GWES
Groundwater for Emergency Situations

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IHP VI – Theme 2, Focal Area 2.2

Identification and management of strategic groundwater bodies to be used for emergency situations as a result of extreme hydrological events and in case of conflicts
Groundwater – important component of IHP-VI

**ISARM** - Internationally Shared Aquifer Resources Management

**WHYMAP** - World Hydrogeological Map

**IGRAC** – International Groundwater Assessment Centre

**WWAP** – World Water Assessment Programme
Groundwater since earlies history have played a fundamental role in human settlement and social development. Groundwater storage is vast - about 98% of global freshwater reserves.

Today a global withdrawal of 600 – 700 km³/year makes groundwater the world’s most extracted raw material. Worldwide some 2 billion people depend on groundwater for their drinking water supply.

In India, groundwater supplies about 80% of rural population, 224 km³/year are estimated to be pumped for irrigation and 70% of national agricultural production is supported by groundwater (Burke And Moench, 2000).
In nature groundwater is a key element in many geological and hydrogeological processes, geotechnical factor conditioning soil and rock behaviour and a component which sustains spring discharge, river base-flow and many lakes and wetlands.

Groundwater use increased significantly from the 1950s due to its widespread occurrence, high reliability during drought seasons, mostly good quality, advances in hydrogeological knowledge and drilling and pump technologies and generally modest development costs.
Groundwater sustainable development and environmentally sound protection

Sustainable groundwater resources development and environmentally sound protection is a complex process, which solution is closely linked to the holistic integrated approach in surface and groundwater planning, policy and management, is influenced by social and economic constraints and should be attentive to ethical, cultural and historical traditions of the society.

The main objective of this process is to ensure quantity, quality, safety and sustainability of groundwater as a 1) strategic source for life (for drinking and other sanitary purposes) and economic development, and 2) important component for the ecosystems.
Groundwater quality degradation

Groundwater is less vulnerable to human impacts than surface water. However, when become polluted, the remediation process is costly, long-term and technically demanding task, because includes also clean up of soil and rock environment in which groundwater is moving.

Earlier, little attention was given to the protection of groundwater quality. The idea that groundwater is well protected by geological environment and therefore not vulnerable to human impacts prevailed for a very long time and had serious and long-term consequences on many countries‘ groundwater quality.
Groundwater, a renewable and finite natural resource

Groundwater is mostly a renewable finite natural resource and strategic resource in case of failure of other water resources during droughts, pollution accidents, breakdowns of surface water supply systems during floods and other catastrophic events.

Groundwater renewability have to be considered with respect to the relation between its recharge and discharge and its residence time in aquifers.
The aim of the GWES

Climatic (floods, droughts), geological hazards (earthquakes, landslides) and human impacts in many parts of our planet often resulted in serious problems in public drinking water supplies, which usually collapsed and had to be substituted by import of water in bottles and tanks to prevent epidemic diseases. Apart from rescuing of the endangered population, the distribution of drinking water become most important among the emergency activities. The aim of the GWES is to consider in advance natural and man-induced catastrophic events that could adversely affected human health and life or have serious influence on the environment. This results in a special approach to the development of low vulnerable groundwater resources in many affected regions.
Management of strategic groundwater bodies to be used for emergency situations

To eliminate the dependence of population on vulnerable water supply systems during climatic or geological hazards, resistent low vulnerable groundwater resources protected from the earth surface and with a long residence time should be identified, evaluated and developed.

They should temporally substitute the standard drinking water supplies before they are restored to normal operation and quality and eliminate the consequences for the time after the catastrophic events,
The methodology of the GWES project will be based on evaluation of vulnerability and resistance of the available groundwater resources against external interference into their regime.

Vulnerability is an intrinsic property of a groundwater system that depends on the sensitivity of that system to human and/or natural impacts.

Two aspects of the groundwater vulnerability should be jointly considered:
- the hydrogeological structure and its piezometric system
- the groundwater residence time (groundwater age)
Hydrogeological structure

There are generally two types of hydrogeological structures:
- structure with active groundwater circulation
- structure with groundwater stagnation

In case of groundwater for emergency situations and in the case of groundwater resources in arid regions, we have to keep in mind deeper confined aquifers with low circulated or stagnating groundwater. Groundwater circulation should be considered in relationship to the time.
Groundwater dating and isotope hydrology will be important working methods at GWES project implementation. Isotope hydrology is an efficient tool for determining the time of origin of groundwater in the geological past and the climatic and hydrological circumstances of that origin by using isotope techniques.

Tritium and radiocarbon dating of groundwater have become almost routine techniques throughout the world. The other methods have not become widespread in hydrological practice due to necessity of processing large volumes of water and due to the special analytical approaches required.
Fossil and recent groundwater

The groundwater which originated in the geological past and which has not participated in the hydrological cycle during recent geological periods is called *fossil or non-renewable*. Recent groundwater has been part of the present hydrological cycle which begun at the beginning of the Holocene. The term *modern* groundwater is used for water which contains modern radionuclides above the natural standards, originating after 1950 (explosion of nuclear weapons). The oldest water, most suitable strategic and safe source of drinking water, has been identified in the deeper confined aquifers in sedimentary basins, whereas faster circulation of younger groundwater prevails at their margines and/or in their dissected and uplifted parts and in shallow vulnerable aquifers.
GWES support to the Integrated Management of Transboundary Aquifers

GWES in cooperation with ISARM will be also focused on potential conflicting issues, because many of large aquifers (e.g. Guarani, Nubian) and hundreds of smaller aquifers are shared by two or more countries. The growing demand for fresh water resources and water pollution problems both increase the risk of future international groundwater conflicts.

Integrated and holistic transboundary aquifers management policies are constrained by groundwater data scarcity and the gaps in relevant international legislation.
Objectives of the GWES project

- to elaborate effective methodologies for determining strategic groundwater resources safe against extreme and catastrophic events
- to introduce suitable geological, hydrogeological, geophysical and isotope-hydrological techniques into the investigation of such groundwater resources
- to elaborate an inventory of resistant aquifers in selected pilot regions and present case studies of the participating countries
- to elaborate and publish a guide for identification, investigation, development and management of strategic groundwater bodies to be used for emergency situations
The pilot areas should have a hydrogeological and isotope-hydrological data from which groundwater system could be defined and should be located in different geographical and hydrogeological regions where the disasters frequently repeat and/or where experience from the past is registered.

With respect to the hydrogeological data cooperation of National Geological and Groundwater Database and IGRAC is expected, like IAEA cooperation in case of isotope-hydrological data.
GWES - Activity modul, Product, Timetable

• International working group formed by UNESCO and IAEA representatives and experts from different regions of the world
• International seminars and workshops in cooperation with UNESCO Regional Offices – OAS, ESCAP, OSS, SADC – cooperation with PWRI and planned International Centre for Water Hazards and Risk Management in Japan will be also established
• Methodological guidelines based on case studies and workshops proceedings
• GWES project duration will be from 2003 to 2007