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WHO GUIDELINES FOR SAFE WASTEWATER USE—MORE THAN JUST NUMBERS†

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ABSTRACT

The use of wastewater in agriculture is occurring more frequently because of water scarcity and population growth. Often the poorest households rely on this resource for their livelihood and food security needs. However, there are negative health implications of this practice that need to be addressed. WHO developed *Health Guidelines for the Use of Wastewater in Agriculture and Aquaculture* in 1989. The *Guidelines* are currently being revised based on new data from epidemiological studies, quantitative microbial risk assessments and other relevant information. WHO Guidelines contain both microbial guideline values and good practices to reduce health risks. They must be practical and offer feasible risk management solutions that will minimize health threats and allow for the beneficial use of scarce resources. It is important that the Guidelines are based on actual health risks and an evaluation of what is a tolerable risk. This will vary from country to country. WHO Guidelines, therefore, need to be adapted to the unique social, economic and environmental factors in each situation.

To achieve the greatest impact on health, guidelines should be implemented with other health measures such as: health education, hygiene promotion, provision of adequate drinking water and sanitation, and other measures such as vaccination. Copyright © 2005 John Wiley & Sons, Ltd.

KEY WORDS: agriculture; guidelines; health protection; sanitation; wastewater use/reuse; WHO

RÉSUMÉ

L'utilisation d'eaux usées dans l'agriculture se produit plus fréquemment à l'heure actuelle en raison du manque d'eau et de la croissance démographique. Ce sont souvent les foyers les plus démunis qui dépendent de cette ressource pour leurs moyens d'existence et leurs besoins en sécurité alimentaire. Toutefois, cette pratique présente pour la santé des implications négatives qu'il faut aborder. L'OMS a rédigé des *Directives de santé relatives à l'utilisation des eaux usées dans l'agriculture et l'aquaculture* en 1989. Ces directives sont en ce moment mises à jour à partir de nouvelles données originaires d'études épidémiologiques, d'évaluations quantitatives des risques microbiens et d'autres informations pertinentes. Les directives de l'OMS comportent à la fois des valeurs microbiennes indicatives et des méthodes adéquates pour réduire les risques de santé. Ces directives doivent être pratiques et offrir des solutions faisables de gestion des risques susceptibles de minimiser les menaces pour la santé, tout en tenant compte de la nécessité d'utiliser les ressources rares à bon escient. Il est important que ces directives se basent sur les risques de santé réels et sur une évaluation de ce qu'est un risque tolérable, évaluation qui variera d'un pays à l'autre. C'est pourquoi les directives de l'OMS doivent être adaptées aux facteurs sociaux, économiques et environnementaux uniques à chaque situation.

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Pour obtenir un impact maximum sur la santé, les directives doivent être mises en œuvre avec d'autres mesures de santé telles que: l'éducation à la santé, la promotion de l'hygiène, la fourniture d'eau potable et d'installations sanitaires adéquates, ainsi que d'autres mesures telles que la vaccination. Copyright © 2005 John Wiley & Sons, Ltd.

MOTS CLÉS: agriculture; directives; protection de la santé; installations sanitaires; utilisation/réutilisation des eaux usées; OMS

INTRODUCTION

The importance of increasing access to sanitation for unserved populations has been given renewed emphasis with the adoption by the United Nations General Assembly of the Millennium Development Goals in 2000 and similar International Development Targets developed at the World Summit on Sustainable Development in Johannesburg in 2002. Because much of the future population growth is expected to occur in or around urban centres, increased sanitation coverage will often take the form of sewerage with a subsequent increase in the generation of wastewater. The use of wastewater in agriculture may actually help to prevent some of the downstream health and environmental impacts especially when the alternative is to discharge wastewater (frequently without adequate treatment) directly into surface waters.

The use of wastewater in agriculture is growing due to water scarcity, population growth and the recognition of its resource value. Wastewater can be used to substitute for other better quality water sources, especially in agriculture. However, the uncontrolled use of wastewater in agriculture has important health implications for product consumers, farmers and their families, produce vendors, and communities in wastewater irrigated areas. Negative health impacts from the use of untreated or inadequately treated wastewater have been documented in many studies. Less attention has been paid to the positive health impacts of the use of wastewater in agriculture that may arise because of improved household food security, better nutrition and increased household income.

WHO Guidelines contain both microbial guideline values and good practices to reduce health risks. They offer feasible risk management solutions that will minimize health threats and allow for the beneficial use of scarce resources. The Guidelines are based on actual health risks and an evaluation of what is a tolerable risk. This will vary from country to country. WHO Guidelines are meant to be adapted to the unique social, economic and environmental factors in each situation.

This paper will look at some of the issues surrounding the use of wastewater in agriculture, the history and philosophy of the WHO Guidelines, health issues, risk management strategies, and guideline implementation.

BACKGROUND

At least one-tenth of the world's population is thought to consume foods produced by irrigation with wastewater (Smit and Nasr, 1992). In many countries, wastewater and excreta used in crop production are not adequately treated. It has been estimated that at least 20 million ha in 50 countries are irrigated with raw or partially treated wastewater (van der Hoek, 2004; Hussain *et al.*, 2001). Wastewater and excreta are also used in urban agriculture which often supplies a large proportion of the fresh vegetables sold in many cities, particularly in developing countries. For example in Dakar, Senegal, more than 60% of the vegetables consumed in the city are grown in urban areas using a mixture of groundwater and untreated wastewater (Faruqui *et al.*, 2004).

WHO/UNICEF (2000) estimates the median percentage of wastewater treated by effective treatment plants to be 35% in Asia, 14% in Latin America and the Caribbean, 90% in North America and 66% in Europe. Other figures are even lower: for example, Homsi (2000) estimates that only around 10% of all wastewater in developing countries receives treatment. Given these circumstances, WHO Guidelines must include feasible strategies for maximizing health protection when untreated wastewater is used in agriculture.

The safe use of wastewater and excreta also has social equity issues. A significant percentage of wastewater and excreta use in agriculture occurs at the subsistence level. Wastewater and excreta are often seen as resources which help to improve food security and positively impact household nutrition and, thus, health.

The regulation of water quality for irrigation is of international importance because agricultural products grown with contaminated water may cause health effects at both the local and international levels. International trade in agricultural products across regions is growing. Exports of contaminated fresh produce from different geographical regions can facilitate the spread of both known pathogens and strains with new virulence characteristics into areas where the pathogens are not normally found or have been absent for many years (Beuchat, 1998).

For food exports, it is important that the wastewater is treated to the WHO recommended levels for unrestricted irrigation. This is to ensure that the risks of consuming such food are low for consumers who may not have immunity to locally endemic diseases. For food products to be consumed locally, national authorities may adapt the guideline values to fit their own circumstances.

HISTORY OF WHO GUIDELINES

To protect public health and facilitate the rational use of wastewater and excreta in agriculture and aquaculture WHO developed the document '*Reuse of Effluents: Methods of Wastewater Treatment and Public Health Safeguards*' during the period up to 1973. The first WHO Guidelines (WHO, 1973) were developed in the absence of good epidemiological studies and borrowed essentially a low-risk approach from the USA. The Guidelines specified a low microbial limit (100 coliforms $100\,ml^{-1}$) and gave specific recommendations on treatment (Havelaar *et al.*, 2001).

In the two decades after the initial Guidelines were developed, the use of wastewater in agriculture expanded in many arid and semi-arid countries. Increasing use and the health and safety questions concerning this practice became driving forces for conducting a number of epidemiological studies. A thorough review of epidemiological studies was prepared by Shuval *et al.* (1986). As epidemiological evidence was compiled it became clear that the previous Guidelines needed to be revised. The following issues needed to be considered:

- Current bacterial standards were overly conservative and not based upon actual health risks as determined by epidemiological studies;
- Overly strict standards were impossible to achieve in many situations and were often ignored and
- Guidelines needed to include risk management approaches which would complement available treatment processes or could be used in the absence of wastewater treatment to reduce health risks.

Based upon these considerations the WHO Guidelines were updated in 1989 (WHO, 1989; Mara and Cairncross, 1989). These Guidelines have been very influential and many countries have adopted or adapted them for their wastewater and excreta-use practices. WHO is currently updating the 1989 Guidelines to incorporate new health evidence including risk assessment. The revised Guidelines will include more information about defining tolerable risks to society based upon the actual disease situation in any given country. This will help policy makers to better evaluate the risks in their countries and develop strategies to address the greatest health risks first.

In order to better package the Guidelines for appropriate audiences it was decided to present the Guidelines in three separate volumes: *Guidelines for the Safe Use of Wastewater and Excreta in Aquaculture*; *Guidelines for the Safe Use of Wastewater in Agriculture* and *Guidelines for the Safe Use of Excreta and Grey Water*.

WHO GUIDELINE PHILOSOPHY

WHO Guidelines are based upon best available scientific evidence and broad participation. The Guidelines incorporate a risk–benefit approach and are developed around "good practices". The Guidelines are meant to be adapted to local social, economic and environmental factors. Where the Guidelines relate to technical issues, for example wastewater treatment, technologies that are readily available and achievable (from both technical and economic standpoints), are explicitly noted. Overly strict standards may not be sustainable and, paradoxically, may lead to less health protection because they may be viewed as unachievable under local circumstances and, thus, ignored. The Guidelines therefore strive to maximize overall public health benefits and the beneficial use of scarce resources.