



OLCOTT ORATION 2013

by

Dr. Sunil J. Wimalawansa

MD, PhD, MBA, CCD, CRCP, MACDS, FRCPath, FACP, FACE, FCCP, FRCP, DSc

Professor of Medicine and Endocrinology
U.S.A.

Olcott Memorial Oration–2013

Water Pollution-Associated Ill Health: Special Emphasis on Chronic Kidney Disease in Sri Lanka

by Professor Sunil J. Wimalawansa, MD, PhD, MBA, DSc
United States of America

SUMMARY

Non-communicable chronic diseases are escalating in many developing countries, including Sri Lanka. Over the past 15 years, the author has been involved in studying water contamination issues affecting human health and the consequent escalation of chronic diseases, including chronic kidney disease (CKD) of multi-factorial origin (CKD-mfo). While actively engaged in an informative awareness campaign on prevention of pollution, he and his colleagues were also involved with the provision of clean water to needy villages. The main objective was to prevent the occurrence of new cases of CKD. This oration summarizes the writer's findings and interpretation of the data available to date and actions need to prevent this dangerous epidemic affecting the farming communities and the economy and soon reaching pandemic proportions.

While a number of groups have been investigating this issue over the past five years, there has been considerable confusion and controversy about the investigational methodologies employed, disparities of findings, interpretation of data, and conclusions. Attention has been diverted from serious water pollution issues related to heavy metals, fluoride/hard water, pesticides and chemical fertilizer, to secondary factors, such as algae and poisoning of North Central Province bordering villages by former terrorist groups who previously influenced the area. In fact, none of these mentioned factors at their reported levels of contamination could singly cause renal failure of this magnitude or explain its geographical distribution.

However, little or no attention has been paid to several other plausible causes of nephrotoxicity (toxic agents that can harm kidneys) in the affected areas. These include the overuse of nephrotoxic non-steroidal anti-inflammatory agents (i.e., most painkillers, except paracetamol), the use of illicit drugs and

alcohol, smoking using locally grown tobacco, lack of safe working conditions in the dry zone regions (including drinking lesser amounts of water, but water that contains pollutants), petrochemical contamination of water sources, leptospirosis, and others.

The author concludes that the CKD in the dry zone in Sri Lanka is an “environmental exposure” disease caused by “multiple factors” acting together—thus the terminology CKD-mfo. Nevertheless, the overall situation suggests that the aetiology of CKD-mfo is not that complicated, and the solutions needed are straightforward.

Blue Print: To prevent CKD-mfo, it is essential to take prompt actions to: (a) educate farmers on prevention of water and environmental pollution and taking proper safety precautions when handling agrochemicals and petrochemicals, (b) provide access to clean and safe potable water, and (c) embark on a broad-based, cause-oriented, environmental and sociological research program covering the entire region. In addition to implementing a well-coordinated synergistic plan, to prevent healthy farmers falling victims to renal failure (i.e., acquiring CKD-mfo), premature death, and massive family disruptions, the programme must include all stakeholders to maximize resource utilization, preferably using the philanthropic and private sectors.

PREAMBLE:



This oration is in honour of and dedicated to the vision and far-sightedness of the founder of Ananda College, **Colonel Henry Steele Olcott**. He left behind a legacy of immense accomplishments in many fields, including education, agriculture, law and order, diplomacy, and journalism. He was a great visionary, a philanthropist of the highest de-

gree, who dedicated his entire life to the peace and welfare of his fellow human beings (volunteerism). All this he did for humanity in general and not for personal gain. He set the bar high for all of us by his selfless dedication in the service of humankind.

WATER IS A HUMAN RIGHT:

Accessible and affordable clean water is a fundamental human need and a basic human right. Clean water and sanitation can make or break human development and societal survival. Water is fundamental for all us; our health, capabilities, and what we can become. Next to oxygen, water is the most essential component required for all life on earth. In fact, without clean water, human and animal life is unsustainable. The failure to invest financial and political capital for improving clean water supplies will lead to loss of fundamental opportunities for social and economic progress, and pave the way for disharmony, unhappiness, and loss of productivity.

Access to clean water is also an important indicator of human progress and healthy growth in a country. In fact, life expectancy in any country is directly related to the availability of clean water and safe sanitary facilities, rather than to economic or structural development, or medical or materialistic comforts and advancements. Water polluted with microbes causes noticeable diarrhoeal diseases, whereas chemical and toxin contaminations make people chronically sick and kill them insidiously. Toxic chemicals or disease-causing organisms affecting health are microscopic and can be neither tasted nor smelled. Although people judge the quality of water by taste, odour, and appearance, these three factors provide no information on the health risks that drinking water might portend.

CLEAN WATER TAKEN FOR GRANTED:

Even today, for more than two billion people, clean water is not a readily accessible commodity, even though it is a basic human requirement. Moreover, approximately 2.4 billion people still have no access to proper and safe sanitation; most of the time these two conditions co-exist. In addition to water wars, the global water crisis has led to worsening incidences of diarrhoea and deaths, especially in economically deprived countries. Consequently, close to eight million people, including three million children, die every year of illnesses related to unsafe water and

poor sanitation alone, which is far more than from any other single disease in the world.

There are two kinds of common water contaminations: microbial and chemical toxins. Most people are familiar with sewage and bacterial water pollution leading to dysenteries. Microbial contamination can be purified relatively easily by chemical disinfectants (e.g., chlorine), certain filtration methods, or by boiling, but it is difficult to dispose of chemical pollutants. Considering the massive scale, solving this is not a simple matter: it needs funds but also a humanistic approach, political will and courage, and proper setting of the priorities. To make it sustainable and cost-effective, the water and sanitation crisis must be addressed through private–public partnerships with all stakeholders together, with firm commitment from the government.

Most people, especially in the economically advanced countries, take water for granted: they turn on the tap and the water flows or they purchase dozens of bottles of water from the local supermarket. They forget that 40 to 50 years ago, all these countries were no better than the currently emerging economies. The difference is that leadership in these countries at some point made the right decision to establish purified pipe-borne water supplies and safe sanitation to the majority of their compatriots and initiated enforcement of environmental protection laws. These are the most important factors in improving human health and advancing the longevity of populations in a country. The outcomes on health and longevity from these actions are more powerful than all scientific discoveries and innovations and medical advances combined.

GLOBALIZATION AND PRIVATIZATIONS:

During the past three decades, privatization was widely advocated worldwide as a solution to the failures of the public sector. It was presumed that the private financial capital and the utilities would create efficiency, generate new jobs, and provide greater accountability. However, the expected outcome proved to be otherwise. Private provision did not turn out to be the magic solution in many countries. The expected efficiency, finance, and governance through the private sector at times did not bear fruit. In recent years, many of these privatizations failed miserably, in part because of miscalculations, greed, and corruption.

Meanwhile, the troubles associated with the public sector and in certain cases the private sector, continued. These include inefficiency, lack of accountability, corruption, mishandling of resources, and inequity. In the case of water, low-cost water was diverted to high-income groups, and low-quality service (or no water) was provided to the poor. Lack of water and water-borne diseases mostly affect poorer communities. Thus, worldwide most of the privatized water enterprises that failed led to more suffering of the poor, those with little or no voice. From the perspective of poor village households, the question of the relative virtues of public versus private sector performance has been only a distraction from concerns that are more fundamental: the inequalities and inadequate performance of public and private water supply sectors. Briefly, water is a national resource that should not be privatized in Sri Lanka.

FOLLOW THE MIDDLE PATH:

Any extreme is not only unwise but also unsustainable. High subsidy and the agro advertising encourage farmers to over-use pesticides and chemical fertilizers. Over-use of agrochemicals and environmentally and economically destructive agricultural practices are unsustainable in the long term, as we have witnessed in the North Central Province (NCP) and the NC region (NCR); yet little or no preventative action has been taken. Continuing wilful destruction of the environment further damages the soil and water sources, which will harm the present and future generations. Resolving such complex ethical, social, and cultural issues at an early stage is highly desirable, rather than having to pay millions of rupees in attempts to eliminate the problems once they are well established.

Globalization, tempting advertisements, and rapid technological advances arouse desires, which are unquenchable. The sectarian increase of wealth increases the gap between the poor and the rich and exerts undue pressure on the middle class, which adds to the ever-increasing unhealthful stress levels. These will negatively affect societal harmony and the health and well-being of the population. Moreover, such problems escalate global disturbances and disharmony; add to destructive warfare, economic disruptions, widespread corruption, global warming and major climatic changes; and disrupt the peace and fabric of society.

The above-mentioned are further reasons why we should focus on The Buddha's teachings, particularly staying in the present moment and following

the Middle Path, the path that leads to compassion, sharing, satisfaction, and everlasting happiness. In part, the escalating CKD epidemic is due to greed and a lack of understanding of reality. Buddhist meditation practices and mental training facilitate achieving contentment. Imagine the majority of people in the world practising these, in any mainstream religious doctrine. It would revolutionize the lives on earth today. However, nothing will work unless there is a genuine desire to change our lives by adopting new healthful habits, sharing resources, eating a healthy diet, engaging in physical activities, practising regular meditation, genuinely following the Five Precepts, ridding ourselves of greed and jealousy, and learning to see the world as it is.

MINDFULNESS AND THE GROSS DOMESTIC HAPPINESS:

Sustained happiness is achieved through mindfulness (*samma sati*) and generosity. Mindfulness trains us to become conscious of things, as they really exist. Mindfulness facilitates progressing through self-discipline and mind control—a gentle and gradual process leading to the elimination of attachments, cravings, and suffering. However, a strong determination is needed to overcome the overriding desires and harmful habits—to oneself and toward others. You can protect your health by practicing good habits; but you cannot buy good health.

One cannot purchase happiness or sustainable peace. No one can bestow happiness to you; you must create your own well-being and discover happiness within yourself. Despite the large plots of farmland where you cultivate paddy, you can consume only a plate of rice; of a dozen mansions you may own, you need only one room to sleep in; of several cars you may have, you can drive only one at a time! Thus, when you have just enough food and money to spend, a safe roof to live under, and access to basic human needs, that should satisfy you. Do the farmers in Rajarata have the facilities and comforts that you have? You should consider spending at least part of your remaining time and resources for the benefit of others and supporting those in need. Rational thinking tells us that we do not need to hold on to our greed and the desires to have more and to compete with others to acquire more materialistic wealth. More you give up happier you will be. Giving up comforts (such) will make the mind lighter and happier. It will elevate you from the mundane to the sublime, thus making you god-like (divine).

CHRONIC KIDNEY DISEASE (CKD) IN RAJARATA:

Over the past two decades, the incidence of several chronic non-communicable diseases (NCDs), such as cancer, heart diseases, and CKD, have increased in many developing countries, while the incidence of communicable diseases is decreasing. A high incidence of chronic renal failure (disease) of an unusual nature (CKDu) exists, originating in agricultural communities in several dry zone areas in the world. One specific example is CKD of multifactorial origin (**CKD-mfo**), which is affecting the NCP and other districts in Sri Lanka. However, this condition is not unique to Sri Lanka. The high incidence of CKD-mfo has been reported in several other dry-zonal agricultural societies, as has Balkan nephropathy, Kashin-Beck nephropathy China, La Isla Chichigalpa, and South American CKD of unknown origin (CKDuo).

To date no specific cause is identified for CKD-mfo in Sri Lanka, but a multitude of potential toxic pollutants have been suggested, including heavy metals, cadmium, arsenic and lead; fluoride and hard water; and ionic-concentration of water, chemical fertilizers and toxic agro-chemicals, but the cause of CKD-mfo is not clear. To-date, CKD-mfo is not linked to an incident, event, organism, or component. Data are sufficient only to make hypotheses, not conclusions. It is highly unlikely that a single component is responsible for causing this CKD-mfo epidemic.

THE COURSE OF CKD:

The development of CKD is insidious; by the time it manifests clinically, advanced pathological and irreversible damage has occurred in kidneys. Once the damage is done, it is difficult or impossible to reverse. Dialysis only slows the deterioration and postpones death. Meanwhile, other NCDs, including diabetes, hypertension, and depression, may co-exist with CKD. Because the causes of CKD-mfo are multiple, a “single-cause hypothesis” or research program to “prove” such is unlikely to generate meaningful data or provide useful evidence to curb CKD.

CKD-mfo is most likely due to a combination of factors, and when the right adverse conditions exist, kidney failure occurs. Nevertheless, there are other serious but preventable potential sources prevailing in the region that have not been addressed to date. These include the over-use of non-steroidal

anti-inflammatory analgesic agents, consumption of illegal drugs and alcohol, smoking locally grown tobacco that contain higher amounts of heavy metals, leptospirosis, excessive exposure to petrochemicals, exposure to harsh climatic conditions in the field, chronic dehydration and continually drinking concentrated (in part due to drought) polluted water, at times from the paddy fields. It is most likely that a combination of some of the above-mentioned components is precipitating the CKD-mfo.

GEOGRAPHICAL PATTERNS AND THE VULNERABILITY FOR CKD:

The potential CKD-mfo area covers approximately 20,000 km², with a population of about 2.8 million. However, this vulnerability and associated risks are likely to increase with time in the absence of definitive preventative actions. The accelerated Mahaveli project has led to bypassing the ancient irrigation system with fast-flowing man-made canals that add to soil and ecological erosion, changing the area’s biodiversity and facilitating silting of tanks. This necessitates frequent dredging of reservoirs in the NCR, which allows re-exposure of deeply deposited heavy metals and other contaminants over centuries, and the potential for them to enter into the dynamic water systems; thus, contaminating the human food chain. In the short term, these new developments are profitable, but they have long-term negative environmental consequences and adverse health effects. Similar issues are likely to occur in Southern region.

Water contamination is not new to Sri Lanka. Deforestation of hill country, industrialization and colonization of former forest areas in the NCP for settlements, further add to the environmental stress. Without adequate planning for potable water, drainage, and sanitation, these human settlements would inflict tremendous pressure on the environment and continue to have adverse impacts on freshwater systems and thus on human health. Uncoordinated planning has led to surface and groundwater contamination with nutrients (nitrate/nitrites, phosphates, and organic matter), toxic chemicals, and other unhealthy substances. Unfortunately, this has worsened due to haphazard and overuse of agro-chemical and other pollutants by farmers.

None of the proposed putative substances explains the geographical distribution with the prevalence of CKD-mfo. The closest would be the fluoride. Nev-

ertheless, taken together the geographical distribution of CKD-mfo and CKD deaths suggest that it is a “multi-factorial environmental exposure” disease. Poor farming habits, dehydration, harsh climatic conditions, continually drinking concentrated chemically polluted water, indulgence with anti-inflammatory painkillers, use of illegal alcohol, tobacco use, exposure to agrochemicals and petrochemicals, and leptospirosis; a combination of these can potentially contribute to the epidemic of CKD-mfo. A single factor alone is unlikely to be responsible. Nevertheless, most of the above-mentioned plausible causes for CKD-mfo in Sri Lanka have not been investigated to date.

While arsenic is an ubiquitous air and soil contaminant, groundwater contamination with fluoride and cadmium is less common, as is water hardness. The levels of pollutants in water are small and vary much within a region; a single-cause hypothesis is improbable. Moreover, water quality varies within a few kilometres in any region and from village to village, and the CKD-mfo-affected villages are located alongside non-affected villages within short distances. Considering the mosaic geographical distribution of CKD-mfo, it is likely that the geo-water environment is contributing to the epidemic in Sri Lanka. Whether it is due to natural evolution or fabrication is to be determined. The priority should not be to debate who is right but saving lives.

The prevalence of CKD in Sri Lanka is geographically demarcated but gradually spreading to adjoining areas in NCP and also to distant areas, such as the Badulla and Hambantota districts. Moreover, the distribution of patients with CKD is not uniform—the prevalence is non-contiguous. Most affected are in agricultural areas, in which more than 90% of the population lives in rural communities with little access to modern amenities, safe potable water, sanitation, and medical facilities. This disease and deaths primarily affects young to middle-age male farmers. Thus, already some villages have only a handful of surviving middle-age men.

PRACTICAL WAY FORWARD TO CURB CKD-MFO:

There is no doubt that the provision of centrally purified, pipe-borne water is the best, safest, and most cost-effective solution in the long term. If premature deaths due to CKD continue at the current rate in the NCP, by the year 2040 there will be less than 10% of adult males living in the entire NCP

region. This not only would devastate families but also would markedly change the demographics and adversely affect the country’s rice sufficiency and the economy.

Over the past fourteen years, the author has tried to persuade successive governments to earmark an additional 10% for funding for pipe-borne water-related infrastructure expansion for the NCP and other remote localities; but this plan has not materialized. With the current approximate 1% effort, it may take over 50 years before the Water Supply Board is able to provide pipe-borne water to these regions. Even with the allocation of an extra 10% per year, earmarked funding for infrastructure expansion, it may take 20 to 25 years before most people in the region have access to a centrally purified, pipe-borne, clean water supply. However, by then, we may witness another 200,000 deaths due to CKD-mfo. Even today, a number of families in the NCP have no living adult males in their households because of CKD. Thus, we must provide a sustainable interim solution for providing clean water to the NCP residents.

Delay in implementing a firm solution promotes deaths of farmers and negatively affects the rice production in the region, as happened after the Chola invasion in the same region hundreds of years ago. On the contrary, to some recent stories, the abandonment of Rajarata was not due to failures of the ancient agricultural system, but to the destruction of hundreds of ancient cascade reservoirs by the Chola invaders. This led to an epidemic of mosquito-borne diseases, particularly malaria that forced Rajarata residents to vacate the territory. Unless we take firm actions now, a similar calamity and abandoning Rajarata can happen again due to CKD-mfo. Would the government and the rest of the country continue to be blind to this matter?

Collectively, we failed to implement solutions a decade ago to prevent deaths and the spread of this deadly disaster that is currently wiping out a large number of families and destroying the breadbasket of Sri Lanka. However, using technology we can reverse this trend. In addition to controlling agrochemicals and decreasing agro subsidy, it is necessary to provide region-wide intense education program on prevention of water pollution, and arrange a sustainable and affordable method to provide clean water to affected villages. Postponing taking definitive actions or waiting until a hypothetical “cause” for the CKD-mfo discovered is unconscionable.

Agriculture is a matter of public interest. It is not merely a way of making money by raising crops or merely an industry or a business; it has to be a public function or service performed by farmers to secure a living for themselves, while providing food for the population, caring and using the land responsibly for the national interest. Thus, agriculture should be considered no different from the public services provided by teachers, public servants, or physicians. The government and its institutions, such as the departments and corporations and other entities that are interlinked to agriculture, health, the environment, economy and national development, must take full responsibility not only for agriculture and the environment, but also for the well-being of people and the long-term sustainability of the country's population at large.

WATER SOURCES AND QUALITY:

Drinking water, both tap and bottled, come from rivers, reservoirs, lakes, ponds, streams, springs, and wells. When rainwater and surface water travel over the ground, it collects contaminants, including naturally occurring substances such as minerals as well as manmade contaminants such as agro- and petro-chemicals, household and commercial disposals, and human and animal waste. Consequently, all drinking water sources contain certain amounts of contaminants. At low concentrations, these contaminants do not harm living beings. Environmental protection agencies of each country provide standards and regulate the amounts of contaminants allowable in drinking water. These standards must be strictly adhered to and apply equally to the NCP and all affected areas, as well as across the country.

Inorganic contaminants, including heavy metals occur naturally and because of storm-water runoffs, industrial or domestic wastewater discharges, gas and oil production, mining, or farming. Pesticides, herbicides, and other toxic components come from a variety of sources, including agriculture, urban storm-water runoff, and residential waste. Additional contaminants include organic chemicals, factory discharges, by-products of industrial processing and petroleum production, gasoline waste from vehicles and stations, radioactive contaminants, urban storm-water runoff, and septic tank systems. The inadequacy in environmental pollution control and virtual lack of implementing existing laws add to the problem.

LONG-TERM STRATEGIES AND ENVIRONMENTALLY FRIENDLY AGRICULTURAL METHODS:

In parallel to the above-mentioned preventative strategies, agricultural research programs should focus on generating naturally pest-resistant, high-yielding seed varieties and ones that thrive on compost and other natural fertilizing methods. In addition, the government needs to embark on reconstructing the thousands of abandoned or partially used cascade tanks and ancient irrigation systems, restoring the natural environment, preventing growth of mosquitoes and other harmful pests, encouraging farmers to use natural methods and the minimum necessary use of agrochemicals, introducing environmentally friendly agricultural methods, minimizing environment pollution, and encouraging soil and water conservation. All these must be a part of the long-term strategy to improve the health, wealth, well-being, and prosperity of the nation (food + agriculture + clean water + healthy environment = Health). Water and clean environment are national treasures; thus, everyone has the responsibility to protect them.

Currently, contribution from the farmers' to agriculture and the economy is much more than the recent economy generated through highly visible infrastructure developments. Yet the distribution channels for their products have not adequately attended to nor improved. It is important that farmers are provided with the right value for their products; it will stimulate spending and the growth (GDP), thus enhancing the economy. It would also decrease the pressure on farmers to produce more by over-use of agro-chemicals and polluting the environment.

THE PRACTICAL WAY FORWARD:

The Preventive Health, Environmental Protection and Research Organization (PHEPRO), that consists of expatriate organizations and local organizations is set up to maximize utilization of human and material resources, raise funds, and implement a broader project to help NCP residents. Such a unified organization would bring expertise and resources of expatriate and local groups and resources together, facilitate and coordinate actions on a clear path to implement an awareness program and provide safe and clean drinking water to all affected areas and neighbouring villages.

Moreover, this would avoid duplications, focus on the matter at hand, and truly offer a multi-disciplinary approach on key issues for the villagers and minimize incidence of CKD-mfo and prevent CKD-deaths. PHEPRO will synergize the working process; bring expertise and resources to help those who are in need in Rajarata and elsewhere in the country. Contingent upon funding, PHEPRO will coordinate systematically the implementation of the programs of public education and effectively provide clean water to all affected regions, as per the set goals.

In addition to multi-disciplinary research program, this practical model provides the opportunity for thousands of concerned expatriates to adopt villages and to contribute in a meaningful way to prevent farmers succumbing to CKD-mfo. When funds are available, clean water is provided to the all affected region within two years. Once the proposal is implemented fully, it will stop or at least markedly decrease the incidence of CKD-mfo in farmers (i.e., new patients acquiring CKD-mfo) within the next five years. That will give an adequate breathing space for the national Water Supply Board to place necessary infrastructure to provide pipe-borne water supplies to the region: the focus of the Water Board (i.e., a sustainable long-term solution).

PROVISION OF CLEAN WATER:

In addition to the provision of clean water, it is essential to train all farmers the correct and safe ways to use pesticides, herbicides and fertilizer and take precautions on preventing exposure to concentrated doses of these chemicals. Good habits such as correct disposal of used utensils, the use of protective gear, and the use only of manufacturer recommended levels of chemicals, encouraged not to use waterways to clean tractors and other petrochemical-driven agricultural equipment, and enforcement to stop it. In parallel, it is necessary to provide a disincentive to prevent farmers' over-using agrochemicals by gradual removal of the agrochemical subsidies.

In contrast to the modern farming methods, traditional farming used little toxic chemicals, and most materials were recycled, thus enriching the environment. The country must start bridging the gap between modern and traditional agricultural methods; they can go hand in hand. Agriculture must encompass a clear and unquestionable public interest and move toward the goals of sustainability, promoting

public health, and self-sufficiency. We need a new vision of culturally and economically acceptable and environmentally sustainable agriculture methods.

WATER PURIFICATION:

None of the domestic water purification units currently sold in Sri Lanka are efficient in removing all potential contaminants to a meaningful level; thus, they have no place in preventing CKD-mfo in Sri Lanka. Over the past three years, the experiments conducted by the author in his laboratory using these filters failed to confirm filter efficiency in removal of potential pollutants. A new, sustainable, reliable, and scalable water purification and supply method is necessary. One such method is reverse osmosis (RO).

REVERSE OSMOSIS TECHNOLOGY:

Reverse osmosis is a widely used mechanical water purification method. By applying hydraulic pressure to the polluted side of compartmentalized water, clean water is forced through a fine membrane. The process also removes soluble compounds and all particulate matter, including salt, heavy metals, fluoride, and agrochemicals from brackish water. Reverse osmosis is used in multiple industries, including recycling, hospitals, wastewater treatment, and the milk, food, and beverage industries. With well-calibrated and properly selected membranes, stand-alone RO systems generate continuous clean and pure water with little running costs for long periods.

However, no two RO systems sold are alike in quality. The quality of RO system membranes varies a lot. Selection of the right RO unit depends on a number of factors, including the quality of contaminated water, its hardness, and the amounts of total dissolved solids (TDS), ionocity, oxidising components, chloride, conductivity, water temperature, the pH, and the volume demand for clean water. Therefore, to be successful in providing clean water and for the durability of the RO membranes (the most expensive part of an RO unit), it is critical to maintain it properly, identify the right RO separation membrane and correct pre-filters for a given village.

The RO plants need electricity to run their pumps, powered from either grid-based electricity or solar energy. RO technology is the most efficient, cost-effective, and practical way to remove all potential

water contaminants and thus is the best interim solution to provide clean water to communities in Rajarata in a sustainable and affordable manner. None of the current filtration processes removes all potential water contaminants. In the absence of the provision of clean water, the incidences of CKD will continue to increase. Despite the relatively high initial capital costs of RO units, they would provide affordable clean water in a sustainable way for ~25 years. Provision of clean water would prevent CKD-mfo and premature deaths and mandate the Water Supply Board to provide pipe-borne water to the entire NCP and other regions.

PRACTICAL WAY FORWARD TO CURB CKD-MFO:

There is no doubt that the provision of centrally purified pipe-borne water by the Water Board or by the private sector is the best solution for the affected regions in Sri Lanka. Depending on the governmental fund allocation and the efficiency of construction, it may take three decades or more for such to materialize. The above-mentioned is achievable in the near future, if the government earmarks an additional 10% (or more) per year for the national water and drainage budget, specifically dedicated for infrastructure development for this region. The supply of bottled water or daily transportation of water via bowsers, as currently practice, are two of the most expensive, environmentally unfriendly, and unsustainable remedies for providing water to any given community and thus, should not be encouraged or pursued.

A unified organization like PHEPRO would bring expertise, expatriates, and interested local groups and resources together to facilitate and coordinate actions on a clear path, including awareness programs, the provision of safe, clean drinking water to affected areas and neighbouring villages will and conduct a long-term, multi-disciplinary research program. It would avoid wasteful duplication, and synergize expertise and resources to help those in need.

This simple and practical model will provide the opportunity for thousands of expatriates and well-wishers worldwide to contribute compassionately in tangible way to help overcome CKD-mfo in Sri Lanka. PHEPRO will lead to measureable, tangible, and beneficial outcomes within the next seven years, while waiting the Water Board to provide pipe-borne water supply.

WHAT IS MISSING?

Public spending has a central role in financing the extension of water systems to poor households. Currently, there are few public-private partnerships to overcome the CKD issue or to improve any healthcare delivery in Sri Lanka. Urgent and a fundamental attention are needed in this neglected area to synergise the efforts and to maximize utilization of resources. The potential role for cross-subsidies and transfer from higher-income to lower-income users in utility pricing is worth exploring. The adaptive systems need customizing for the country and for a given community. High-priced water is not in the interest of public health.

Pure water is in abundance, but it must be made available at a price within the reach of all. Core attributes of water security, sufficiency, safety, acceptability, accessibility, and affordability should recognize when providing domestic water supply and must be addressed in all districts, regardless of whether they are urban or remotely located communities in the country. The water-sanitation disconnect delays the progress of a society. Therefore, sanitation and sanitary practices must given attention in parallel. It is not possible to sustain one without attending to the other. In addition, we need to incorporate a broad-based, environmental (soil-water-air) and socio-economic research program covering the area affected by CKD-mfo. Such a program is likely to reveal various ways of how we can prevent a similar calamity in the future.

CONCLUSIONS:

Water security has become a global threat, especially with the on-going unprecedented climatic changes and its environmental impacts, including on potable water. Cycles of flooding and droughts, rising sea levels and frequent storms, hurricanes and typhoons, together with over-population in certain areas add to water contamination, sanitary issues, and water security.

Provision of access to clean water is one of the greatest challenges facing most of the economically disadvantaged countries in this millennium. Water insecurity leads not only to poverty and sickness but also to water wars. The implementation of the new millennium goals and the Universal Declaration of Human Rights include, among others, the provision of clean water. Yet the progress around the world is too slow and inadequate. Consequent-

ly, one fourth of the world's population has no access to this vital life-saving commodity.

Many are still unaware that over a third of the water-related deaths are due to non-bacterial water pollution: consumption of water contaminated with chemicals and toxins. These chemicals and toxic agents enter the human body through oral, inhalational routes, or via the skin, and exert negative effects on all organ systems, including the kidneys. Unfortunately, exposure to toxic agents in the natural and occupational environments has become a common occurrence. Ingestion of heavy metals, such as lead, cadmium, arsenic, and fluoride, and agro-chemicals, such as pesticides, herbicides, and fungicides, increases the morbidity and mortality of the exposed individuals. Such contaminations lead to many chronic diseases, including CKD, liver disease, cardiovascular diseases, infertility, developmental disorders, and brain disorders.

Access to potable drinking water has a profound impact on controlling water-borne pathogens and toxins and chemical-induced morbidity and mortality; these are preventable causes of deaths. These include diarrhoea and dysentery, and chemical-induced ailments, especially in the vulnerable groups. No intervention has greater overall impact on national development and public health than the provision of safe drinking water and the proper disposal of human waste.

There are increasing concerns about the health impacts of climate changes, water and air pollution, global warming, and ecosystem degradation. Over-utilization of the finite reserves of non-renewable energy, and the accumulation of waste, and the misuse of water resources further compromise the availability of potable water. While conventional wisdom is good, conventional thinking may not be healthy or even appropriate, especially in times of crisis. New paradigms should explore on adapting to changing situations and prompt actions to be taken.

To be successful, no matter what profession or industry you are in, education and skills training are needed to develop with an inquisitive mind; these are encouraged in Buddhist teachings. A system of integration of skills for innovations and inventions coupled with ethical leadership possessing product/services management skills are imperative in generating new inventions. The great volunteer, Colonel Henry Steele Olcott was endowed with all these great qualities. These are applicable whether you are in education, services, production, or in sales.

Col. Olcott was a broad-minded practical man, an expert in agriculture. If he were alive today, he would recommend a similar plan indicated above to overcome the CKD-mfo affecting Rajarata.

HOW CAN YOU BE A PART OF THE SOLUTION? PLEASE JOIN US FOR

- A) Island-wide campaign on prevention of water contamination and environmental pollution.
- B) Provision of clean and safe water using RO systems to all CKD-affected villages in Hela.
- C) Broad-based environmental and socio-economic research program in CKD affected areas.
- D) Taking part in raising funds and developing collaborations and partnerships with non-profits and the private sectors to implement the project and achieve its longer-term goals in NCR.

Once funds are available, PHEPRO will install RO plants within 18 to 24 months to provide clean water to all affected villages in the NCP. In addition to providing clean water, the project should embrace provision of toilet facilities. **We look forward to meaningful discussions, undertaking firm commitments by you and the government, leading to sustainable action.**

Let us all join hands, the learned and the not so learned, the mighty and the meek, the rich and the poor, the Buddhist and the Christian, the Muslim and the Hindu to safeguard Hela, our only Homeland. The land you love and cherish, the land you value most, in order that we all live and let live. So that we are able to leave a better world for generations of our descendants!



WIMALAWANSA
FOUNDATION
Opening Doors for Healthier Life

www.wimalawansa.org