sewage drains**
  - Solid waste, including expired antibiotics are **buried** in pits



HOW DOES AMR SPREAD FROM FARMS?

Poultry litter is rich in antibiotic resistant bacteria and un-metabolized antibiotics

The common practice of using untreated poultry litter as manure in agricultural land is transferring bacteria that are resistant to multiple antibiotics



Environmental Guidelines for Poultry Farms

Central Pollution Control Board

- **Farm siting criteria**
- **Criteria for location of feed mills**, approaches to limit pest/insect infestation, sanitation and cleanliness
- **Management of solid waste**
  - Dead birds, manure, hatchery debris
- **Manure storage and management**
- **Hatchery waste management**
- **Waste water discharge**
  - Methods for treatment and disposal of effluent
- **Feed and pest management**

- **Need to strengthen these and making it mandatory to be followed**
- **Few states have approved these guidelines, such as Punjab, West Bengal, Karnataka. Others must now come forward to adopt and notify these**

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE GOVT. OF INDIA

SPEED-POST

F. No. B-29012/IPC-VI/2017-18/

July 19, 2017

To

The Member Secretaries
All SPCBs/PCCs

Sub: Clarification in the matter of Revised Categorization of the industrial Sector namely "Poultry, Hatchery and Piggery" and dealing new category of industry for classification and review of existing category

Sir,

Modified Directions are issued by CPCB on 07.03.2016 under Section 18 (1)(b) of the Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981 on "Revised Classification of Industrial Sectors under Red, Orange, Green and White Categories". In this context, references are received by Central Pollution Control Board for elaboration of the activities covered under the industrial sector namely **"Poultry, Hatchery and Piggery"** which is placed at Sl. No 33 in Green category of industrial sectors. The matter has been examined and following clarification is hereby issued:

1. Poultry farms less than one lakh birds need not to obtain Consent to Operate, as per CPCB Guidelines circulated vide letter no. B-4032/PCI-SSI/poultry/2015 dated 20.10.2015.
2. The poultry farms which are handling one lakh or more birds at a given time in single location need to approach State Pollution Control Board to obtain necessary Consent to Operate under the Water Act, 1974.
3. Environmental Guidelines for Poultry Farm including minimization of odour pollution, management of solid waste, management of waste water discharge, good housekeeping practices is applicable to all poultry farm irrespective of no. of birds.

As per direction dated 7.3.2016 on categorisation of industries, the SPCBs/PCCs were asked to categorise any new or left-over industrial sector, if any, at the level of concerned SPCB/PCC following the criteria and guidelines prescribed by CPCB. In case, SPCBs/PCCs received any references / their own issues regarding categorisation of industries (existing / new), it can be decided at the level of concerned SPCBs/PCCs as per pollution index assessment.

Yours faithfully,

(A. B. Akolkar)
Member Secretary

Copy to:
The Joint Secretary (CP Div.)
Ministry of Environment, Forests and Climate Change
Room No P320, Indira Paryavaran Bhawan
Aliganj, Jor Bagh Road
New Delhi - 110 003

Divisional Head, IT Div., CPCB for uploading on the website of CPCB

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दूरभाष/Tel : 43102030, 22305792, वेबसाईट/Website : www.cpcb.nic.in

July 2017 Notification by CPCB

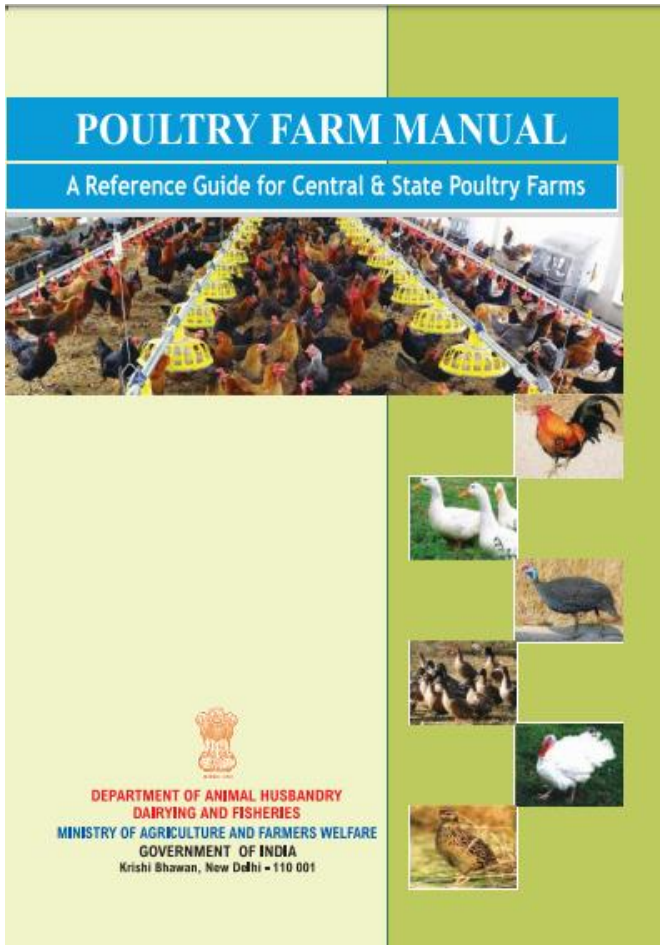
Environmental Guidelines for Poultry Farms including minimization of odour pollution, management of solid waste, management of wastewater discharge, good housekeeping practices, is applicable to all poultry farms irrespective of no. of birds

Poultry Farm Manual

Department of Animal Husbandry, Dairying and Fisheries

BIOWASTE MANAGEMENT

- **Disposal/recycling of hatchery waste**
  - Incineration, Fermentation, Rendering, Boiling, Enzyme treatment, Composting
- **Management of litter waste**
- **Methods of disposal**
  - Composting, Gasification technology
- **Disposal of dead birds**
  - Incineration, Burial, Composting
- **Management of biomedical waste**
- **Management of wastewater discharge**
- **Management of biomass waste**



Key policy gaps

- **Waste from farms not on radar of environment regulators**
- **Agriculture vs. Industry**
  - Farms considered agriculture; **regulator's mandate is trade/industrial effluents**
- **Pollution-causing potential classification**
  - Poultry and hatchery categorized '**green**'; aquaculture not categorized at all
- **Farm registration** is a lesser priority
- **No framework for freshwater aquaculture**
- Others
  - Agricultural **lands converted for aquaculture** purposes
  - Inadequate **supervision/outreach** by concerned officials

What should be done?

- **Environment regulators at the Centre and State should have a greater leadership role and develop AMR-centric environmental regulations for farms**
- **Pollution causing potential** of the poultry farm sector should be **re-prioritized**
- **Less risky litter/manure management approaches** such as **biogas generation** must be preferred over land application. Other options of waste to energy conversion can also be explored
  - **In-house biogas generation plants** for Big/integrated poultry farms; **Common biogas generation plant** for small poultry farmers
- **Land application of untreated litter** must be **prohibited** through laws, awareness and surveillance
- **Proper composting** for treatment of litter/manure should be encouraged only under **very high level of supervision**
- Laws related to approval of composting sites, validation of treated manure and timing of application of litter/manure should be made
- Poultry litter must **not be allowed** to be in aquaculture

Factories

Point Sources				Non-point Sources
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Waste management practice in Baddi pharmaceutical hub

- **Improper disposal of pharmaceutical industry waste (observations and stakeholder interaction):**
  - Solid waste given to scrap dealers who dump or burn them at any open area
  - Effluents are injected into bore wells dug in ground at night
  - Effluent treatment plants (ETPs) release toxic effluents during monsoon
  - Smaller companies drain ETP treated water into nallahs
  - Sewer lines of some industries are not connected to CETP and open directly into the nearby river
  - Pipes/outlets from plants open at backside or are channeled underground to open into bushy low lying areas

Bitter medicine

It is time to treat pharma waste more rigorously. The waste contains active ingredients used in antibiotics and may be contributing to the spread of antimicrobial resistance

RAJESHWARI SINHA | BADDI, HIMACHAL PRADESH

SPREAD OVER 390 square kilometres in Himachal Pradesh's Solan district, the Baddi-Barotiwala-Nalagarh (BBN) industrial area is one of India's largest pharmaceutical manufacturing hubs. The region hosts around 500 small, medium and large pharma units and accounts for 35 per cent of Asia's total medicine production. But rapid industrialisation and a lax attitude towards safe disposal and management of pharma waste have raised concerns about the effects of pollution on the environment and health.

The water of the Sirsa river, which flows downstream through Baddi, is black and emanates a foul odour. In Jharmajri village, which has the largest number of pharma units, resident Balvinder Thakur points to an open area where solid waste has been burnt. The burnt waste, which contains medicine wrappers, flows along with wastewater into a dirty canal nearby. "All of this is going to the river," he says. Pharma manufacturing units are required to send their solid waste to the treatment, storage, and disposal facility (TSDF). But people in the area allege that pharma units sometimes do not comply with these norms. "To cut down on costs, waste is given to scrap dealers who visit plants. They dump the

Key policy gaps

No standards in view of AMR

Industry/Factory	Type of waste	Standard parameters
Pharmaceutical (manufacturing and formulation) industry	Effluents	Compulsory parameters: pH, oil and grease, BOD, TSS, Bioassay test Additional parameters: heavy metals etc.
Sewage Treatment Plants	Effluents	pH, BOD, TSS, Fecal coliform
Dairy	Effluents	pH, BOD, suspended solids, wastewater generation, oil and grease
Common Effluent Treatment Plants (CETPs)	Treated effluent	pH, BOD, COD, TSS, oil and grease, FDS, heavy metals etc.
Slaughter houses, meat processing units	Effluent	pH, BOD, COD, suspended solids, oil and grease
Sea Food industry	Effluent	BOD, suspended solids, oil and grease

BOD: Biological oxygen demand, TSS: Total Suspended Solids, COD: Chemical Oxygen Demand, FDS: Fixed Dissolved Solids

- **Present standards not aimed to address AMR**
- **In view of AMR containment, draft standards for residual antibiotics in pharma industry developed by CPCB; yet to be notified**

Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

- **Production/formulation of drugs/pharmaceutical and health care product**-considered as a process generating hazardous waste

- **Hazardous waste** means any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is **likely to cause danger to health or environment**, whether alone or in contact with other wastes or substances

- Components of hazardous waste in production/formulation of drugs/pharmaceutical
  - **Process Residue and wastes**
  - Spent catalyst
  - Spent carbon
  - **Off specification products**
  - **Date-expired products**
  - Spent solvents

Households

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Disposal of drugs at domestic level

- **Drugs which are unused or expired at the household levels are often disposed improperly**
  - Disposed into drains, along with regular household waste
- **Similar is the fate across other points in the value chain**
  - Retailers dispose into open drains/nallahs, bury or dump underground, burn them etc.
- Globally manufacturing companies ensure drug take back from household level; no such provision in India
- **Handling of expired drugs at the household or retail level needs attention, in view of rising AMR**
  - Recent initiative in Kerala by Dept. of Drug Control and All Kerala Chemist and Druggist Association (AKCDA) to **"take back"** unused drugs, including antibiotics from households
  - **Programme for Removal of Unused Drugs (PROUD)**

Solid Waste Management Rules, 2016

- Defines **“domestic hazardous waste” to include** discarded paint drums, pesticide cans, CFL bulbs, tube lights, **expired medicines**, broken mercury thermometers, used batteries, used needles and syringes and contaminated gauge, etc., **generated at the household level**

- Defines **"solid waste"** to include solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, **treated bio-medical waste** excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities mentioned in rule

States that all biomedical waste shall be disposed of in accordance with the Bio-medical Waste Management Rules, 2016, as amended from time to time

Draft Model Municipal Solid Waste (Management & Handling), Cleanliness and Sanitation RULES / BYE-LAWS

- **Segregation, storage, delivery and collection of Municipal Solid Waste**
  - Every generator of Municipal Solid **Waste shall separate the waste at source of generation** into the following categories as applicable and **shall store separately**, **without mixing it** for segregated storage in **authorized storage bins** , **private/public receptacles** for handing over or delivering to authorized waste pickers or waste collectors as directed by the local authority/body from time to time
  - One category of segregated waste: **Fully treated Bio-medical waste**

These talk about correct segregation, storage, delivery, collection of municipal solid waste which can contain out-dated, contaminated, expired medicines generated at household level

Draft Model Municipal Solid Waste (Management & Handling), Cleanliness and Sanitation RULES / BYE-LAWS

Segregation, storage, delivery and collection of Municipal Solid Waste

5.7 **Specified household hazardous waste:** (as listed in **Schedule III**) shall be stored and delivered by every generator of waste to the collection vehicle, which shall be provided weekly/periodically by Municipal Corporation/Council/Municipality/Urban Local Body of XYZ or any other Agency authorized by the XYZ Pollution Control Board / Committee (__PCB /PCC) for collection of such waste, or to a center designed for collection of such waste for disposal in a manner that is mandated by the Government of XYZ or the XYZ Pollution Control Board / Committee (_____PCB /PCC).

Includes discarded medicines and its containers

5.8 **Untreated bio-medical waste** (as listed in **Schedule IV**) shall be collected & stored in specified type of covered receptacles and delivered by every generator of such waste to the collection vehicle which shall be provided weekly/periodically by Municipal Corporation/Council/Municipality/Urban Local Body of XYZ or any other Agency authorized by the XYZ Pollution Control Board / Committee (__PCB /PCC), or to a center designated for collection of such waste, for disposal in manner that is mandated by XYZ Pollution Control Board / Committee (__PCB /PCC) in accordance with the Bio-Medical Waste (Management & Handling) Rules, 2016.

Includes discarded medicines and cytotoxic drugs (waste comprising of outdated, contaminated and discarded medicines)

Based on the draft, few states have adopted municipal solid waste management Bye-laws

Healthcare settings

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Bio-Medical Waste Management Rules, 2016

- Defines "**bio-medical waste**" as any waste, which is generated during the **diagnosis, treatment or immunisation of human beings or animals or research activities** pertaining thereto or in the production or testing of biological or in health camps, including the categories mentioned in Schedule I appended to the rules

- **Type of waste: Expired or Discarded Medicines**
  - Pharmaceutical waste like **antibiotics**, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.

- **Type of bag/container to be used**
  - Yellow coloured non-chlorinated plastic bags or containers

- **Treatment and disposal option**
  - Expired `cytotoxic drugs and items contaminated with cytotoxic drugs **to be returned back to the manufacturer or supplier for incineration at temperature >1200° C** or to **common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >1200° C** OR **Encapsulation or Plasma Pyrolysis at >1200° C**
  - All other discarded medicines shall be either **sent back to manufacturer or disposed by incineration**

WHAT SHOULD STATES DO?

Framework for Guidance

INTERVENTION AREAS

- **Policy/law/ regulations/ standards/ programmes**
- **Implementation tools- Infrastructure/ capacity/systems/ resources**
- **Advocacy/awareness and education/ training/curriculum**
- **Record keeping/ database generation/ collation/ dissemination and research/survey**
- **Review/monitoring /feedback**

Responsible Antibiotic Use in Food Animals

THEMATIC AREAS				
Supply of antibiotics	Production Systems			Consumers
	Reduce need for antibiotics	Veterinarians and veterinary services	Farms and farmers	

Surveillance of Antibiotic Use, Residues and Resistance

THEMATIC AREAS			
Antibiotic use in food animals	Antibiotic resistance in animals and food from animals	Antibiotic residues in food from animals	Environmental surveillance of residues and resistance

Environment Management to Contain Antimicrobial Resistance

THEMATIC AREAS			
Registration/ licensing (based on environment risk assessment)	Biosecurity/sanitation and hygiene/good manufacturing Practices	Waste management	Research

Short-term **(S)**: <1 yr; Medium-term **(M)**: 1-3 yrs; Long term **(L)**: 3-5 yrs; Continues throughout: **(S-M-L)**

Environmental surveillance of AMR

Policy/law/ regulations/ standards/ programmes

- National **AMR surveillance programme** to monitor resistance in environment (**S)**
- **Regulation on antibiotic residues** in effluent and waste from industries and farms (**S)**
- **Standards for waste discharge** from farms, slaughter houses, animal food processing industry, pharmaceutical industry and healthcare settings **(S)**

Implementation tools - infrastructure / capacity/ systems/ resources

- **Monitoring** and **surveillance framework** including monitoring of antibiotic residues and AMR in indicator bacteria in environment, farms, factories, slaughter house, wet market, processing unit, health care facilities, vet care facility (prioritization based on ground realities) **(M)**
- **Assess infrastructure needs**, accordingly build/strengthen appropriate infrastructure and capacity **(M)**
- Develop **systems to adapt, standardize, compare data** across countries **(M)**

Environmental surveillance of AMR

Advocacy/ awareness and education/ training/ curriculum

- **Awareness campaigns** on importance and need of environmental surveillance across stakeholders **(S-M-L)**
- **Training needs assessment** for those conducting surveillance **(S)**
- Development of **training material**, protocols and data management **(S)**
- **Capacity building** and training programme (including at university level) **(M)**
- Training of peer/participatory monitoring systems **(M)**
- **Advocacy** at community/institutional level based on surveillance data reports **(S-M-L)**

Record keeping/ database generation/ collation/ dissemination and research/ survey

- Data **collection, collation and analysis** at regional and sub-regional level **(S-M-L)** **-** Selection of sentinel sites to begin with
- Correlation with animal antibiotic use and AMR data **(S-M-L)**
- Development of an online integrated information system and publishing of annual reports and public dissemination of data to ensure transparency **(M)**
- Develop early warning system **(S)**

Review/ monitoring/ feedback

- Periodic review and mapping of data with antibiotic use and resistance in animal and human for continued advocacy, awareness and future policy and practice **(S-M-L)**

Registration and Licensing

Policy/law/ regulations/ standards/ programmes

- **Policy on registration** of farms, factories, slaughter houses, wet markets, processing units, feed manufacturers, health care facilities, veterinary care facilities **(S)**
- **Siting guidelines** and **licensing** for farms, factories, slaughter houses, wet markets, processing units, feed manufacturers, health care facilities, veterinary care facilities **(S)**
- Policy on environment risk assessment for registration and renewal of antibiotics for humans and animals **(M)**

Implementation tools - infrastructure / capacity/ systems/ resources

- Regulatory system for enforcement of laws, ensuring compliance with adequate funding and capacity **(M)**
  - Small producers to be facilitated through required measures
- Tool for environmental risk assessment for siting, registration and renewal of antibiotics **(S)**

Registration and Licensing

Advocacy/ awareness and education/ training/ curriculum

- **Sensitise regulators, industry and farmers (S)**
  - Inclusion of environment management in antibiotics awareness week
- **Build capacity** of regulators **(S)**
- Development of customised **material for awareness and training (S)**

Record keeping/ database generation/ collation/ dissemination and research/ survey

- **Public database** of licensed farms, factories, human and veterinary healthcare settings **(S)**

Review/ monitoring/ feedback

- Comprehensive review framework for policy/regulations and standards **(S-M-L)**

Biosecurity, sanitation and hygiene, good manufacturing practices

Policy/law/ regulations/ standards/ programmes

- **Development of guidelines**, best practices for farms, factories, slaughter houses, wet market, health care facilities, veterinary care facilities **(S)**

Implementation tools - infrastructure/ capacity/ systems/ resources

- **Regulatory system** for enforcement of laws, ensuring compliance with adequate funding and capacity **(M)**
- Adopt progressive pathways to improve management **(S-M-L)**
- Develop **incentives and disincentives for compliance** including performance benchmarks and rating system (such as through pond and farm health cards) **(S)**

Advocacy/ awareness and education/ training/ curriculum

- **Training** and hand-holding **on biosecurity (S)**
- Sector-specific manuals and guidelines on progressive management pathways to improve environment management **(M)**
- Inclusion of biosecurity in **farmer-field school curriculum** or similar such approaches **(S)**

Record keeping/ database generation/ collation/ dissemination and research/ survey

- **Database** on biosecurity compliance performance/ rating system (depending on local circumstances decision on public disclosure can be made) **(M)**

Review/ monitoring/ feedback

- Review of progressive pathways to improve biosecurity management **(S-M-L)**
- Review of guidelines for their success and impact **(S-M-L)**

Waste management

Policy/Law/ Regulations/ Standards/ Programmes

- **Adopt/develop** standards for antibiotic residues and microbial quality in effluent and solid waste from industries, sewage treatment plants, farms, health care facilities, processing units, slaughter houses **(S)**
- Policy on **Extended Producers Responsibility** for expired antibiotics **(S)**

Implementation tools - Infrastructure/ Capacity/ Systems/ Resources

- **Standard Operating Procedures (SOPs)** on waste management for industries, sewage treatment plants, farms, health care facilities, processing units, slaughter houses, wet market, feed manufacturers **(S)**
- Regulatory system for enforcement of laws, ensuring compliance with adequate funding and capacity **(M)**

Advocacy/ Awareness and Education/ Training/ Curriculum

- **Stakeholder training** on waste management guidelines and SOPs **(S)**

Record keeping/ Database generation/ Collation/ Dissemination and Research/ Survey

- **Online database** on waste discharge quality, rating system, compliance/non-compliance **(M)**

Review/ Monitoring/ Feedback

- Development of success/failure indicators/milestones as part of review framework **(M)**
- Compliance status with review framework **(S-M-L)**

Managing AMR in the environment

Approach for surveillance

1. Identify target bacteria and antibiotics
2. Identify sampling location, sample type, sample size, collector
3. Standardize and harmonize testing method(s)
4. Develop and operationalise laboratory network(s)
5. Harmonized data analysis and period reporting, available in public domain

Thank you

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Draft Model Municipal Solid Waste (Management & Handling), Cleanliness and Sanitation RULES / BYE-LAWS

- Defines **“Bio-medical waste**” as any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological and including:
  - **Discarded Medicines and Cytotoxic drugs (waste comprising of outdated, contaminated and discarded medicines)** among others

- Defines “**Municipal Solid Waste**” as commercial and residential wastes generated in a Municipal or Notified Local Body in either solid or semi -solid form excluding industrial hazardous waste but including **properly and fully treated bio-medical waste**

- Defines **“Solid waste"** as solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non-residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, **treated bio-medical waste** excluding industrial waste, biomedical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities mentioned in rule 2;

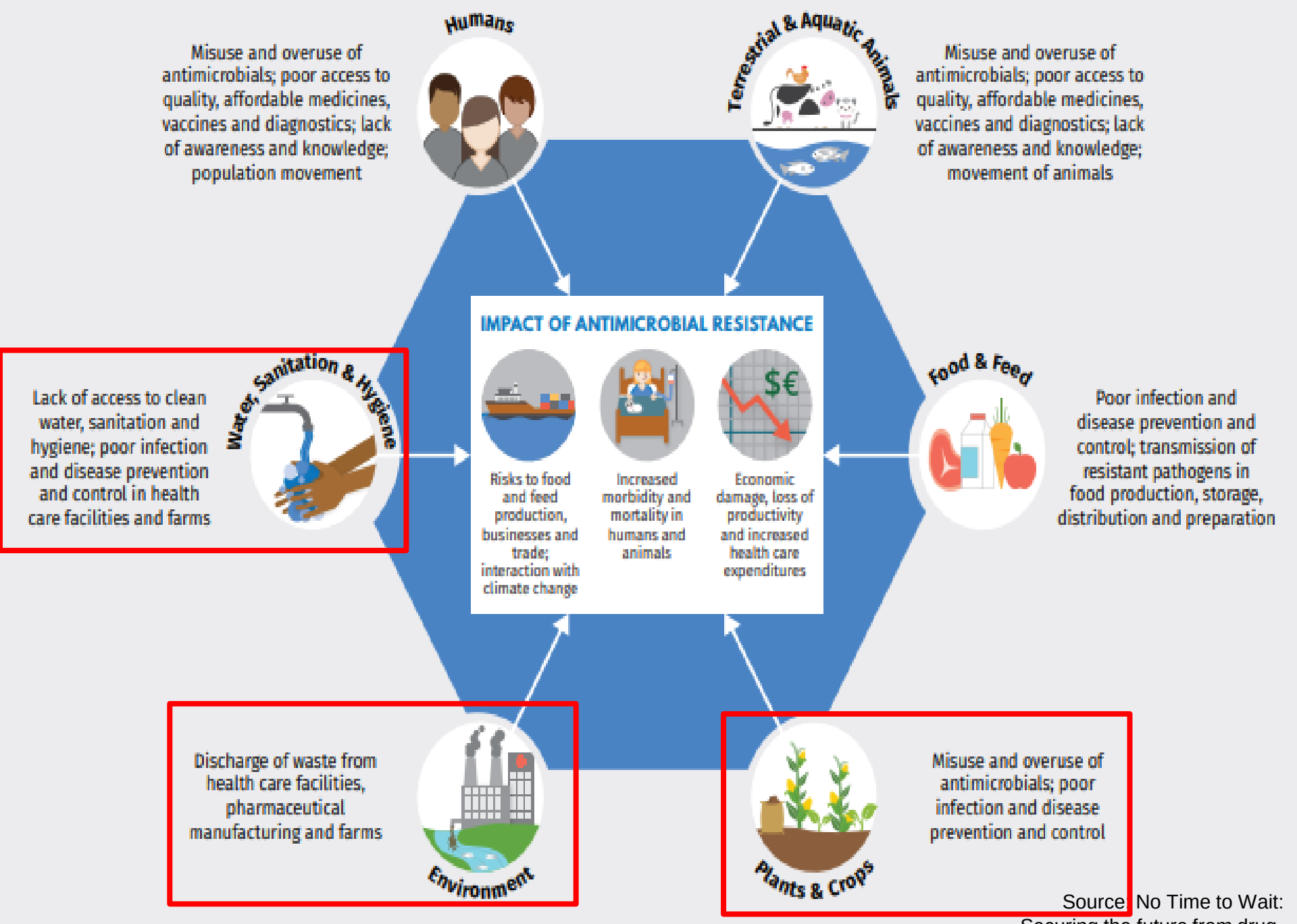
Status in India

No-limited awareness – environmental policymakers and regulators

- **Historic focus** on pesticides, heavy metals etc.
- Understanding **limited to antibiotic residues** in pharma waste –but more as an industrial waste; no standards and monitoring though
- Limited laboratory preparedness on **microbiology-related** aspects

Lack of monitoring

- **No surveillance or monitoring of waste** from pharmaceutical industry, intensive animal farm, hospitals for antibiotic residue or resistant bacteria



Source: No Time to Wait: Securing the future from drug-resistant infections

Growing global momentum on AMR in the environment

From being neglected to an area of key concern!

"Although evidence remains limited, ***concerns are also growing about the impact of antimicrobial resistance on the environment and natural ecosystems due to overuse and discharge of antimicrobials and resistant micro-organisms in manure and waste from health care facilities and pharmaceutical manufacturing, commercial livestock and plant production, and fish and seafood farming****, a problem that may be fuelled by changes in the world's climate"*

"*Many national action plans focus mainly on the health of humans and livestock,* ***paying insufficient attention to plants, food and feed production, waste management and the environment....****"*

No Time to Wait: Securing the future from drug-resistant infections (IACG's final report to the UN Secretary General)