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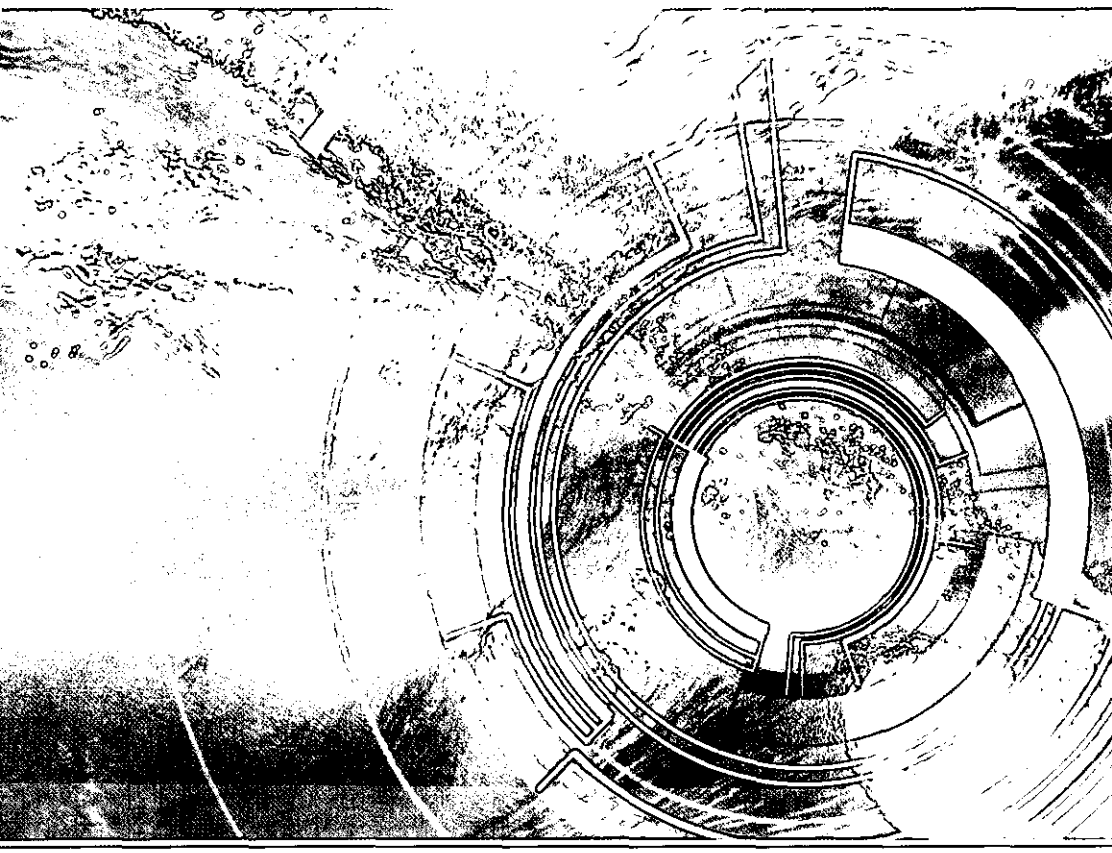
Identification, assessment and prioritization of Pollution Hot Spots



UNIDO Methodology

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Identification, assessment and prioritisation of Pollution Hot Spots

UNIDO METHODOLOGY

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FOREWORD

In the Millennium Declaration of 2000, the UN General Assembly asserted that current unsustainable patterns of production and consumption had to be changed, and that no effort should be spared to free all of humanity, particularly future generations, from the threat of living on a planet irredeemably spoilt by human activities, and whose resources would no longer be sufficient for their needs. They codified this in the Seventh Millennium Development Goal of Ensuring Environmental Sustainability.

In their Plan of Implementation, the delegates to the World Summit on Sustainable Development of 2002 reaffirmed the necessity for sustainable patterns of consumption and production, calling inter alia for an enhancement of industrial productivity and competitiveness as well as an intensification of efforts in cleaner production and the transfer of environmentally sound technologies.

The UNIDO Corporate Strategy responds to these challenges, affirming that for development to be sustainable environmental concerns must be systematically incorporated into the paradigms of economic development. This way the achievement of high levels of productivity in the use of natural resources becomes a central concern both in the developing countries as well as in the advanced industrial nations. As stated in the Strategy, "in the process of industrialization there has to be a shift from end-of-pipe pollution control to the use of new and advanced technologies which are more efficient in the use of energy and materials and produce less pollution and waste; and finally to the adoption of fundamental changes in both production design and technology represented by the concept of 'natural capitalism' and the 'cradle-to-cradle' approach."

This Series on Productivity, Viability and Improved Environmental Performance has been conceived as one of UNIDO's tools to promote the message that increased levels of productivity by enterprises in their use of natural resources enhances their environmental performance while assuring them a greater viability when affronting the challenges of the future. Through the experience gained in the Dnieper River Basin, this volume "Identification, Assessment and Pioritization of Pollution Hot Spots" provides a methodology for the identification, asessment and prioritization of

the most significant sources of industrial pollution based on their impacts and characteristics. These sources of pollution, also known as "pollution hot spots", include point sources such as industrial and municipal effluents and non-point sources such as agricultural and urban run off. Each contributes to human health risk and environmental degradation including significant impacts to environmentally sensitive areas where biodiversity is threatened.

CARLOS MAGARIÑOS
Director General

ACKNOWLEDGEMENTS

At the outset the authors would like to thank the Global Environment Facility (GEF) as the main source of project funding and the numerous distinguished individuals and organisations that contributed to the success of this publication. The project owes its success primarily to the GEF/UNDP Project Management Unit and particularly to its Director Mr. L. Markevych and Deputy-Director Mr. V. Belokon. The valuable inputs towards Hot Spots deliberations were contributed by the International Research and Development Centre and its Director Mr. M. Lahola.

Special acknowledgements to the "SNC Lavalin" company that helped UNIDO in working out the original methodological basis for Hot Spots identification while extending its gratitude to the Team Leader (technical advisor) Mr. John Payne and the Team Member, Mr. E. Dobrowolski as well as to the rest of the team. The Governments of Belarus, Russia and Ukraine have provided their invaluable contributions for refining and application of the concept.

The United Nations Development Programme (UNDP) contributed to the project success in providing the necessary coordination for the project activities.

The authors also convey their special appreciation to the national coordinators Mr. N.Tsygankov (Belarus), Mr. E. Resnik (Russia) and Mr. K. Sereda (Ukraine). The UNIDO project coordinator in the field Mr. A. Galyapa provided excellent and outstanding services in supporting the exchange of information, organizing, including coordinating the work of international and national stakeholders.

The project could not have succeeded without the conscientious work of company representatives and national consultants. Gratitude is expressed to Mr. Z. Csizer, Special Advisor to the UNIDO Managing Director of Programme Development and Technical Cooperation Division (PTC), Mr. P. Huidobro, UNIDO Senior Technical Adviser and Ms. R. De-Palma UNIDO consultant, who provided useful technical and editorial inputs towards the early drafts of this publication.

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1.0 INTRODUCTION

1.1 OBJECTIVE

The Methodology for Hot Spots evaluation was developed within the framework of the GEF (Global Environmental Facility) regional project "Preparation of a Strategic Action Programme (SAP) for the Dnieper River Basin and Development of SAP Implementation Mechanisms". The objective of the Strategic Action Plan programme is to facilitate the reduction of pollution in the transboundary Dnieper River Basin and ultimately to contribute to the protection of regional and international waters, namely the Black Sea.

Similar to most river basins in populated areas of the world, there are thousands of pollution sources in the Dnieper River Basin. The objective of this document is to provide a methodology for the identification, asessment and prioritization of the most significant sources of pollution based on their impacts and characteristics. These sources of pollution, known hereafter as "pollution hot spots" (Hot Spots), include point sources such as industrial and municipal effluents and non-point sources such as agricultural and urban run off. Each contributes to human health risk and environmental degradation including significant impacts to environmentally sensitive areas where biodiversity is threatened.

1.2 APPROACH

As there are thousands of potential and known Hot Spots in the basin, it is proposed to use a multi-stage screening system to identify priority Hot Spots in an efficient and timely manner. The initial stages of screening will be simple, easy to use and broad in its application. As the number of potential Hot Spots is reduced, the level of detail for which they are assessed increases, providing a more detailed, comparative analysis.

Using the proposed methodology and the approach, UNIDO is to identify and confirm major sources of pollution, examine the environmental effects of contaminant loading and facilitate the implementation of Strategic Action Programmes for all three Dnieper River nations, providing an administrative framework for implementing practical and cost-effective solutions.

2.0 HOT SPOT DEFINITION

2.0 HOT SPOT DEFINITION

There is no universally accepted definition for the "hot spot" (Hot Spot) concept. The Dnieper Basin Environment Programme defines Hot Spots as:

- Point source of pollution/contamination
- Non-point source of pollution/contamination
- Biodiversity sensitive areas
- Areas with human health risks
- Areas with environmental degradation

In order to develop a systematic and accurate approach addressing the large number of potential Hot Spots to be identified and assessed, a more precise and detailed definition is required.
It is accepted that for the purpose of this project, a Hot Spot be restricted to a sources of pollution/contamination only. Sources of pollution/contamination (Hot Spots) that can be characterized quantitatively will be assessed and prioritized using the proposed Methodology. Those identified sources of pollution/contamination that cannot not be characterized quantitatively will be qualitatively described in the National Pollution Reduction Reports/National Reviews. Hence Hot Spots fall under two distinct categories: Hot Spots subject to scoring, and Hot Spots subject to qualitative description.

The following clarifies what is included under the Hot Spot definition for this project and what is not included.

What is included under Hot Spot definition

Hot Spots subject to scoring

It is accepted that Hot Spots be restricted primarily to sources that introduce pollution directly to the surface waters of the Dnieper River Basin (i.e. 'direct dischargers', through sewer outfalls (sanitary, process and stormwater). Sources of pollution that introduce pollution indirectly (i.e. 'indirect dischargers'), by filtration of contaminated groundwater or leachate to sur-

face water bodies (e.g. landfills) or through deposition of contaminated media through other pathways (such as air emissions) should only be considered if their impacts are proven to be as significant in scale and effect as direct dischargers, and that the pollution source is quantifiable (e.g. flow, concentration and loading).

Direct dischargers include municipal and industrial wastewater treatment plants, industrial complexes, manufacturing plants, mineral and resource extraction centres, centres of large-scale livestock rearing and areas of high population density (towns and cities). Sources of pollution of this type are typically characterized by availability of data, which can be used for their quantitative description and assessment. These identified sources of pollution (Hot Spots) will be assessed and scored using the proposed Methodology.

Hot Spots subject to scoring typically are the point sources of pollution/contamination. Non-point (diffuse) sources of pollution/contamination such as large farms, contaminated farming and industrial areas, military bases, etc., may also be considered as Hot Spots subject to scoring, if they can be "equated" to point sources with the availability of data sufficient to proceed them through the scoring process.

Hot Spots subject to qualitative description

National Experts can also identify, using their professional judgment, particular sources of substantial pollution/contamination that for different reasons may not have sufficient data to characterize them quantitatively (for scoring). Sources of pollution (Hot Spots) of this type will be qualitatively described in the National Pollution Reduction Reports/National Reviews.

Typical examples of this type of pollution sources include landfills or areas with environmental degradation such as many military bases, large tailing ponds or drained peatlands, that are very extensive and thus difficult to quantitatively characterize. These Hot Spots will not be scored, but described in the National Pollution Reduction Reports qualitatively.

Other examples of Hot Spots subject to qualitative description are features with significant risk (potential for significant impacts), that cannot be considered as active Hot Spots, for example:
Petroleum tank farms and pipelines;

- Water transportation: i.e. barges carrying dangerous substances (e.g. fuels, chemicals);
- Tailing ponds and reservoirs located on or near of the Dnieper River banks or its tributaries with water levels higher than in the river;
- Non-operational facilities: historical discharges, decommissioned or closed facilities (unless they have active effluent discharges)

These features will also be identified by National Experts of each country, using their professional judgment, and described qualitatively in the National Pollution Reduction Reports.

What is not included under Hot Spots definition

It is fully acknowledged that biodiversity sensitive areas are important features that need attention in the study, however, they are receptors of pollution, not sources of pollution. As such, biodiversity sensitive areas should not be considered Hot Spots. Instead they should be considered useful factors in the prioritization of the Hot Spots. From this perspective, it is proposed that the following areas should be considered "Biodiversity Sensitive Areas" representing potential receptors only:

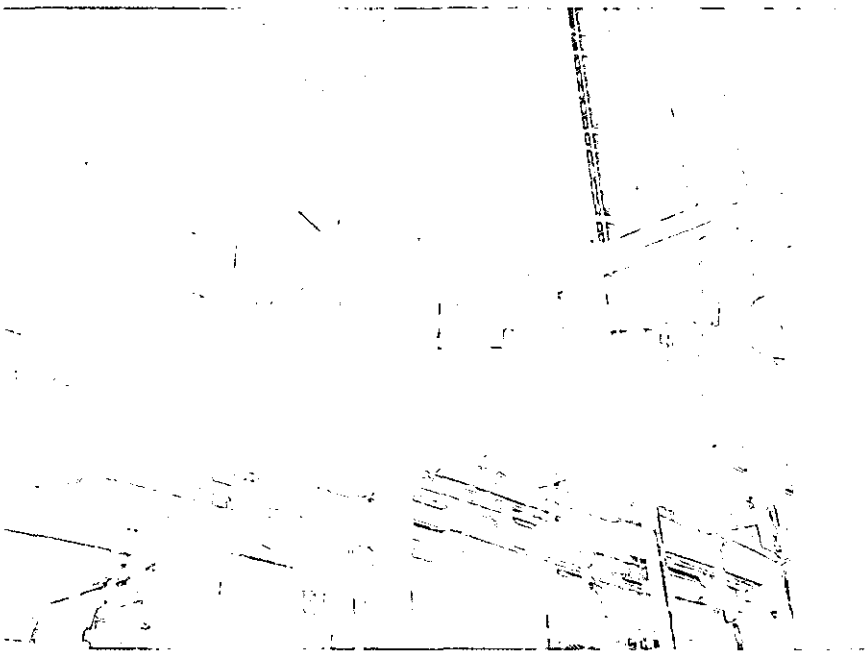
- Wildlife Preserves (areas designated for Environmental Protection);
- Areas with significant habitats (wetlands and terrestrial habitat areas);
- Significant ecosystems, species complexes in need of conservation (e.g., spawning, migration, or staging areas).

Additional categories of biodiversity sensitive areas can be added to the methodology .
Other important receptors include drinking water treatment plants and industrial water intakes whose source waters are from rivers in the basin, recreational areas and commercial fisheries.

Another proposed restriction on the definition of Hot Spots are activities with significant impacts. These include activities or features whose potential mitigation measures mainly include additional legislation, institutional strengthening, changes in practices, training and education. While these measures may be important for any mitigation, if they comprise the measures exclusively, they will not be perceived as 'bankable'. Examples of these activities may include the following:

- Riverbank modifications: habitat loss;
- Farming (crops): soil erosion, run-off contaminated with fertilizers, pesticides;
- Forestry: soil erosion, run-off shock;
- Construction: soil erosion.

3.0 METHODOLOGY



3.1 Summary of Approach

The proposed methodology offers a formal, systematic approach to addressing the large number of potential Hot Spots using as a case the Dnieper River Basin and recognizing the short period of time available to the National Experts to complete their tasks. The approach is iterative in that rules can be readily modified to ultimately obtain a manageable number of Hot Spots for detailed evaluation.

Five steps are proposed:

Step 1	Identification and Preliminary Screening of Hot Spots
Step 2	Detailed Evaluation of Hot Spots (passing Preliminary Screening)
Step 3	Prioritization of Hot Spots
Step 4	Identification of Mitigation Measures and Associated Costs
Step 5	Reporting

Each step is briefly described in the following sections.

3.2 Step 1: Identification and Preliminary Screening of Hot Spots

For each country, the National Hot Spots Experts (NHSE) will compile a list of Hot Spots based on the guidance provided by the definition. The Hot Spots will be selected from information available in records of each country and from the knowledge and experience of the NHSE.

Decreasing the number of Hot Spots to a more manageable number to scrutinize with some depth is important given the limited time frame and resources available to the project. For the purpose of this document, the following number of Hot Spots are proposed for each country:

- Belarus: 50 to 100 Hot Spots
- Russia: 50 to 100 Hot Spots
- Ukraine: 100 to 200 Hot Spots

Ukraine's larger number of Hot Spots reflects their greater portion of the basin in terms of industry, population and land area. We propose to use

both numerical criteria (such as contaminant loadings released from the Hot Spot) and the knowledge of NHSE to screen the Hot Spots and arrive at a manageable number for in-depth assessment. Numerical criteria can be adjusted to arrive at the appropriate number and can be selected to correspond with data used in each country according to format and availability. The parameters used as indicators will be selected based on their availability. For example, most sewage treatment municipal plants measure Biochemical Oxygen Demand (BOD) in effluent discharges and therefore BOD will likely be selected for this sector, while one of the heavy metals may be selected as the indicator for the industrial sector.

For preliminary screening it is proposed to make use of the "effective mass of contaminant" methodology which was developed for the characterization of different discharges (their quantity and toxicity) and is based on the "toxic equivalent" concept. The "effective mass of contaminant" derived for a discharge can be used for the comparative assessment of different contaminant discharges where multiple contaminants may be involved. The Hot Spots yielding the highest "effective mass of contaminant" would be promoted to Step 2 for more detailed evaluation.

The method makes use of existing contaminant loading estimates available in the State Statistical Database (2TP – "Vodkhoz"), collected for most dischargers in each of the three countries during the period from 2000 to 2002.

Calculation of the effective mass of contaminant for "Hot Spot X"($\mathbf{M_x}$) is based on two parameters: mass of discharged pollutant "i" ($\mathbf{m_i}$), and relative toxicity of pollutant "i", defined by the coefficient of toxicity, Ai. The coefficient of toxicity, $\mathbf{A_i}$, can be calculated on a relative basis to the toxicity of ammonium sulphate which has a Maximum Permissible Concentration, (**MPC**) value of 1 mg/L (State Surface Water Quality Standards for Fishery):

$$\mathbf{Ai} = \frac{\mathbf{MPC\ ammonium\ \ sulphate}\ \ [mg\ /\ L]}{\mathbf{MPCi}\ \ [mg\ /\ L]}$$

For example,

for formaldehyde, $A_i = 4$ since $MPC_{formaldehyde} = 0.25$ mg/L,
for ammonium perchlorate, $A_i = 125$ since $MPC_{\ ammonium\ perchlorate} = 0.008$ mg/L.

The formula for calculating the "effective mass of contaminant i" for a discharge is given by the following:

$$\mathbf{Mi\ [tonnes/year]} = \mathbf{A_i\ [dimensionless]\ x\ m_i\ [tonnes/year]}$$

Masses of discharged pollutants by individual discharger for a broad range of components (m_i) are stored in the Database "2TP – Vodkhoz". Values of Maximum Permissible Concentrations (MPC_i) for different components can be found in the State Surface Water Quality Standards (Fishery).

The total effective mass of discharged contaminants for the "Hot Spot X"(M_X) is calculated as a sum of effective masses of discharged individual contaminants:

$$X = \sum \mathbf{Mi}$$

Values of M_X for individual Hot Spots will be used as score values for the preliminary screening and preliminary ranking of selected Hot Spots.

For multi-point sources of contamination such as those associated with large industrial or municipal complexes, the effective mass of contaminant can by assessed using the following formula which sums multiple point sources:

$$\sum^n \mathbf{M_i} = \mathbf{M_1} + \mathbf{M_2} + ... + \mathbf{M_n}$$

It will be at the discretion of the National Experts whether there is any merit in aggregating multiple discharges in this manner. The decision will partly depend on whether mitigation can be applied over several sources and whether a "bankable" project can be identified.

Being a simple system, the numerical screening may leave-out substantial sources of contamination known to the NHSE. In addition to the above methodology the preliminary screening has been augmented with additional criteria designed to ensure "Hot Spots" associated with most of the major economic sectors are included and that there remains flexibility to promote some "Hot Spots" based on the professional judgement of the National Experts. This is in recognition of the fact that some significant "Hot Spots" may not meet the preliminary screen. These additional criteria for promotion to Step 2 are provided below (Table 1).

Table 1 - Hotspot Promotion Criteria For Preliminary Screening

2.4...0.1240644 Sector	2.4...1 Factor	Numeric Criterion*
Municipal Sector	M.1 Total Annual Load [kg/year]. For choice of parameter see notes**	>2% of Total Annual "Watershed" Load
	M.2 Total Annual Hydraulic Loading [km^3/year]	>1% of Total Annual "Watershed" Flow
Industrial Sector	I.1 Total Annual Load [kg/year]. For choice of parameter see notes**	>2% of Total Annual "Watershed" Load
	I.2 Largest establishments in most important industrial sectors for each country	Professional Judgment by National Experts.
Agricultural Sector	A.1 Largest livestock establishments in each country based on animal equivalents (not hectares)***	
Other (Power Sector, etc.)	O.1 Significance to human and environmental health	Professional Judgment by National Experts.

In Step 1 the NHSE will compile a full list of Hot Spots for each country based on information available and shorten this list to manageable number of Hot Spots using the screening method. If too few or too many Hot Spots pass through the screening method, the parameters will be altered until a manageable number of Hot Spots have been identified for further assessment (Step 2). The IHSE will provide support and guidance as needed and will review the work conducted.

3.3 Step 2: Detailed Evaluation of Hotspots

The detailed evaluation of Hot Spots will be conducted using the scoring sheets attached. A scoring sheet and a rationale document has been developed for each of the categories of Hot Spot issues as follows:

- Water Quality & Human Health Issues
- Pollution Control Issues
- Environmental & Biodiversity Issues
- Economic Issues

* actual numerical values to be adjusted based on data availability, "watershed" defined on a country-specific basis given each country will carry out screening independently.

** for Municipal Sector promote on the basis of BOD and Total Phosphorus loading which will serve as surrogates for other potential contaminants in municipal discharges. For the Industrial Sector use parameters for which reasonably good watershed loading inventories are available

*** focus on livestock operations since fertilizer/pesticide issues more readily addressed through implementation of Best Management Practices

The rationale documents explain why criteria have been proposed and their relative importance.

A detailed evaluation is conducted using a numerical scoring methodology. The four areas of interest, identified as Categories in the scoring methodology, are broken into Subcategories of multiple questions (Indicators) all of which are collectively referred to as Criteria. The scores are transferred to a Summary Scoring Sheet which calculates the total score of each Hot Spot after accounting for weightings. An example of the scoring system is shown on the Scoring Summary Sheet.

The initial activity required for the scoring methodology is the selection of reasonable weightings to determine the relative importance of each indicator. The weighting is undertaken at three levels (categories, subcategories and indicators). Weightings are only relative between indicators in the same subcategories, subcategories in the same categories and between categories. This approach makes selecting weighting factors relatively easy to implement and revise as required. It eliminates any bias introduced between categories and/or subcategories with many indicators compared to those categories and/or subcategories with few indicators. Once weightings have been assigned, the relative weightings of indicators can be determined as shown in the green column of the scoring sheet.

The range of scores was designated as 0 to 5. The range can be altered as desired (i.e., 0 to 100) to provide greater refinement of resolution (more detailed discrimination between criteria). It was considered that a range of 0 to 5 provided an appropriate amount of discrimination for the evaluation.

A scoring sheet with proposed weightings has been provided with the guideline. As one of the their first tasks, the NHSE were required to review and revise the proposed weighting values. The NHSE will complete the scoring sheets for each of the short-listed Hot Spots using data available in national and regional centres. The International Hot Spots Experts (IHSE) will provide support and guidance as needed and will review the work conducted.

During this process, a data quality assessment will be conducted by the NHSE for each country to be used in a sensitivity analysis of the scoring methodology.

3.4 Step 3: Prioritization of Hotspots

The prioritization of the Hot Spots would be based on the scores determined from the previous step (Step 2) with the highest scores being promoted. Some latitude should be allowed for flexibility in developing the final list for immediate implementation of corrective action (i.e., initial mitigation estimates and funding list). For example, a good range of the major industries in each portion of the basin should be represented.

The NHSE will prioritize the short-listed Hot Spots using the results of Step 3 and identify the Hot Spots which will proceed to Step 4. We propose that the number of Hot Spots to be subject to Step 4 is as follows:

- Belarus: 5 Hot Spots
- Russia: 5 Hot Spots
- Ukraine: 10 Hot Spots

The IHSE will provide support and guidance as needed and will review the work conducted.

3.5 Step 4: Identification of Mitigation Measures and Associated Costs

For selected Hot Spots, mitigation measures will be proposed and costs for their implementation estimated. This work will be primarily conducted by the NHSE for Pollution Control and Economics. Their IHSE counterparts will provide support and introduce their experience in implementing controls outside of the region.

The results of this step will be reported in a similar format to the Project Plans prepared by the Danube Pollution Reduction Programme for the 1998 National Reviews.

Mitigation measures will include the installation of treatment technologies, improvements of operating procedures and also adopting new policies, legislation and practices.

A cost-benefit analysis of the proposed measures will be conducted by the NHSE for economic issues with support from their SLE&C counterpart.

3.6 Step 5: Reporting

The findings of the steps above will be summarized in reports – National Pollution Reduction Reports/National Reviews. NHSEs of each participating country will produce a National Pollution Reduction Report representing a situational analysis of the country in terms of identification and analysis of sources of pollution for the Dnieper River Basin. The three National Pollution Reduction Reports/National Reviews will be later combined in the Final Regional Report on Pollution Reduction Measures for the Dnieper River Basin.

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RECOMMENDATIONS

NGO STATEMENT

REFERENCES

Tables: Scoring results, etc.,
Figures: Maps locating Hot Spots, ecological receivers, etc.

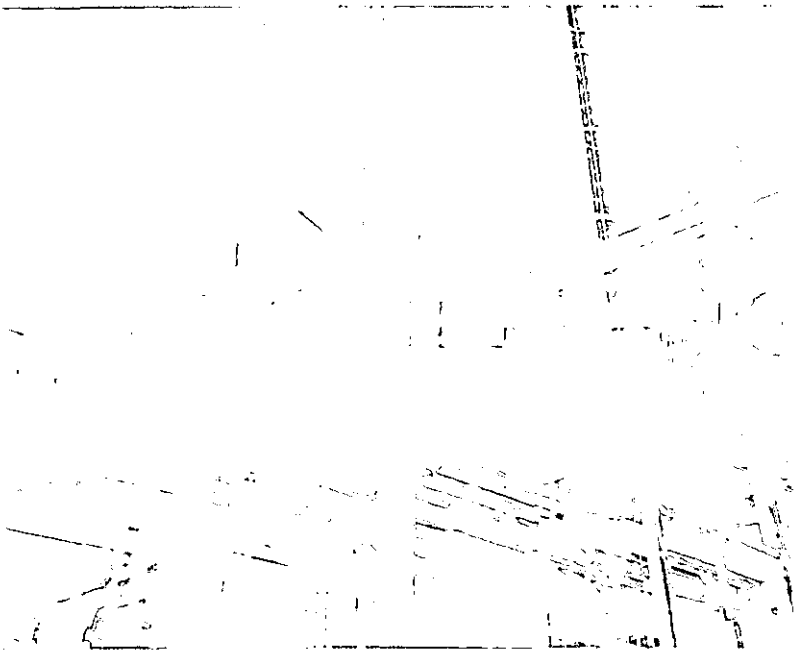
3.7 Preferences

Numerous sources were used to develop the methodology, the most important are shown below:

'Transboundary Diagnostic Analysis for the Dnieper River Basin: Synthesis Report', UNDP, UNEP, GEF, 1997
'Environmental Situation in the Lower Dnipro River Basin', O.G. Vasenko, Ukrainian Scientific Centre for Protection of Waters, Water Quality Research Journal Canada, 1998, Volume 33, No. 4, 457-487
Convention on Cooperation for the Protection and Sustainable Use of the Danube River Basin' Danube River Protection Convention
'National Reviews 1998', Danube Pollution Reduction Programme
'GIWA Methodology: Stage 1: Scaling and Scoping: Guidance to the Methodology and its Use', Global International Waters Assessment, July 2001
'Report of the GIWA Methodology Testing Workshop in the Gulf of Thailand System', Southeast Asia Global Change START Regional Centre, July 2000
'Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources and Activities'
Methodology of the integral pollution assessment, from monograph of V. K. Papisov, Nauka Press, Moscow, 1989

Many other sources of information, internet web sites and published reports provided valuable aid and guidance for many issues but are not listed above.

4.0 POLLUTION CONTROL ISSUES



4.1 Preamble

Industries and wastewater treatment plants directly discharging effluents to the Dneiper River watershed are to be evaluated with respect to their designation as a "Hot Spot" by virtue of two considerations: (1) their characteristics i.e. flow rate and quality and (2) treatment, monitoring and type of discharge.

Regarding characteristics, the intent is to promote dischargers of large volumes of effluent and dischargers of large loads of specific, basic parameters which would directly impact on river water quality. These basic or conventional parameters typically are also the parameters for which Best Available Treatment (BAT) technologies can be applied, operated and monitored with respect to adequate performance.

The type and degree of wastewater treatment already in place also must also be considered in promoting industries to "Hot Spots". By including this consideration, credit can be given to dischargers of large volumes of fully treated wastewater. Thus, large wastewater treatment plants and industries would not necessarily be promoted to Hot Spots based solely on size and conversely preference will be given, for example, to smaller industries having no effluent treatment at all.

Credit is also given to dischargers who (a) already have in place good effluent monitoring (flow measurement, sampling and analytical) programs and (b) discharge effluents intermittently and / or through well designed and constructed sub-surface river outfalls and diffusers. Data provided by those per (a) above can be considered more reliable and accurate. Those dischargers meeting criterion (b) above will likely be creating smaller zones of adverse (toxic) river water quality and may be allowed to discharge effluent with higher concentrations of certain non-persistent parameters.

Following is a brief description and rationale for inclusion of each specific criterion on the Hot Spot Evaluation sheets.

The scoring methodology allows alternative questions to be answered for the same criteria when appropriate. For example, flow rates from municipal wastewater treatment plants tend to be much larger than from industrial complexes, therefore, there are two sets of evaluation data for Criterion

No. 1.1: one pertaining to municipal waste water treatment plants and one pertaining to industrial complexes. With respect to Hot Spots that do not fall into either of the two categories above, select the evaluation data based on the characteristics of the effluent (i.e. stormwater discharges and agricultural run-off would both most likely fit with the evaluation data for municipal wastewater treatment plants.

Additionally, for wastewater characteristics, it is acknowledged that it is unlikely that all Hot Spots will have laboratory analysis characterizing the wastewater for every parameter proposed. Thus, for every evaluation question pertaining to specific contaminants, an alternate question is proposed that relies on professional judgement. Similarly, for loadings, there is an alternate question to those relying on data which relies on professional judgement. Criteria scoring based on professional judgement has a maximum score of 3 as opposed to 5 for measured results in order to compensate for uncertainty.

4.2 Wastewater Treatment and Discharge

4.2.1 Normal Total Effluent Flow Rate

Industrial: For a given industrial sector, this criterion will allow separation of industrial facilities based on size. Wastewater generation rates are typically proportional to production rates. Industries with effluent flow rates greater than 2500 m3/day would be considered very large, 1000 m3/day medium and less than 50 m3/day small.

With this scoring criterion, credit would be given for large industries which have implemented or achieved water conservation measures (i.e. lower effluent rate per unit of production).

Municipal: As municipal wastewater treatment plant effluents tend to be larger than their industrial counterparts, the rates have been increased based on professional judgement. The rate ranges have been modified to increments of 1000 m3/day. The National Experts will utilize official information contained in the 2TP reports for effluent rate data.

4.2.2 Proportion of Effluent Treated

Both continuous and intermittent effluent discharges must be scored in this criterion, so that while all continuous process effluent streams may be treated, spills and clean out wastewater may not be and may have significant impacts. This would be the case, for example, for base metal mining where processing effluents were being treated but discharging from tailings dams were not.

4.2.3 Dilution/Mixing

To account for the assimilative capacity of the river, the hydraulic flow rate of the discharge, m3/d, should be included in the evaluation. This can be accomplished by ranking the dilution factor, river flow to effluent discharge. We propose to use the minimum average 7-day river flow with a recurrence interval of 10 years (7Q10) as a standard river flow criterion. This is used by industry in New York State as a guideline for monitoring industrial waste discharges.

For point source discharges to rivers/streams, Ontario Ministry of the Environment (MOE) uses the 7Q20 low flow statistic (the minimum 7-day average low flow with a recurrence period of 20 years) - i.e. a 5% chance of there being inadequate streamflow to meet the minimum acceptable dilution in any given year.

For discharges to lakes (reservoirs) and interconnecting channels, discharges directly to a shoreline are not acceptable (MOE). A shoreline discharge of storm water and/or cooling water may be considered on a case-by-case basis.

In the Great Lakes, initial mixing for discharge diffusers in lakes must have a minimum near field (initial mixing) ratio of 20:1. Specification of additional site-specific conditions (e.g. spawning shoals, beaches, drinking water intakes, minimum depth of submergence and distance offshore, etc.) are based on the professional judgment of the reviewer (MOE staff).

For the Dneiper River Basin, the low flow criterion was discussed with the National Experts. The 7Q10 flow rate is not used and it was suggested to base the discharge dilution on 95% of the inter-season river water flow rate

4.2.4 Secondary Contributors

For both municipal wastewater treatment plants and industrial dischargers, contribution to the effluent by secondary sources can have an important impact on effluent quality. For industry, secondary contributors are less under control than their own operations and therefore add uncertainty to effluent quality and thus greater concern for adverse impacts. For municipal wastewater treatment plants, the greater the portion of the effluent whose source is industrial, the more likely that contaminants such as heavy metals and petroleum products will be present in the effluent.

4.2.5 Method of Discharge

The method of discharge of treated or untreated effluent will impact on the location and size of the mixing zone where toxic conditions could exist.

Full credit is given for situations where there is no discharge by virtue of complete containment, recycling, re-use, etc.

Uncontrolled discharges would be those with no distinct point of discharge which could be readily sampled. Such would be the case if no collection sewers or pipes were evident and discharge was by overland routes.

Discharge into the sub-surface, either controlled or not, is considered less desirable based on the potential for the contamination of groundwater which is used as a supply of potable water for a large number of communities.

4.2.6 Frequency of Discharge

While intermittent discharge is considered as having less impact than continuous discharges because there would be times when local impairment of water quality does not occur, intermittent discharges can be more detrimental to fish and other aquatic life if they are present at the point of discharge and then could be subject to rapid changes in water quality. Mobile aquatic life will often stay away from continuous discharge mixing zones.

4.2.7 Frequency of Flow Monitoring

High frequency of flow monitoring implies better actual or potential environmental management and control.

Continuous flow monitoring would generally be preferred to intermittent flow monitoring so that possible uncontrolled discharges are known and hopefully controlled. However, where effluent flow remained constant, intermittent flow monitoring would be acceptable.

4.2.8 Frequency of Sampling and Analysis

High frequency of effluent sampling and analysis implies better actual or potential environmental management and control.

Continuous effluent sampling and analysis would generally be preferred to intermittent sampling and analysis so that possible uncontrolled discharges are known and hopefully controlled. However, where effluent quality remains constant, intermittent or grab sampling and analysis would be acceptable. Continuous sampling would have to be done initially and periodically thereafter to confirm the invariability of effluent quality.

4.2.9 Type of Sampling

Continuous, composite sampling is preferred to grab sampling so that intermittent quality spikes are captured. However, as for the frequency of flow monitoring, sampling and analysis, grab sampling of effluents with constant quality (as determined by initial and confirmed by periodic continuous sampling) would be equivalent.

4.3 Wastewater Characteristics

The ranking of the severity of the impact on the environment is based on 6 categories as follows:

0 - no effect, 1- slight effect, 2 - moderate effect, 3 - major effect, 4 - severe effect, 5- extreme effect

4.3.1 Oxygen Demanding or Depleting Materials

This criterion is rather subjective in that under certain circumstances, BOD or COD discharge loads or concentrations could fluctuate as a result of intermittent, highly polluting operations.

Also for certain industries, such as agri-food, and especially where there is no effluent treatment, BOD / COD concentrations will be very high.

If BOD or COD data is unavailable, total organic carbon (TOC) or dissolved organic carbon (DOC) data can be used.

4.3.2 Nitrogen

Nitrogen in the form of nitrites, nitrates and organic nitrogen contributes to river water eutrophication.

4.3.3 Ammonia

Ammonia is included because of its acute toxicity to aquatic life particularly at higher pH.

4.3.4 Phosphorus

Phosphorus in the form of ortho-phosphates and condensed phosphates contribute to water eutrophication.

4.3.5 Total Suspended Solids

This quality parameter impacts water clarity and build up of sediment at the point of discharge and possible movement downstream. The secondary characteristics of the solids are not specified e.g. biodegradability, specific gravity, particle size, hazardous constituents, etc.

Suspended solids containing toxic organics, heavy metals and the like will be scored under their specific criteria.

4.3.6 Phenols

The non-specific phenol parameter is useful for initial evaluation of wastewaters particularly from petroleum and petrochemical plants. Phenols are also good indicators of water contamination from organic chemical facilities and the presence of other organic compounds. At low concentrations, phenols impart objectionable taste and odour to drinking water.

4.3.7 Persistent Organic Pollutants

Persistent organic pollutants (POPs) are those organic compounds which do not readily (bio)degrade in the natural environment and therefore tend to accumulate in sediment and aquatic life. These compounds include specific pesticides and herbicides, PCB, polyaromatic hydrocarbons (PAH), halogenated organic chemicals and others.

The type and load or concentration of persistent organic compounds discharged will depend on the industry. While many of these compounds can be detected at low (trace) concentrations in many if not all industrial

discharges, the intent is to identify those discharges containing relatively high loads or concentrations which would be associated with their use as raw materials and generation as un-recovered or un-treated by-products or products.

While all detected POPs are grouped in this criterion, information available which identifies specific compounds and their discharge concentration or load would also be useful to assist in subjective evaluation as hot spots. For example, more acutely toxic POPs could receive a higher weighting.

4.3.8 Oil and Grease

There are usually two discharge limits for oil and grease – one for animal or vegetable oil and grease and the other for mineral or synthetic oil and grease. Discharge limits are usually an order of magnitude more stringent for the latter type as animal and vegetable oil and grease is typically more biodegradable. However, both are aesthetic quality criteria. The concentrations of animal / vegetable fats and oils in the scoring matrix have been reduced to reflect more likely actual concentrations encountered in certain industrial discharges.

4.3.9 Heavy Metals

The eight heavy metals of concern are iron, copper, zinc, nickel, chromium, cadmium, lead and mercury. Metals concentrations and loads are to determined as total (dissolved + solid). The impact of heavy metals on the environment relates to water and sediment quality. Dissolved metals impact primarily on toxicity to aquatic life and drinking water toxicity and aesthetics i.e. taste. Evaluation should be made of each of these heavy metals, individually, rather than collectively.

4.3.10 Radioisotopes

The main radioisotopes of concern are Ce137 and Sr90 which arise from the nuclear power industry.

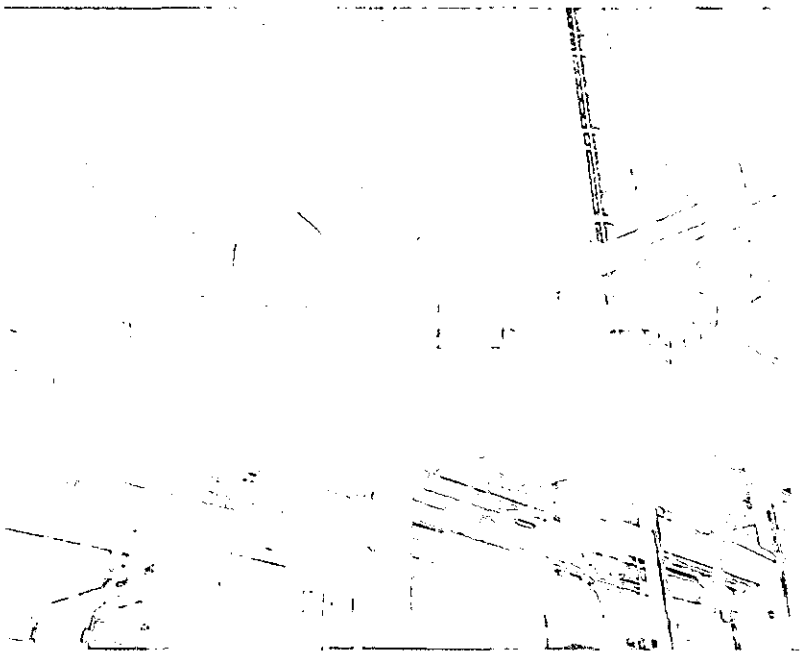
4.4 *Pollution Loadings*

While the concentration of contaminants in a discharge have immediate effect on receiving waters, contaminant loadings are also important to the overall ecological health and beneficial use of a river system. Thus, a similar scoring methodology has been created for loadings following the same contaminant-by-contaminant approach as the previous section.

The loads are represented by the percentage of total load at the nearest downstream national boundary (e.g. Ukraine's would be a percentage of the loading that reaches the Black Sea minus the national loads from Belarus and the Russian Federation). Professional judgement is based on high, medium, low and none.

The National Experts indicated that loading information for all but 6 of the parameters may not be available. The six parameters for which data is routinely recorded are BOD, COD, ammonium nitrogen , iron, copper and oil. Where loading data is unavailable for specific other parameters, the professional judgement of the National Experts can be used to estimate qualitatively whether loadings would be expected to be high, moderate, low or non-existent.

5.0 WATER QUALITY ISSUES



5.1 Preamble

The water quality scoring focuses primarily on the beneficial uses of the river which have a significant impact on human health. It was not considered prudent to place too much emphasis on measured instream water quality data as it would likely not be adequate to separate the contribution of individual Hot Spot discharges to the measured impact on river quality (i.e., upstream and downstream river quality data isolating each specific discharge will not be available). Therefore it was assumed that the preliminary "short-listing" criteria and the municipal and industrial pollutant source scoring would isolate the most significant Hot Spots from a loading perspective and hence potential impact basis, including contribution to Transboundary Pollution.

5.2 Drinking Water Supply

5.2.1 Location of Nearest Municipal Drinking Water Withdrawal

This criteria establishes the proximity to the nearest drinking water withdrawal downstream of the Hot Spot. Municipal systems have been specified to distinguish from individual water takings. The criterion is based on the assumption that pollutant assimilation and drinking water supply are incompatible uses in close proximity. For scoring purposes it has been assumed that all existing drinking water treatment plants are not adequately designed to treat the river water supply , or if adequately designed, not maintained or operated to appropriate standards. If there are exceptions to this assumption, these treatment plants can be excluded from consideration in this criterion.

5.2.2 Municipal Drinking Water Withdrawals Under the Direct Influence of River Quality

This criteria examines whether the nearest downstream drinking water withdrawal is influenced by river quality recognizing that in numerous instances well water supplies (and not direct river withdrawals) are used as the source of municipal water supplies. The criterion is based on an evaluation factor, ?, which establishes for a given well supply its relationship or connectivity to the river (surface water). The evaluation system takes into account the physical relationship and distance between the well and the river or

time for contaminant migration between the river and the well. The evaluation methodology is detailed in Appendix __. For scoring purposes it has been assumed that water supplies under the direct influence of the river (surface) waters would obtain the highest scores.

5.2.3. Population Being Supplied By River Water Within 25 Km Downstream of Hot Spot

A pollutant discharge can pose a threat to drinking water supply with the overall risk greater where higher populations are dependent on the river supply. The specified 25 km limit was arbitrarily selected for comparison purposes and does not represent a real measure of the potential impact zone.

5.3 Recreation

While local residents may place a high value on recreational pursuits in and on the river, the Recreation scoring criteria should be assigned a lower weight relative to Drinking Water Supply given the greater health risks associated with the latter. For contact recreation (e.g. swimming) typically bacteriological quality is the primary focus however aesthetics (as governed by nutrient and suspended solids loadings) are also clearly relevant.

5.3.1. Recreational Bathing Areas Located Near The Hot Spot

The presence of a recreational bathing (swimming) area in close proximity to a Hot Spot discharge is a potential source of concern. Greater distance downstream assumes greater pollutant assimilative potential and hence reduced concern (and score). The downstream distance cut-off of 10 km used in the scoring criterion versus the 25 km distance used in the drinking water supply criteria, was selected to partly account for the reduced weight to be applied for recreation relative to drinking water supply.

5.3.2. Other Aquatic Recreational Activities Near The Hot Spot

Rowing, sailing and other aquatic recreational activities may result in direct contact and exposure to the river water. Poor aesthetics (eg., eutrophication, colour, odour) will diminish enjoyment of these activities.

5.3.3 Any Illnesses Attributed To The Recreational Areas

This criterion was developed to provide higher scores to Hot Spots which have the potential to be directly implicated with causing illness in people engaged in recreational activities regardless of whether the Hot Spot is the confirmed cause of the reported illness. The criterion assumes that a contaminated recreational area should not be further stressed.

5.3.4. Hot Spot Identified as Source of Illnesses

This criterion was developed to provide higher scores to Hot Spots which have been directly implicated with causing illness in people engaged in recreational activities. The criterion provides a zero score to a Hot Spot which is not characterized by bacteriological releases and hence cannot be identified as a source of illness.

5.4 Fishing – Recreational

For recreational fishing (Criterion 3.1) the potential impact on fishing opportunities is determined by using proximity of established licensed fishing areas to the Hot Spot discharge. Commercial fishing is addressed in Criterion 4.1. The overall health of the fisheries is considered under Environmental, Biodiversity & Natural Areas Issues.

5.4.1 Proximity of Recreational Fishing Areas and Sustainability

This criterion focuses on the potential impact on recreational fishing opportunities by using proximity of fishing areas to the Hot Spot discharge. While it is recognized that recreational fishing is conducted throughout the watershed, the scoring system has been based on proximity of designated, licensed recreational fishing areas to help differentiate Hot Spots. The highest score is assigned to Hot Spots which have already been identified as having adversely impacted these recreational fishing areas. So as not to bias the scoring, the scoring criteria take into account the possibility that no recreational fishing is carried out anymore at some locations because river conditions are so degraded. In these cases it is assumed that further degradation is unacceptable and a high score is warranted.

5.5 Fishing – Commercial

For commercial fishing (Criterion 4.1) the original intent was to base the scoring on human exposure (health risks) to trace organics and heavy metals which may bioaccumulate in fish flesh. While testing of commercial fish for potential contamination prior to their reaching the market is routinely carried out, no overall database of contaminant levels in fish are maintained in the three countries. Several scientific studies on bioaccumulation are available or underway, however these are very site-specific, research-oriented studies (often focused on specific fish organs) which cannot be applied basin-wide. For this reason the commercial fishing criterion was modeled after that developed for recreational fishing. The overall health of the fisheries is considered under Environmental, Biodiversity & Natural Areas Issues.

5.5.1. Proximity of Commercial Fishing Areas and Sustainability

This criterion focuses on the potential impact on commercial fishing opportunities by using proximity of designated, licensed commercial fishing areas to the Hot Spot discharge. The closer the licensed commercial fishing areas are to the Hot Spot, the greater the overall risk to human consumers. The highest score is assigned to Hot Spots which have already been identified as having adversely impacted these commercial fishing areas. So as not to bias the scoring, the scoring criteria take into account the possibility that no commercial fishing is carried out anymore at some designated locations because river conditions are so degraded. In these cases it is assumed that further degradation is unacceptable and a high score is warranted.

5.6. Agricultural Water Taking

5.6.1. Agricultural Water Utilization in Proximity to Hot Spot

Agricultural water taking for crop irrigation and livestock watering are important uses of the river particularly in the lower reaches of the river. Proximity to a Hotspot is used as a potential indicator of increased risk to livestock and crops. Scoring assigns higher risk to areas where this beneficial use is carried out more extensively. The degree of use is a relative scale which must be determined and applied by each national expert independently.

Data sources to be used to determine utilization include: presence of large pumping stations (investment), crop water consumption normals in conjunction with areas (hectares) under cultivation for specific crops, calculated water deficits by basin area and licensed water taking volumes.
[Note: In Russian/Ukrainian the term irrigation encompasses land drainage activities and hence should be used with caution.]

5.7. Sediment Quality

5.7.1. Sediment Contamination

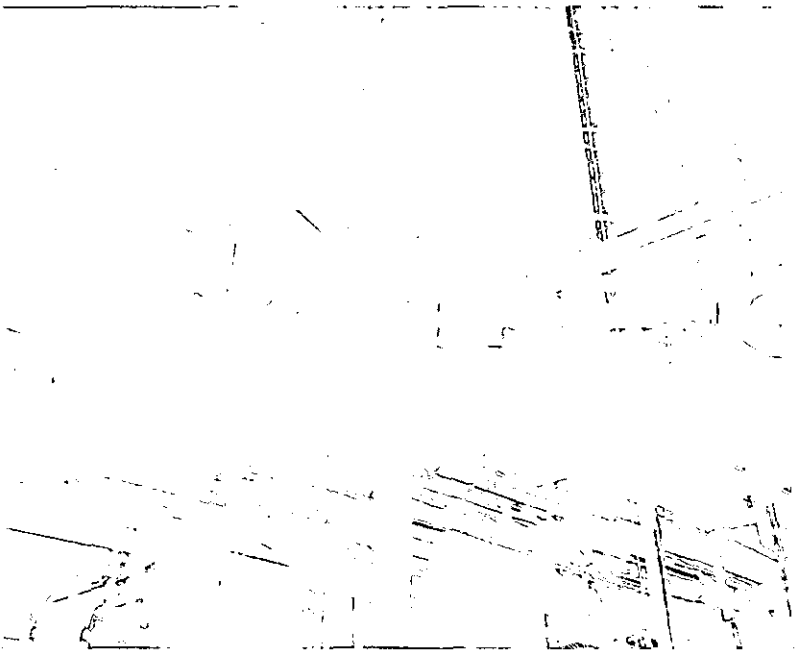
For the purposes of this criterion, an area of sediment contamination is defined as an area where the sediment quality concentration for at least one parameter is over five times the respective sediment background concentration for that parameter. The criterion assumes that there will likely not be enough data available to attribute sediment contamination to a specific Hot Spot discharge. However, where the Hot Spot is the confirmed source of the contamination, the highest score is assigned. A score of zero is assigned if the Hot Spot discharge does not contain significant quantities of the subject contaminant parameter on which the contamination was defined.

5.8. Transboundary Issues

5.8.1. Proximity to National Boundaries

This criterion reflects one of the stated objectives of this UNIDO project to reduce transboundary transport of pollutants and loadings to the Black Sea. Hot Spots located in close proximity to national boundaries (or the Black Sea) warrant higher scores than those more distant as they will have a greater impact on their downstream "neighbours".

6.0 BIODIVERSITY ISSUES



6.1. General

The following is an item-by-item explanation of the scoring methodology for environmental and biodiversity issues. Sections 1.1 to 1.5 describe the indicator criteria which establish the proximity of environmental receptors to sources of pollution. Proximity will be assessed by mapping. The various types of receptors have been separated only to allow the opportunity for different weightings denoting relative importance. Receptors will be identified by published sources such as the "Red Book" for each of the riparian countries as well as by the knowledge of each individual expert for biodiversity. The first three indicator criteria relate to areas officially protected by government decree. The final two indicator criteria relate to areas that are not officially protected but have been identified by scientific authorities as significant. The environmental receptors do not have to be located downstream of the Hot Spot. The National Experts will use their judgement to apply a modifier to the score based on the likelihood of impact. This likelihood will be assessed by considering the relative position of Hot Spot and the receptor (upstream/downstream, side of bank, water flow, breadth of river, mixing, intervening islands, sand banks, etc.) as well as the mobility of the receptors (fish or waterfowl). The modifier will be as follows:

+ 1-5 potential for direct or indirect impact

insufficient evidence for assessment

- 1-5 unlikely to have direct or indirect impact

The maximum score will always be 5 and the minimum score always 0. The selection of the modifier will be made by the National Expert of each riparian country and be fully justified in the comment section of the work.

The final indicator criteria (1.6) relates to a more substantial linkage between the Hot Spot and the receptor than described above. The determination will be made based on the results of scientific studies, observed impacts on receptors or experience from similar situations. This indicator criteria has been given the highest weighting and addresses both proven impacts and suspected impacts.

6.1.1. Location Near Wildlife Sanctuaries

This criteria establishes the proximity to the nearest of these potential receptors but does not necessarily assume there is an impact on officially designated wildlife sanctuaries (officially protected). The criteria was selected because it is easily measurable when the wildlife sanctuaries are defined and the Hot Spot is an identified point source or, if a non-point/diffuse source, is a local source (i.e. municipal storm sewers from a defined area such as a city or a town). It is anticipated that the effects of individual Hot Spots on individual wildlife sanctuaries have not been defined in many cases. Whether the Hot Spot is having an impact on these areas is not accounted for in this criteria (other than the modifier scheme identified above).

6.1.2. Location Near National Parks

This criteria has the same objective as 1.1 but with respect to National Parks as opposed to Wildlife Sanctuaries. National Parks are officially designated protected areas.

6.1.3. Location Near Areas Frequented by Rare and Endangered Species

This criteria has the same objective as 1.1 but with respect to areas frequented by rare and endangered species as opposed to Wildlife Sanctuaries. These areas would be those that are officially designated protected areas. Such determinations would be made by referring to the "Red Book" or other published sources.

6.1.4. Location Near Unprotected Areas of Ecological Significance

This criteria has the same objective as 1.1 but with respect to areas of ecological significance as opposed to Wildlife Sanctuaries. These areas would be those that are **not** officially designated protected areas. These areas may include areas identified through scientific studies as being important spawning grounds, habitat, nesting, or stopover spots for both migratory and non-migratory species.

6.1.5. Location Near Environmentally Sensitive Areas

This criteria has the same objective as 1.1 but with respect to areas defined as "Environmentally Sensitive Areas" (ESA) as opposed to Wildlife Sanctuaries. These areas would be those that are not officially designated protected areas. For the purpose of this methodology, ESA has been defined as an area with a high biodiversity determined by the professional judgement of the NHSE based on the number of species present, various biotic indices which may be available and other applicable sources of information.

Biotic indices will be used as they are available. Such indices may include the Trent Biotic Index (Woodiwiss) and oligochaetal index (Goodnight-Whitely) for zoobenthos as well as the Saprobe Index for phyto- and zooplankton.

6.1.6. Identified Adverse Impacts

It is assumed that in some cases, although not comprehensively, that adverse impacts on environmental features (Wildlife Sanctuaries, National Parks, etc.) may have been studied. When such information is available, this criteria allows it to be entered in the rating system.

6.2. Aquatic Species (Fish)

6.2.1. Adverse Impacts To Fish Habitat

In the event the impacts to the habitat of fish from the Hot Spot have been suspected, identified or studied, this criteria allows for the situation to be scored accordingly. It is not anticipated that such studies are widely available for individual Hot Spots.

6.2.2. Fish Kills

This criteria accounts for any fish kills in the area of specific Hot Spots. The fish kill may be attributable to a specific Hot Spot, potentially attributable or not attributable, each category decreasing in scoring weight.

6.2.3. Reproductive Impacts On Fish Species

In the event the impacts to fish species in the form of reproductive effects as evidenced by abundance, diversity or community structure, have been identified through studies, this criteria allows for the situation to be scored accordingly. It is not anticipated that such studies are widely available for individual Hot Spots. The effects may be attributable to a specific Hot Spot, potentially attributable or not attributable, each category decreasing in scoring weight.

6.3. Aquatic Species (Benthic)

6.3.1. Impacts On Benthic Species

In the event the impacts to benthic species in the form of reproductive effects as evidenced by abundance, diversity or community structure, have been identified through studies, this criteria allows for the situation to be scored accordingly. It is not anticipated that such studies are widely available for individual Hot Spots. The effects may be attributable to a specific Hot Spot, potentially attributable or not attributable, each category decreasing in scoring weight.

6.3.2. Biotic Index

In areas within the proximity of the Hot Spot for which a biotic index has been determined, this information will be used to assess the relative significance of the Hot Spot. For this criteria, proximity will be determined by the NHSE using professional judgement and based on the likelihood of significant impact. It is assumed that the areas subject to monitoring by biotic indices will be downstream from the Hot Spot and within a reasonable distances (i.e. 5 km) so that an impact is possible. The Trent Biotic Index for zoobenthos as defined by Woodiwisss (1964) will be used. This is a measure of structure for zoobenthos. The higher the index the more diverse the zoobenthos community is and, therefore, the more important the area is with respect to biodiversity. Thus, this criteria is not a measure of impact from the Hot Spot but an measure of proximity to an area of significant biodiversity.

6.4. Aquatic Species (Waterfowl)

6.4.1. Adverse Impacts To Waterfowl Habitat/Nesting Areas

Similar to that for fish (2.1), this criteria allows for scoring in the event the impacts to waterfowl habitat or nesting areas from the Hot Spot have been suspected, identified or studied. It is not anticipated that such studies are widely available for individual Hot Spots.

6.4.2. Adverse Impact To Migratory Species

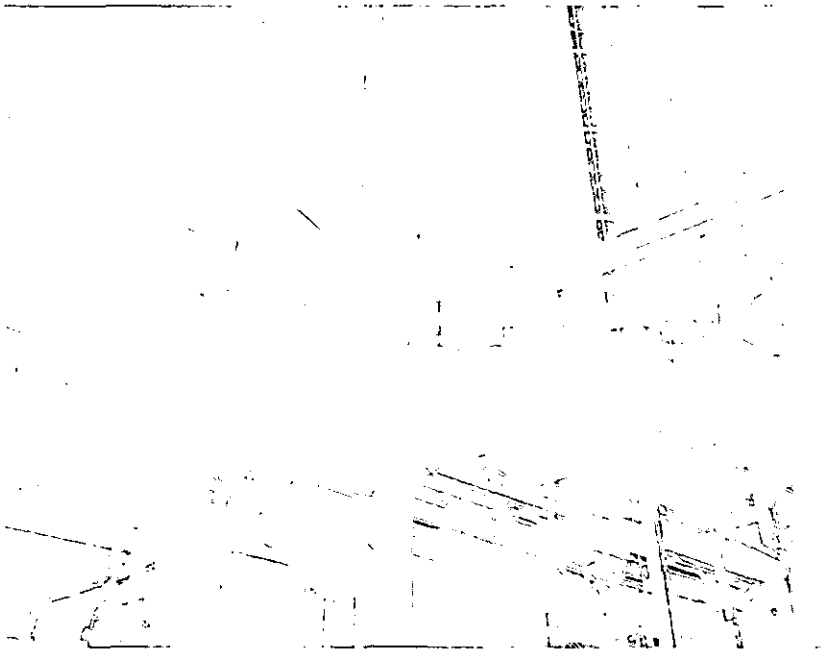
Similar to impacts to local waterfowl (4.1), this criteria allows for the scoring of impacts on migratory bird species. The congregation of migratory birds would have to be significant for the assessment. Such impacts may have been identified in studies.

6.5. Plant Species

6.5.1. Adverse Impacts To Plant Species

This criteria allows for scoring in the event the impacts to plant species from the Hot Spot have been suspected, identified or studied. It is not anticipated that such studies are widely available for individual Hot Spots.

7.0 ECONOMIC ISSUES



7.0. Context

While most criteria developed for "Water Quality," "Pollution Control" and "Environmental, Biodiversity & Natural Areas" are based on traditional monitoring and standard diagnostic measures, "Economic Issues" are nebulous. The immediate challenge is to develop criteria based on the direct effect of pollution on the economic well being within the Dnieper River Basin.

7.1. Statement of Problem[1]

The Dnieper is the third largest river in Europe. It is 2,200 km long and covers a drainage basin of 509,000 km^2, comparable to the size of France. It extends into the territories of Russia (20% of the river basin), Belarus (23%) and Ukraine (over about 55% of the river basin). Over 84% of the river's total annual flow is collected in the upper parts of the basin (Russia and Belarus total 44.8 km^3). However, most of this water is consumed by industrial and agricultural activities in the middle and lower stretches of the river in Ukraine - the annual discharge at the estuary is only 8.5 km^3. The Dnieper is a vital artery for these three countries and it provides an economic lifeline to industry, agriculture and the population. It is therefore understandable that there are many concerns about the water quality of the basin and its overall ecosystem health, as well as the health of the human population affected. There are over 33 million people living in the Dnieper Basin - 22 million of these live in Ukraine and rely directly on drinking water supplied from the river. Unfortunately, most of the river contains water of poor quality, which can be attributed to the following factors.

- the high industrial density and urban population.
- the fact that only 45% of wastewaters receive some kind of treatment.
- the high concentration of nutrients, BOD, bacteria, heavy metals and toxic organic contaminants, which results in water quality classified as "bad" to "extremely bad".

The excessive damming of the river system, with six major reservoirs on the main stream and over 500 smaller dams on the tributaries that generate electricity for heavy industry. This results in the accumulation and fre-

[1] Source: Foreword, "Why the Dnipro?" Ken Babcock and Jan Barica, International Development Research Centre; Water Quality Resources Journal Canada; Vol 33, No. 4, 453-455; 1998.

quent resuspension of highly contaminated sediments and their transport downstream, and the development of nuisance algal blooms and their consequent production of algal toxins, anoxia, massive fishkills and suspected carcinogenic compounds.
Large-scale and extensive water extraction for agricultural and industrial use, particularly for metallurgic industrial complexes which discharge untreated or inadequately treated process water into the river.

Intensively farmed areas with a history of over fertilization to compensate for the loss of agricultural land due to urban, mining and industrial development.
The aftermath of the ill-fated nuclear complex at Chernobyl following the 1986 accidental meltdown of one of its reactors, whereby vast areas of eastern and northern Europe were contaminated by radioactive fallout. Large quantities of radioactive caesium were carried into the Dnieper system and ultimately deposited in the sediments of the water reservoirs.
The frequent accidental spills of contaminated wastewater into the river and, on occasion, into the drinking water supply itself.
Consequently, heavy metals, PCBs, PAHs and pesticides contaminate the aquatic biota. The diversity of planktonic and fish communities has declined significantly, and the population numbers have often been decimated. Last, but not least, the health of the human population in the basin is being affected. Recently, outbreaks of cholera and hepatitis have become frequent.

All of these factors, in one way or another, affect the economy of communities within the region. Numerous factors can be assessed in the development of scoring scheme to prioritize hot spots to identify a short-list for subsequent evaluation. A first step in developing the scoring scheme is review some key concepts of environmental economics and develop assumptions to provide a boundary for the evaluation.

7.2. Key Concepts of Economic Evaluation of Environmental Issues – Theory, Approaches and Tools

While much attention and detail has been identified below, the discussion and recognition of these concepts will greatly assist in focusing the Phase 1 evaluation of Economic Issues.

7.2.1. Externalities

For many years, externalities, such as pollution, was considered a "market failure." For purposes of developing the rationale for the economic valuation of hot spots, the following definition of an externality[2] will be used for this analysis, and must satisfy both of the following conditions:

Condition 1: An externality is present whenever some individual's utility or production relationships include real (that is, non-monetary) variables, whose values are chosen by others (person, corporations, governments), without particular attention to the effects on that individual's welfare.

Condition 2: The decision maker, whose activity affects others' utility levels or enters their production functions, does not receive (pay) in compensation for this activity an amount equal in value to the resulting benefits (or costs) to others.

Condition 1 stipulates that actions are inadvertent and, thus, non-deliberate. Condition 2 emphasizes that costs, and in this case consequences, were incurred that had economic consequences and adverse effects directly related to the activity/effect. The net result is distortion in the economic well being relative to circumstances in a non-polluted/pollution-mitigated (Pareto-optimal[3]) world.

7.2.2. Distributive Considerations in Mitigative Activities

Mitigative activities typically involve transitional costs (dedicated towards improving the environment) and continuing costs (that is maintaining a given state of environmental quality). The economic literature acknowledges that there is a likelihood of a highly uneven pattern of adherence.

[2] Source: "The Theory of Environmental Policy," William J. Baumol and Wallace E. Oates, 2nd Edition, 1988.

[3] That is, a change that makes at least one member of a community better off while making none worse off. Such an approach is dependent on the notion that, other things being equal, and increase in economic efficiency is a good thing. It is acknowledged that the "decision-making" approach focuses on the key question "what objective would a social decision-maker choose to pursue?" The latter approach provides a range of options where the objective chosen will correspond to that implied by the potential Pareto improvement condition (Source: "The Principles of Practical Cost-Benefit Analysis," Robert Sugden and Alan Williams, Oxford University Press, 1985.

Consider the case of application of mitigative measures such as effluent charges (i.e. Pigouvian charges) or direct regulation. Heavy polluters located in populous areas may be forced to curtail or cease their operations completely. Given observed frequent opposition in industrial towns one of the most significant costs of mitigative activities will likely be the loss of jobs. This may pose significant problems if the application of such measures is not applied equally across affected areas (e.g. a river basin) equally.

Beyond this, once the transitional period has concluded, the maintenance of "steady-state" environmental programs becomes a matter of the equilibrium set of prices (including wage levels). It is expected that there will be a rise in the relative prices of goods whose production involves substantial external costs (in this case, where the mitigation of pollutants into the river are significantly more costly than the "free" dumping of wastes). Traditionally, economic research indicates that lower-income groups bear costs that constitute a larger fraction of their incomes than do higher-income classes.[4]

The application of such mitigative approached may meet further opposition in depressed regions where such jobs are considered as "badly needed." Thus, those populations typically at risk – low income and less education in poorer regions – would typically accept "less than perfect" environmental conditions in order to maintain employment.

7.2.3. Contingent Valuation Method (CVM)[5]

The CVM is a direct means for estimating the economic costs and benefits of securing quality environmental services, in this case a potable water and quality industrial water supplies. It is a means of determining how much a party is willing to pay for a given level of service. The method is called "contingent valuation" because a party is asked what they would do in a hypothetical (or contingent) situation in which the level of service is expected to be improved.

[4] Source: "The Distributional Effects of Uniform Air Pollution Policy in the United States," H. David Robinson, referenced in "The Theory of Environmental Policy," William J. Baumol and Wallace E. Oates, 2nd Edition, 1988.

[5] Source: "Guidelines for Conducting Willingness-to-Pay Studies for Improved Water Services in Developing Countries," WASH, 1998.

There are three main benefits in applying CVM:

The current situation for affected parties can be observed, and assess the level of service parties want and how much they are willing to pay for it;
Parties can value services for which indirect approaches would be imperfect (e.g. what are the benefits of increase reliability, higher water quality); and
Program evaluators can estimate reactions of affected parties to prices or technologies beyond the range of experiences.

While conducting a survey of parties maybe the best approach to collecting key data, such an approach will be more suitable to a subsequent phase of this project. For this Phase, in using a score sheet/prioritization approach, concepts of CVM will be used to direct the team on what areas willingness-to-pay concepts will be valuable in conducting a cost/benefit analysis.

7.2.4. Legislation & Regulation

Though closely related to "Externalities -" as there are a number of economic means to mitigate externalities, including the deployment of regulations and fines to induce compliance – the area warrants individual attention.

As noted by Dr. Soili Nystén-Haarala[6]:

Russia, Ukraine and Byelorussia have the same Soviet background for their environmental legislation and management. Each of the countries has started to develop their legislation building a system of payments for use and fines for misuse of licences on the Soviet based management system. After ten years the general structure is still, compared to each other, very much similar in all the three countries.
Environmental regulation is organized as management of different natural resources such as land, water, forest and below ground resources. Protection of the environment has been treated as a separate branch. Since natural

[6] Source: "Environmental Legislation of Russia, Ukraine And Byelorussia Compared with the Principles of EU Environmental Law," Prepared for the United Nations Project: Preparation of a Strategic Action Programme (SAP) for the Dnieper River Basin and Development of SAP Implementation Mechanisms, By the United Nations Industrial Development Organization Acting as executing agency for the United Nations Development Programme; Based on the work of Dr. Soili Nystén-Haarala, Consultant

resources have not been privatised, the management structure has maintained its main features of the state owner control for the use of the resources. Russia has had a special problem with dividing decision power between the federal and the regional levels of the state owner. Private ownership of natural resources has been made possible in the Russian federal constitution of 1993, but in federal legislation state ownership of natural resources is maintained as the main rule. The Byelorussian choice for state ownership is even stronger. The constitution recognises only state ownership of natural resources and there exists legislation denying transferring natural resources into private ownership.

However, most of the major polluters within the Basin are formerly state owned enterprises.

The separate regimes are, however, not going to drift apart in a significant manner because of strong international harmonisation tendencies. Especially Ukraine and Russia have declared that they aim at harmonizing their legislation with the EU countries. For Ukraine choosing to harmonize with the EU is connected with the plans for joining the union. Byelorussia and Russia have a "union treaty" which apparently means that Byelorussia is going to follow the Russian example.

The EU is now working on coordinating environmental policy with other EU policies (competition, transports etc.) In water policy this development has advanced with a new Water Framework Directive, which takes a combined approach. On the source side, it required that as part of the basic measures to be taken in the river basin, all existing technology-driven source-based controls must be implemented as a first step. But it also sets out a framework for developing further such controls. The framework comprises the development of a list of priority substances for action at EU level, prioritised on the basis of risk; and then the design of the most cost-effective set of measures to achieve load reduction of those substances, taking into account both product and process sources.

EU countries use tax reductions when enterprises invest in environmental friendly technology. Also consumers in many countries prefer environmentally friendly produced products, which makes environmental protection profitable for enterprises. In Russia, Ukraine and Byelorussia the social problems of transition always compete with environmental investments, and when people have to choose between their jobs and better environment, they tend to choose their jobs even when they are worried about the pollution of the environment and the health problems it causes in the long run.

Enterprises need funds for investing in better technology. Privatised former state enterprises have inherited economically dangerous technology, and therefore it is not fair to push all the problems on them. Often the actual polluter is the former Soviet state is not the new private enterprise. The state should not only punish but also support and encourage enterprises for environmental investments. (However) Collecting funds for cleansing and protection of the environment mainly with payments and fines imposed on enterprises may also have negative side effects on the enterprises.

Thus, with a collective objective of meeting the EU standards, the application of regulations/legislation is a distinct economic concern.

Industrial Pollution Projection System[7]

The Industrial Pollution Projection System (IPPS) is a modeling system that uses manufacturing, industry or trade data to generate profiles of industrial pollution for countries, regions or urban areas. Most developing countries have little or no reliable information about local emissions, but most have detailed industry survey information on employment, value-added or output. IPPS converts any of these measures of manufacturing activity into estimates of the associated pollution output. The model is driven by US data, but given the high level of sectoral detail; it is possible to match IPPS Data with the industrial profile of virtually any country.

The IPPS is based on the fact that levels of industrial pollution are closely related to the scale and sectoral composition of industrial activity and to the level of control. The outcomes of the IPPS should be used primarily for estimating a relative change in emissions according to different scenarios of industrial activity rather than drawing conclusions about absolute levels of industrial emissions.

Beniot Laplante and Craig Meisner[8] used the IPPS to assist in identifying which industrial sectors within specific areas of Thailand are the major pol-

[7] Adapted from: "Analytical Support for Cost-Effective Pollution Control," pp. 78-81; "Pollution Prevention and Abatement Handbook," World Bank Group, July 1998.

[8] "Estimating Conventional Industrial Water Pollution in Thailand," Beniot Laplante and Craig Meisner, Consultants, Development Research Group, World Bank, Sept 2001

luters of BOD and TSS. As is shown in the paper, results clearly demonstrate that industrial BOD and TSS emissions are accounted for by a very limited number of industrial sectors: Across regions and provinces, typically 4 or 5 industrial sectors account for more than 80% of total releases of industrial BOD and TSS emissions. These sectors typically include the following ones: Iron and steel; Pulp, paper and paperboard; Distilled spirits; Dairy products; Sugar factories and refineries; and Fish products. Contrary to what is currently perceived, the authors also found that across regions and provinces, firms located in industrial estates contribute only a small percentage of industrial emissions of BOD and TSS. The results obtained in this paper thus suggest that focusing effort and resources on a very limited number of industrial sectors can obtain significant reductions in water pollution.

While the application of the IPPS may be helpful in Phase 2 of the evaluation of short-listed hot spots, within the economic issues score sheet scheme it may be more useful to evaluate relative employment and sectoral circumstances that may be more beneficial in prioritization.

Comparative Risk Assessment[9]

Comparative risk assessment provides a general framework for evaluating environmental problems that affect human health. There are four generally recognized steps in assessing human health risks:

Hazard Identification: the process of describing the inherent toxicity of a chemical based on toxicological data from laboratory or epidemiological studies.
Exposure Assessment: combines the data on the distribution and concentrations of pollution in the environment with information on behaviour and physiology to estimate the amount, or dose, of a pollutant to which humans are exposed.
Dose-response assessment: relates to the probability of a health effect to the dose of pollutant.
Risk Characterization: the last step in risk assessment, combines the expo-

[9] Adapted from: "Comparative Risk Assessment," pp. 45-53; "Pollution Prevention and Abatement Handbook," World Bank Group, July 1998.

sure and dose response assessments to calculate the health risk estimates, such as the number of people predicted to experience a particular disease, for the population of concern.

While epidemiologists typically handle much of this work, the net costs of health effects of increase pollution in a river basin are a distinct economic concern. While it may be difficult to control for confounding factors (such as dietary habits, smoking habits), a "relative risk" approach may yield useful insights in a prioritization exercise.

7.3. Assumptions and Approaches for Establishment of Economic Evaluation Criteria

Hot Spots subject to scoring typically are the point sources of pollution/contamination. Thus, wherever possible, only "direct-effect" criteria will be used.
Impacts isolated to the Baltic Sea will not be considered.
The range of scores will follow the "0 to 100" scheme[10]. This scoring scheme will be adapted to accommodate the existing "0 to 5" scheme, as well as other schemes that will be used in subsequent analysis.
Acknowledged that some criteria are highly correlated. However, they are only being used for ranking purposes only (and not any econometric modeling).
Any costs directly related to pollution and water quality will be evaluated based on criteria identified in preceding sections on "Water Quality Issues" and "Pollution Control Issues." At this point economic issues directly related to "Environmental, Biodiversity & Natural Areas Issues" are considered difficult and problematic to quantify, and thus, will not be considered.
For key economic criteria where no absolute measures are widely available, relative measures will be used.
As a more detailed economic analysis will be undertaken in subsequent phase, evaluation criteria developed should provide directional data for sub-

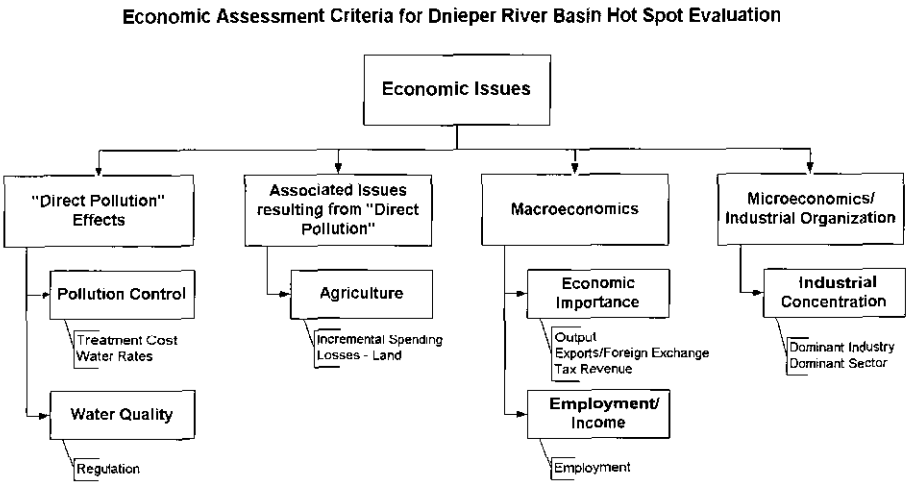
[10] The Global Environment Facility (GEF) - Black Sea Environmental Programme (BSEP) analysis includes land-based pollution sources in each coastal country and identifies "hot spots" which are contributing to negative effects on human health, ecosystems, sustainability and the economies. Of the 35 "hot spots" for which there are already data, 33 have a rating of 3 or more on a scale of 1 to 6 (i.e. a six point scale, similar to the 0 to 5 scale used for this project phase), with 6 being most severe in terms of their threat to public health. Twenty-one of these are rated from 4-6. One of the severe problems is the lack of systematic reporting on the condition of bathing water for the public. (Source: "Helping Save the Black Sea," IAEA/UNDP)

sequent analysis.
Until this point (Sept. 2002), limited regulatory enforcement or fines have been imposed.
It is the goal of the three countries to reach the EU standards outlined in the Water Framework Directive.

Assume Ramsey (i.e. differential) pricing in effect for water services (industrial and potable), and that any increases in treatment costs will be transferred to the consumer (household and industry).
Assume direct health impacts cannot be measured (i.e. direct causality may be difficult to establish).
Assume direct impacts to fishery and tourism cannot be measured (i.e. direct causality may be difficult to establish).
Assume flat rate/normalized cost for agricultural inputs.
Assume no major public expenditures in investment and tourism marketing.
Current mitigative actions are not considered in each country's respective GNP.
Assume direct demographic (i.e. life expectancy, migration and fertility rates) impacts cannot be measured (i.e. direct causality may be difficult to establish).
At this point, no compensation costs have been paid.
No resettlement initiative resulting from water pollution has been undertaken anywhere in the river basin.
Incremental communication costs, such as public education and industrial pollution control, will not be considered.

7.4. *Framework for Evaluation*

The following framework was developed to identify the key criteria for analysis. "Direct Pollution" and "Associated Issues resulting from 'Direct Pollution'" are considered economic issues resulting from direct effects (i.e. technical aspects) of a hot spot. The latter two – "Macroeconomics" and "Microeconomics/Industrial Organization -" have been developed to assess the economic significance (i.e. political aspects) of the hot spot. The role of each criterion will be explained in the rationale (Section 4) below.



7.5. *Rationale for Criteria*

7.5.1. "Direct Pollution" Effects

Criteria developed under this area seek to assess the effect pollution on has on the water supply, as well as incremental costs associated with water treatment.

7.5.2. Potable Water – Incremental Treatment Cost

Additional operating costs, for activities/items such as labour, energy and chemicals (and in some cases alternative sources), are required to treat and purify raw water to potable level. The costs to be considered are only those extra costs that are due to pollution from the hot spots.

7.5.3. Potable Water – Relative Treatment Costs

Depending on levels of pollution, there are different levels of treatment required to meet potable standards. As pollution varies from one area to another, it is anticipated that treatment costs will vary accordingly. This measure will evaluate the per unit treatment cost for potable water in hot spot areas relative to the average per unit treatment costs for the country as whole. It is assumed that relatively higher treatment costs will be transferred to residential users at higher water tariffs.

7.5.4. Industrial Water – Incremental Treatment Costs

Additional operating costs, for activities/items such as labour, energy and chemicals (and in some cases alternative sources), are required to treat and purify raw water to an acceptable level for industrial use. The costs to be considered are only those extra costs that are due to pollution from the hot spots.

7.5.5. Industrial Water – Relative Treatment Costs

Depending on levels of pollution, there are different levels of treatment required to meet industrial usage standards. As pollution varies from one area to another, it is anticipated that treatment costs will vary accordingly. This measure will evaluate the per unit treatment cost for industrial water in hot spot areas relative to the average per unit treatment costs for the country as whole. It is assumed that relatively higher treatment costs will be transferred to industrial users at higher tariffs.

7.5.6. Meeting EU Water Standards

A willingness-to-pay measure. It is assumed that it is all countries' goal to meet the EU standards outlined, for example, in the Water Framework and Pollution Control Directives. However, to meet the all the identified standards, substantial investment will need to be made to reduce the release of all pollutants to acceptable levels into waterways. Where high-levels of discharges are observed, it is expected compliance costs will be high (and likely expensive).

7.6. Associated Issues Resulting from "Direct Pollution"

Agriculture within the basinis dependent on the River's resources. Additional costs are incurred to mitigate negative effects of pollution and in some cases, there is a substantial decline in the productivity.

7.6.1. Agricultural Production - Increased Operating & Investment Cost

Incremental operating costs could be incurred through the application of more fertilizers, the use of more chemicals spray on trees and crops to kill insects and parasites, and additional water use for leaching purposes due

to extra soil salinity caused by pollution. Also, there may be increased investment required to treat raw water to make it safe for irrigation, as well as resolve damages due to pollution. A trend in incremental cost needs to be firmly established.

7.6.2. Loss of Arable Land

The effects of pollution may be irreversible in the short term. Losing arable land means losing the economic potential of that resource. While, it may not be feasible to assess the total value of such a loss, the mere loss of access to land for agricultural purposes can serve as a evaluation criterion. In this case, a relative measure of loss is assessed within a fixed area within the vicinity of a hot spot.

7.7. Macroeconomics

Criteria in this category provide a macro-measure of economic significance. Criteria developed assess significance of the hot spot to the economy and government, and if the area is a strong employer.

7.7.1. Contribution to GNP

This criterion allows for a general appraisal of a hot spot's importance to the national economy in terms of output.

7.7.2. Exports & Foreign Exchange

This criterion allows for a general appraisal of a hot spot's importance to the national economy in terms of exports and foreign exchange earning ability.

7.7.3. Tax Revenue

This criterion allows for a general appraisal of a hot spot's importance to the national government in terms as a source of tax revenue.

7.7.4. Employment

Criterion establishes economic significance on the number of people employed within the hot spot. Ranges were developed based on total population of 33 million residing within the River basin.

7.8. Microeconomics/Industrial Organization

Industries are noted to be key point sources for pollution. These criteria assess industries within hot spot areas that have a dominant share of regional employment, but also play a dominant role in the national sector.

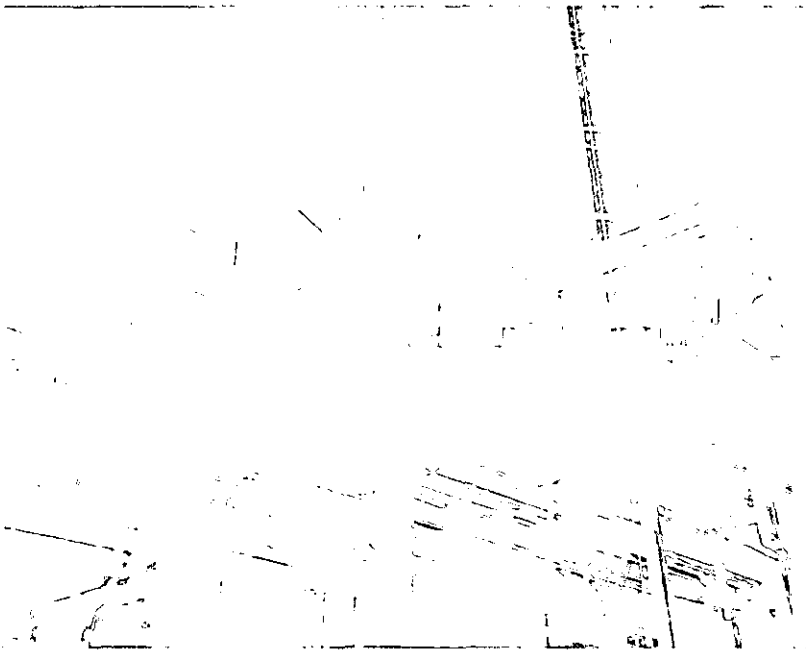
7.8.1. Dominance of Regional Industrial Employment

Within each region, a small number of hot spots may account for a large share of the total industrial employment. This may further be concentrated within a single sector within the hot spot. This criterion assesses if there is one industry/sector that dominates industrial employment within a hot spot. This data is a key input into the IPPS model and should be carefully evaluated for subsequent prioritization.

7.8.2. Dominance of National Industrial Sector Employment

Within each industrial sector, a small number of hot spots may account for a large share of the total sector's employment. Such information is valuable if that sector is noted as relatively a higher polluter compared to other sectors. This criterion assesses if there is one industry within a hot spot dominates industrial employment in a specific national sector. This data is a key input into the IPPS model and should be carefully evaluated for subsequent prioritization.

8.0 DEFINING AN INVESTMENT PORTFOLIO



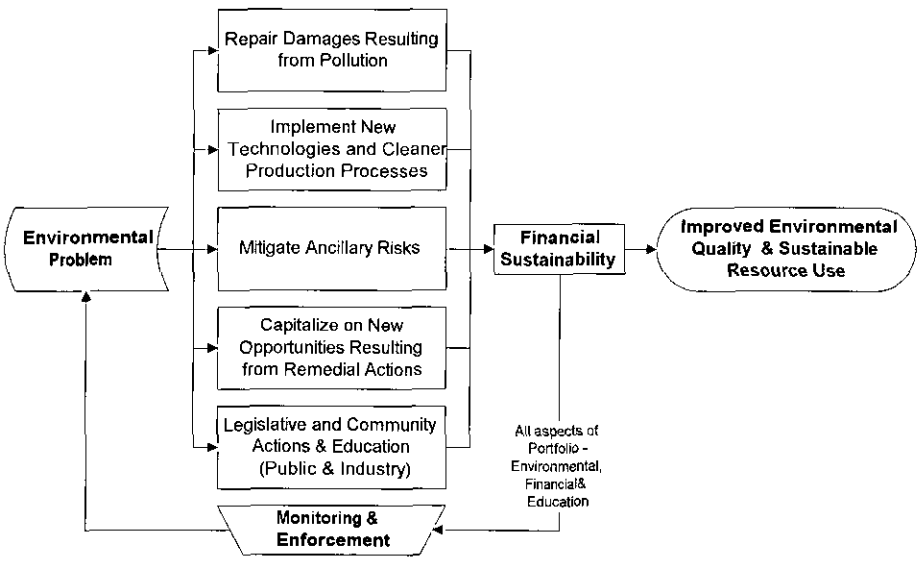
8.1. *What is an Investment Portfolio?*

Within the context of an environmental initiative using a renewable resource, an investment portfolio is a combination of projects and programmes using a variety of financial instruments and funding sources dedicated to mitigating the harmful effects of pollution, and establishing mechanisms and cleaner processes to ensure resource and environment sustainability in the most economically efficient and viable manner.

An investment portfolio is unique to a specific project. Depending on the objectives of a specific initiative, the portfolio approach identifies a number of projects and programmes whose collective implementation reduces the harmful effects of pollution, whilst promoting and deploying economically viable cleaner technologies and processes. The net effect is an integrated approach toward the sustainable use of a renewable resource in an environmentally efficient, yet economically viable manner.

The following characterizes the fundamental elements in developing an (environmental) investment portfolio.

Approach to Developing An Environmental Investment Portfolio



In addressing an environmental problem (and in the case of the Dnieper River Basin, "hot spots"), the portfolio approach seeks to primarily address the problem at hand ("Repair Damages Resulting from Pollution" and "Implement New Technologies and Cleaner Production Process"). Thus, the main cause(s) of pollution are immediately addressed.

However, the portfolio approach goes beyond solving the immediate problem. Investment should also include projects that pose ancillary pollution risks but also to the efficacy and success of mitigating the main cause(s) of pollution. Opportunities for the development of downstream or upstream businesses should be investigated, as their integration would add a valuable element to the financial viability of the overall undertaking. To provide a framework for sustainability, legislation needs to be enacted to protect and reinforce to objectives of such remedial actions, as well as community and (public and industry) education initiatives to reinforce the benefits of the portfolio approach.

To ensure the ultimate sustainability of the portfolio approach, funds and financial mechanisms need to established and allocated to re-invest in the projects and to maintain the benefits of the initial integrated actions. Thus, monitoring and enforcement is a key element to assess ongoing performance of the overall investment portfolio.

The following sections will explore experiences in other jurisdictions, as well as identify some key considerations for developing investment portfolios for the short-listed "hot spots" identified within the Dnieper River Basin Strategic Action Plan.

8.2. Experiences in Other Jurisdictions[11]

Investment Portfolios have been used in other jurisdictions to address a range of environmental problems. Examples include:

- The International Commission for the Danube River Basin (ICDRB)

  The Convention on Cooperation for the Protection and Sustainable Use of the River Danube (Danube River Protection Convention -

[11] Much of the information presented in this section has been paraphrased and adapted from International Agency documents and information sources. Details of documents are identified in the bibliography and (provided) Webforia Internet Directory.

DRPC) was signed in Sofia in June 1994 by eleven Danube River Basin countries1 and the European Commission. The signatories to the Danube Protection Convention, which is based on the UN-ECE framework Convention on the Protection and the Use of Transboundary Watercourses and International Lakes (Helsinki Convention), have agreed on the "conservation, improvement and rational use of surface and groundwater in the catchment area, to control the hazards originating from accidents and to contribute to reducing the pollution loads of the Black Sea from sources in the catchment area." The International Commission for the Protection of the Danube River (ICPDR) is the institutional mechanism to assure interregional coordination of water quality control and pollution reduction measures for efficient implementation of the Danube River Protection Convention. Issues associated with the development of its investment portfolio are discussed in detail below.

- The Caspian Environment Program (CEP)

The Caspian Environment Program (CEP) was launched in April 1995 as a regional program by the five littoral states (Azerbaijan, Iran, Kazakhstan, the Russian Federation, and Turkmenistan) in cooperation with the World Bank Group, UNDP, and UNEP. The program supports measures to improve environmental quality and to efficiently manage the bioresources of the Caspian Sea. Program components focus on developing national policies to reduce the pollution load of the Caspian Basin by clearly defining priorities and preparing investment projects, establishing a system of monitoring regional pollution with data banks, developing a strategy for a sustainable sturgeon yield, improving the management of coastal zone and wetland areas, protecting marine mammals, developing a regional system for self-financing the management of the Caspian's natural resources, and strengthening institutional capacity at the local, national, and regional levels. Issues associated with the development of its investment portfolio are discussed in detail below.

- Mediterranean Environmental Technical Assistance Program (METAP)
  The Mediterranean Environmental Technical Assistance Program (METAP) was established in 1990 by the European Union, UNDP, and the European Investment Bank. The program brings the Mediterranean countries together to cope with and reduce the effects of environmental degradation. METAP's third phase, which begun in 1996, incorporates a decentralized, demand-responsive approach that focuses on three areas: arresting and controlling pollution, integrated management of water and coastal resources, and capacity building. The METAP III portfolio comprises more than seventy-five activities, of which about 25 percent are in Southern Europe and 75 percent are in the Middle East and North Africa. Activities include investment project preparation and national and regional capacity building. Of note, METAP's first two phases mobilized more than $25 million to fund nearly 100 technical assistance activities. METAP III is considerably more ambitious in scope, with provisional costs of $116 million.
- Other examples include: (i) Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) – targeting hot spots in the South China Sea and Yellow Sea/Bohai Large Marine Ecosystem (LME); (ii) Argentina's Provincial Development Projects – portfolios managed by Provincial Executing Units (PEUs); and (iii) The Natural Heritage Trust in Australia – a $1.25 billion (Aus) fund to help local communities manage natural resources and undertake environmental conservation.

As noted, details in the development of the Danube River Basin and Caspian Sea investment Portfolios are discussed below.

8.2.1. International Commission for the Danube River Basin

The Danube River Basin is the heartland of south-central and southeastern Europe. Over the years, significant problems have arisen from discharges of municipal and industrial wastewaters into the tributaries of the Danube and into the Danube itself. Few of the major cities in the Danube Basin had adequate wastewater treatment plants and agriculture, rural housing, and solid waste and sludge disposal. With the lack of adequate infrastructure

and treatment processes, a number of jurisdictions have continued to pollute the Basin.

The Investment Portfolio was developed within the framework of the overall Pollution Reduction Program. The Project Portfolio was designed to give potential (multi- and bilateral) donors an overview of concrete investment possibilities for the rehabilitation of environmental problems in the Danube basin, and facilitate respective co-operation with local governments and recipients.

The starting point for the design of the portfolio was the "Transboundary Analysis" of the Danube Pollution Reduction Programme that identified sources ("Hot Spots") and effects of pollution ("Significant Impact Areas"), as well as the agreed objectives and strategies (identified in "Revised Strategic Action Plan") to reduce this pollution. The identified portfolio give special emphasis to reducing both the nutrient load to the Black Sea and the transboundary effects within the Danube River Basin. Apart from a pool of 420 to 450 high, medium and low priority projects (mostly municipal and industrial) already suggested before in National Reviews, further agricultural and wetland the basin governments suggested rehabilitation projects during the mission.

Projects underway in DRB countries, excluding Austria and Germany, were compiled to develop an inventory of "Actual Investment Portfolios" for water quality and management programmes and projects over the period 1997/98 (prior to adoption of the "Revised Strategic Action Plan").

Actual Investment Portfolios for Water Quality and Management Programmes and Projects in the DRB Countries (Excluding Austria & Germany) by FUNDING SOURCES (Million $US, 2-year Period, 1997/98)				
Funding Sources			**Total Capital Requirements (Millions $US)**	**% of Total Funding**
National Funding Sources	Equity		$190.4	17%
	Environmental Fund		$74.3	7%
	Water Management Fund		$33.1	3%
	Public Loans	Central Budget	$119.8	11%
		Regional Budget	$7.0	1%
		Local Budget	$0.0	0%
	Public Grants	Central Budget	$337.6	30%
		Regional Budget	$18.0	2%
		Local Budget	$2.7	0%
	Commercial Bank Loans		$36.3	3%
	Other		$10.3	1%
International Funding	Grant		$102.7	9%
	Loan		$52.0	5%
Non Specified Funding Portions			$130.2	12%
		Total	$1,114.3	100.0%

Actual Investment Portfolios for Water Quality and Management Programmes and Projects in the DRB Countries (Excluding Austria & Germany) by FUNDING SOURCES (Million $US, 2-year Period, 1997/98)				
Funding Sources			**Total Capital Requirements (Millions $US)**	**% of Total Funding**
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International Funding	Grant		$102.7	9%
	Loan		$52.0	5%
Non Specified Funding Portions			$130.2	12%
		Total	$1,114.3	100.0%

Subsequent review of the full range of projects entailed and evaluation of criteria developed by GEF (Global Environment Facility) and by the ICPDR. Criteria included:

8.2.2. Danube Programme Criteria

- Project is part of/compatible with the Danube Pollution Reduction Programme
- Project meets objectives of revised SAP (Strategic Action Plan, June 1999)
- Country submitting the project has fulfilled its obligations to the ICPDR
- ICPDR supports the project package
- Implementation agency is clearly defined.

8.2.3. GEF Eligibility Criteria

- Financial viability: secured funding, especially for national components (baseline costs)
- Financial and technical sustainability: secured operation and maintenance, no risk
- Transboundary effects
- Innovative approach or process
- Demonstration character
- Incremental costs securing nutrient reduction for the Black Sea clearly identified
- Government endorses project and requests preparation and GEF funds
- Efficiency/technical feasibility: emission and nutrient load reduction in t/year.

8.3. Desired Character of Selected Danube Partnership Projects

Danube basin governments were asked to present project proposals which have innovative character and can be considered as demonstration projects for a period of up to 5 years and a budget of between US$ 300,000 to $5 million per project.

The "Partnership Portfolio" developed identified a list of 73 national projects with regional importance. Projects were categorized into 4 groups: Municipal wastewater treatment (28 projects), wetland restoration (10 projects), industrial pollution reduction (12 projects), and agriculture (23 projects – pilot projects for organic farming). Total investment volume for the selected projects would be more than US$ 400 million, with an average of 50% of funds already being nationally or internationally secured.

8.3.1. Resources for international funding

Outside of the relatively wealthy countries of Austria and Germany, constraints on the availability of domestic funding means and the need for foreign exchange emphasize the need to make the use of external financial resources in the short and medium term.

International financial assistance is typically provided through international financing institutions (IFIs), country specific funds, international foundations or Non-Governmental-Organizations (NGOs), bilateral agreements at government level, as well as by foreign private investors or commercial banks. Assistance is provided either directly or by means of national financial intermediaries for structural and non-structural projects, respectively programs, on the various administration levels of the recipient countries in form of:

- Grants (usually as financial or technical assistance, donations from foundations, trust funds, etc);
- Concessional loans (with preferential terms regarding interest rate, maturity period, grace period, subsidization of interest payments, guarantees);
- Loans at commercial terms (either in form of stand-alone loans, or in form of senior, respectively subordinated loans);
- Guarantees (to facilitate equity investment or commercial bank financing);
- Private investment capital (usually in form of joint venture capital);
- Twinning arrangements (usually in form of knowledge transfer).

The types of actions dealt with in the framework of the revised "Strategic Action Plan 1995-2005" (SAP) include policy and regulation, public awareness, institutional strengthening and capacity building and public and private sector investments in water pollution control and water management - critical elements that need to be integrated into the overall programme to ensure the sustainability of projects.

Accordingly, the financing needs fall into three categories:

1. Funds for preparatory technical activities (identification of problems and what projects)
2. Funds for capital investments related to water pollution control and water management (securing and allocation of funds for specific projects); and
3. Funds for project implementation (actual project undertaking, including monitoring, and legislative and knowledge development).

The overall capital requirements for the implementation of the ICPDR investment program in all DRB countries was identified at about USD $5.7 billion; and are structured as follows: the overwhelming portion is dedicated to the municipal sector (63%); the requirements for the industrial sector are about 14%, for wetland restoration (including cost of land) in the range of 20%; the requirements for agriculture, land use and other projects are less than 3%. In the revised Financial Mechanisms Report (Dec. 1999), allocation of USD $4.3 billion was identified for planned investment (see following tables).

Planned Investment Portfolios for Water Quality and Management Programmes and Projects in the DRB Countries (Excluding Austria & Germany) BY FUNDING SOURCES (*Million $US, Period, Varied by Country 1998-2005*)				
Funding Sources			**Total Capital Requirements (Millions $US)**	**% of Total Funding**
National Funding Sources	Equity		$366.8	9%
	Environmental Fund		$321.9	8%
	Water Management Fund		$194.8	5%
	Public Loans	Central Budget	$300.0	7%
		Regional Budget	$6.3	0%
		Local Budget	$18.2	0%
	Public Grants	Central Budget	$915.4	21%
		Regional Budget	$187.7	4%
		Local Budget	$21.6	1%
	Commercial Bank Loans		$78.5	2%
	Other		$19.0	0%
International Funding	Grant		$41.4	1%
	Loan		$83.7	2%
Non Specified Funding Portions			$1734.1	40%
		Total	$4,289.5	100.0%

8.4. *Concepts and Actions for Financing Implementation in the DRB*[11]

Since domestic and external financial resources are limited and obviously not sufficient to cover even the high priority requirements in the short term outside of Austria and Germany, it was necessary to focus on long-term sustainable funding concepts and innovative financial mechanisms which are based on common basic principles. Therefore, domestic financial resources should be used primarily on leveraging external resources wherever possible to avoid pressure on the usually unfavorable countries' balance of payments. Thus, restricted domestic funding sources should be allocated to the competing projects of a particular sub-sector in utmost accordance with the results of the basin-wide project priority ranking, as carried out in the framework of the Pollution Reduction Program. Emphasis should be placed on meeting funding requirements from revenues generated at the project level (e.g. charges for municipal water and waste water services) before seeking external national or international sources of funding. International funding agencies are predisposed to such domestic "due diligence" prior to any funding request.

[12] This section was adapted from: "Financing Mechanisms for implementation of the Strategic Action Plan (SAP);" Danube Watch - Issue 3/1999.

Domestic private investment, especially within former communist countries, has been constrained by historical barriers to private ownership (including land tenure), a limited domestic banking and financial sector, and the inexperience of potential investors with the types of activities required. Therefore it is essential to modernize and adjust the legal, regulatory and institutional framework to international standards to enable and attract utmost private participation in project funding and operation. This will satisfy most funding bodies' preference for public-private partnerships, especially in undertaking large capital investments.

In the short term, actions are being taken at the national level, such as a confirmation at the governmental level to identify high priority projects. In addition, project databases are being improved and completed and internal discussions on governmental level have been initiated in order to establish the agreed investment portfolios dealing with the most urgent short-term priorities. To improve project investors' net income and internal cash generation, cost covering tariffs (e.g. higher utility charges, user fees) for public services and adequate charges for the utilization of natural resources have to be established gradually.

A reasonably structured set of economic and financial incentives (e.g. to promote a rational utilization of natural resources or to prevent or reduce environmental pollution and degradation of natural environment) has been considered as helpful.

The establishment of standard projects (to develop documented business cases) with country specific "standard funding schemes" could help to improve the "planning certainty" of potential investors. If international funding assistance is needed, funding schemes have to take into account the requirements and procedures of the particular IFIs (and profile requests accordingly). These country specific standards should – among some other aspects – clarify the priority of the particular project and the eligibility of the project for potential national and international funding sources. It could also help to find out the potential range for public grants and loans, for the contribution of relevant public funds and for international co-funding.

Within the existing framework of the ICPDR, a "Project Implementation Facility" (PIF) should be established. The mandate of this group, similar to

the group established under METAP, is to support the work of the ICPDR regarding implementation of investment programs, to assist member countries in preparation of projects for IFIs, and to prepare projects with transboundary environmental benefits for GEF. Last but not least the proposed PIF has to monitor the results and establish itself as the central point of overall portfolio accountability.

A "Project Appraisal Group" (PAG) (i.e. a multidisciplinary expert group), within the existing framework of the ICPDR may examine and endorse investment proposals from the member states which otherwise might not gain the attention of multilateral donors or IFIs. The "PAG" tasks would be to examine the proposal on the relevant environmental performance standards, to check the technical design, the cost calculations and the management plans.

8.4.1. Caspian Environment Programme

The Caspian Environment Programme (CEP) was launched in April 1995 at the request of littoral states – Azerbaijan, Iran, Kazakhstan, Russia and Turkmenistan – with a Joint Mission of the World Bank, the United Nations Development Program (UNDP) and the United Nations Environment Program (UNEP). The overall goal of the Program is to promote sustainable development and management of the Caspian environment over the period of approximately 20 years. Subsidiary goals include:

- Understanding and learning to live with the Caspian water level fluctuations;
- Abatement of existing and prevention of new types of pollution and deterioration of the Caspian environment and its bio-resources;
- Recovery and rehabilitation of those elements of the Caspian environment (including biodiversity) that are degraded and that still have potential for recovery;
- Long term sustainability of environmental quality and bio-resources as assets for the present and future human populations of the region.

8.5. *Pollution Prevention & Clean-up*

The countries in the Caspian region recognise the clear need to mitigate existing pollution and to prevent and limit new contamination. Emphasis has been placed on oil and natural gas - including exploration, exploitation, processing and transport - as an important sector both for new economic development, and as a major polluter in the region in the past. Other key targets include construction or upgrading of wastewater treatment and waste management systems, installation of pollution treatment or control equipment at industrial enterprises, and introduction of pollution prevention and waste minimisation regimes at operating enterprises. In addition, efforts may be directed to the decommissioning and clean up of industrial sites and defunct oil fields where hazardous materials are present.

Development of Priority Investment Portfolios[13]

The main objective of the "Priority Investment Portfolio" component of the Caspian Initiative is to facilitate the identification, selection and preparation of the highest priority projects to address the most urgent environmental problems in the Caspian region. To achieve this, the Joint Mission agencies provided limited funding and technical assistance to develop, on a participatory basis, a portfolio of priority investment projects for each country. The World Bank has provided each Caspian country with suggested criteria for the selection of 2-3 projects for inclusion in the PIP.

The Priority Investment Portfolio Project (PIPP) concept was initiated within the framework of the Caspian Environment Program and as a component of the GEF Project "Addressing Transboundary Environmental Issues in the Caspian Environment Programme". The development objective of the PIPP is to increase the number and quality of priority environmental investments that have a positive transboundary environmental impact and that contribute to economic growth of the Caspian littoral countries.

The primary benefit from the overall CEP and PIPP will be to improve long-term conservation and management of the coastal zone and bio-resources

[13] This section was adapted from content obtained from the CEP Website (www.caspianenvironment.org), and "Environmental Development Co-operation Opportunities - Kazakhstan, Kyrgyz Republic, Turkmenistan, Uzbekistan;" Finnish Environment Institute, Marjukka Hiltunen 1998

of the Caspian basin. It is also expected to increase regional, national and local capacities to manage environmentally related investments in context of a nationally developed agenda. Specific beneficiaries include:

- Coastal and Neighboring Inland Communities will benefit from, for example, pollution prevention, control and remediation, such as the water supply and wastewater treatment; hazardous waste management; capping of flooded oil wells; cleanup of past pollution from oil exploration activities, both on-shore and off-shore; and the preparation of oil spill contingency plans and risk prioritization activities. Neighboring inland and coastal communities will also benefit from lower public health risks brought about by exposure to contaminants, and from increased opportunities for tourism in the long term.

- Fishing and Aquaculture Communities will benefit from investments identified, prepared and implemented related to the recovery of sturgeon stocks and habitat. The Project will also help revive employment opportunities to both individuals and private-sector organizations in the fishing and aquaculture industries.

The Project includes four major Subcomponents:

Subcomponent 1 - Investment Identification and Pre-Preparation

This Subcomponent would support the identification and pre-preparation of investment projects, with emphasis on the financial feasibility and blended funding for implementation. It is expected that in the initial phase of this proposed Project, priority investments may include, but would not be limited to, transboundary environmental issues in two areas:

- Industrial pollution prevention and mitigation directly affecting the Caspian waters (including pollution from the oil industry),

- The recovery of sturgeon stocks and their habitat.

Additional transboundary environmental problems may also be addressed.

Subcomponent 2 - Institutional Strengthening and Training for Project Preparation

It is envisioned that this Subcomponent would address two main areas of institutional strengthening:

- Training of National Focal Points (NFP) and other National personnel on project preparation, project cycle, financing, management and supervision, and

- Training or seminars for NFPs and other senior National personnel on the role of investments in implementing the national policy agenda.

The training on project preparation, financing, management and supervision would be targeted to coincide with pre-preparation activities undertaken as part of the first Subcomponent of this project.

Subcomponent 3 - Matched Small-Grants Program for Transboundary Issues

This Subcomponent will advance implementation of small-scale priority projects as quickly as possible in order to take curative or preventative actions, as well as to develop the capacity for future activities. It is envisioned that small-scale or pilot projects developed under this Subcomponent could complement projects to be identified or pre-prepared under the first Subcomponent of this proposed Project. The small demonstration or pilot projects are in direct support of development of small-scale investment projects. As a result of the demonstration or pilot projects, it is expected that a number (order of 5 to 10) of the projects will develop either into larger scale investment opportunities, or projects that can be replicated in other locations around the Caspian Sea.

This Subcomponent would establish a grant program to support the implementation of small demonstration or pilot projects.

Subcomponent 4 - Project Management

PIPP would ensure transparency and the maximum use of resources by:

- Establishing a Priority Investment Portfolio Project (PIPP) Baku-based Project Manager at the CEP Project Coordination Unit (PCU), who would be responsible for all coordination among the NFPs, Caspian Regional Thematic Centres, and the PCU; and

- Establishing contracts with one lead local consultant on a half-time basis in each Caspian state to assist the NFP in implementation of the project.

Overall, the tentative projected cost of the program for the 1997-2002 period is $101 million, of which IBRD may provide $20 million for investment projects that are identified and prepared under the CEP. The program seeks co-financing from official and private sources for the remainder.

Partnership Opportunities

An effective partnership has been established between the Bank, EU/TACIS, UNDP and UNEP to coordinate efforts on the Caspian within the framework of the CEP. Participation by relevant bilateral programs and private sector organizations (principally oil consortia operating in the Caspian Basin) is being sought to integrate individual environmental programs and activities in the region in order to maximize impact.

Potential donor partners have been approached as the program has been developed, both in concert with the littoral countries and on an ad hoc basis. The primary formal process for coordinating and enlisting bilateral donor support is through the Environment for Europe Environmental Action Programme Project Preparation Committee (EAP/PPC).

It is also recognized that a key area of partnership is the development of co-ordinated legislation, laws and regulations, and organizational framework for the development of an integrated coastal zone management system, all of which are critical components to the sustainable development of the region.

8.6. *Public Private partnerships*[14]

With the implementation of Agenda 21 in 1992, here was the increased recognition that the private sector has a powerful contribution to offer at three levels:

- By improving corporate environmental performance throughout business and industry;
- By creating, through a policy dialog with government, the right framework conditions; and
- By becoming actively involved in specific projects that support sustainable development goals.

Though challenging, and sometimes yielding non-optimal solutions, there have been areas where such partnerships are natural and, through careful planning and legislated frameworks, can be implemented efficiently.

Water, waste, and energy services in developing countries have traditionally been the exclusive responsibility of public authorities. But these agencies cannot, and in many cases have not been able to, on their own, meet the continually expanding demand for services.

Traditionally, they are providing such services at prices barely above break-even that they lack the funds to improve and develop services. Hence, they have difficulties identifying and affording new, eco-efficient technologies. They lack the skills to manage the services efficiently. They can barely cope and are stuck with antiquated inefficient technologies.

The private sector traditionally has financial, technological, and management resources as well as a proven track record of providing services at lower production costs, delivering services more efficiently, maintaining capital equipment at a higher standard, making decisions faster than public bureaucracies, and offering consumers greater choice.

[14] This section is adapted from: "Bridges to Sustainability - Engaging The Private Sector Through Public-Private Partnerships," The Honourable J. Hugh Faulkner, P.C., Executive Chairman Sustainable Project Management, UNDP, 1997

So, why not privatize the services? Is it suitable to privatize such utilities? Certainly, this is an option, but it has its limitations. Governments need to remain involved in providing these essential services. Their involvement guarantees a degree of public accountability, preserves the public service philosophy, ensures the protection of all sections of society, and underwrites the delivery of social and environmental, as well as economic benefits; that is, it meets sustainable development as well as purely financial goals. Also, through subsidization, it also manages to keep service delivery cost low.

In seeking the "middle-ground," the public-private partnership (PPP) model where the public and private sectors assume co-ownership and co-responsibility for providing high-quality city services is an alternative to both a public-sector monopoly (traditionally delivering substandard services) and full privatization.

The UNDP, in its support for PPP initiative in concert with Sustainable Project Management (SPM, initiated in 1994), supports the creation of such new enterprises. PPP enterprises pool the best features of the two sectors: the dynamism, access to finance, knowledge of technologies, managerial efficiency, and entrepreneurism of the private sector with the social responsibility, environmental awareness, local knowledge, and job creation concerns of the public.

It is recognized that community participation (and education) is a central element, from a project's conception to its management. Capacity building, training local people to adapt, develop, and operate clean technologies is another key component.

To ensure the effective deployment of PPP, every SPM-UNDP has to meet the clear and specific criteria:

- be demand-driven and address a priority problem;
- fully involve the public and private sectors from the outset;
- demonstrate a strong potential for attracting private-sector participation, including the possibility of reasonable profit ability;
- use eco-efficient technologies;
- provide an opportunity for improving local social conditions

through job creation, training, and overall improvement of city services and urban living conditions;

- respect local cultural values and established traditions; and
- involve local stakeholders, non-governmental organizations (NGOs), and community groups in its development.

Private-sector partners must also meet sharply defined criteria before they qualify to be involved in projects. They must:

- be willing to contribute to the cost of the project's feasibility studies from the outset;
- be prepared to invest in the new company when it is formed;
- preferably have experience operating the eco-efficient technologies to be used by the new company;
- in the case of international firms, have experience operating in a developing country;
- have the support of its own government's development agency; and
- strongly support and advocate eco-efficiency and local participation.

Such projects are focused on the areas of water and sanitation, waste management, energy services, and the eco-efficient use of natural resources, and they address a range of issues - water pollution, inadequate water supply, insufficient sanitation infrastructure, excessive waste of natural resources in industrial production processes, inadequate or nonexistent waste management procedures, environmentally unsound technologies, lack of environmental education, lack of environmental considerations in development initiatives, and ineffective and wasteful energy sources and technologies. The intention is that they are replicable, that is, they address problems of common concern to other cities in the region, and even beyond, and can be easily transplanted there. This approach has been deployed in the 3rd Phase of METAP. And in the case of the Dnieper River Basin, such approaches can be deployed in lower priority hot spots.

The support for PPP has been picking up support from other international agencies. The following is an excerpt from a recent World Bank Group report, on their support for the water and sanitation projects.

WBG Assistance to Infrastructure: Rethinking future possibilities

This note has been prepared on November 2, 2000 by the following team in alphabetical order: Philippe Dongier, John Flora, Michael Hamaide, Dominique Lallement, Frannie Leautier, , Christine Kessides, Lee Travers

Water and sanitation (page 6):

The urban water sector portfolio has recovered after a revamping that moved to a model of support for private sector involvement in countries where public sector institutions were proven failures. Rural water continues to be a key sectoral component in rural development projects as well as in stand-alone operations. Loan approvals doubled between FY98 and FY00, with the prospect of remaining at about the $1 billion level attained in FY00.

- *Urban water and sanitation lending seeks to catalyze long-term private sector investment and management. To the degree this strategy succeeds, the Bank will face a declining market in the prime business target of private concessions—the major urban areas—although demand for technical assistance/advisory work may continue. These cities have been our biggest customers. Public sector financing needs will remain large in smaller urban areas, towns, and rural areas. Few of these have access to the long term financing needed in water and sanitation.*
- *Shifting the portfolio to focus on towns and smaller urban areas will force a corresponding shift in lending instruments. Project financing is too costly for the Bank in these areas. Instead, we need to develop policy-based loans. Progress in policy in most countries has remained slow and uncertain, limiting the scope for such investments.*
- *The challenge for the sector is to practice selective lending, with higher incentive reform conditions up-front and fewer behavioural covenants. This will allow us to put into practice performance-based lending for the water and sanitation sector. KM work underway targets the small town/small urban environment, seeking to clarify issues that are key to success or failure in such systems. Results are expected this FY, which will allow us to rethink conditionality, and*

design performance-based lending. However, sector professionals harbour no illusions that this will result in a burst of new lending. Developing this line of lending will require continued intensive sector dialogue on a country-by-country basis. That countries have a demand for the funds is clear. Their ability to resolve quickly critical policy problems is less clear.

- *We anticipate that the non-sector specific water and sanitation lending will continue at a good pace. Our goal is to provide inputs to those loans that will ensure good policy practice.*

In summary, for the water and sanitation sector, the WBG strategy is to move away from lending to large city W&S systems, shifting to small towns and rural areas for middle-income countries. For IDA countries, the strategy is to focus on strategic lending (esp. IDA) to attract private management and operations/maintenance in large urban systems of poorer or high-risk countries. Among the key instruments we will consider are incentives to attract the private sector to tackle issues of services to the poor, as well as direct provision of water and sanitation services to the poor through the public sector where private investment in not forthcoming. This has been the focus of recent urban water lending in Africa, Central Asia, MNA, and is becoming the focus of lending development work in South Asia. The Portfolio Improvement Plan (PIP) under execution for more than a year in the water and sanitation sector already has tested the operationalization of this approach.

8.7. Framework for Portfolio Development

Each hot spot identified in the Strategic Action Plan will have unique pollution, industrial mix and community characteristics. Thus, each will have its own unique investment portfolio.

In developing a portfolio for a specific hot spot, it is recommended that the framework identified earlier in this chapter (Approach to Developing An Environmental Investment Portfolio) be pursued. The prescribed framework combines the collective learning from the implementation of related

projects within former Eastern Bloc/communist countries (e.g. the development of the Danube Investment Portfolios), as well as the preferred direction identified by international agencies.
There are a number of issues/opportunities that should be considered in the design of an investment portfolio for an individual hot spot.

- Pursuit of overall objective of pollution reduction/minimization/elimination in the most economically efficient and sustainable manner
- The approach could consider Vodokanals and Industries as elements of the same portfolio.
- Complete audit of existing and potential polluting sources within hot spot, as well as industries/locations that can be negatively affected from any remedial measures.
- "Due diligence" for pursuing local solutions – technology and finances – need to be demonstrated (and documented)
- Gradual implementation of cost covering tariffs (e.g. higher utility charges, user fees) for public services and adequate charges for the utilization of natural resources.
- Implementation of economic and financial incentives (e.g. to reduce environmental pollution and degradation of natural environment, and adoption of cleaner technologies) to industries and water users.
- Development of range of funding mechanisms – establishment of environmental and water management funds, as well as ability to implement dedicated taxes – established at national level. Detailed programme/project monitoring – efficacy and financial viability (and enforcement, where appropriate) – a cornerstone of accountability.
- As noted before: "Domestic private investment, especially within former communist countries, has been constrained by historical barriers to private ownership (including land tenure), a limited domestic banking and financial sector, and the inexperience of potential investors with the types of activities required. Therefore it is essential to modernize and adjust the legal, regulatory and institutional framework to international standards to enable and attract utmost private participation in project funding and opera-

tion." Access to capital would be a key component of such reforms.

- Institutional Reform: Clear and proper definition of the roles of and between the public sector, the private sector and communities
- Public-Private Partnerships need to be explored, and pursued where appropriate. The environment to foster such relationships will need to be undertaken through the modernization of the legal, regulatory and institutional frameworks of each of the riparian countries.
- Co-coordinated legislation, laws and regulations, and organization framework for the development of a water basin-wide management system – critical for sustainable development.
- Principles of Economic Viability: (i) choice of technologies guided by willingness and capacity to pay for the service; (ii) tariff/user fee policy for operation & maintenance, and upgrade and replacement of equipment; (iii) portfolios' capacity to ensure the security of replacement funds (as defined by financial sustainability).
- Community participation: Involvement of local actors throughout project cycle (and lifecycle of investment portfolio) – Full knowledge (including educational initiatives) of the implications and constraints in terms of quality of service, cost of investment (community contribution), tariffs and user fees, and management complexity.
- Technology, Process and Knowledge Transfer – ability to adapt learning from projects within the portfolio to projects in lower-priority hot spots.
- Establishment of a central national body to oversee the securing, deployment and accountability of funds for projects within an investment portfolio.

8.7.1. Investment Portfolio Worksheets

A series of Investment Portfolio worksheets have been prepared (see attached spreadsheet). They were developed to complement the subsequent feasibility analyses of selected hot spots.

Three summary sheets have been prepared:

- Actual Investment Portfolios – those activities that have been undertaken over the period 1999 to 2000 (i.e., until the point of acceptance of the prescribed Strategic Action Plan).
- Planned Investment Portfolios – those projects that were planned over the next five (5) years (2001 to 2005), independent of the Strategic Action Plan
- Incremental Investment Portfolios – additional activities/projects that would be required to attain pollution reduction targets identified in the Strategic Action Plan over the period 2006 to 2015.

The approach adopts the stance that current projects are part of an existing portfolio should be treated as such. Thus, such an adoption of the investment portfolio approach will provide a vital linkage to all phases of any mitigative actions in the River Basin.

The approach is versatile as it can be adapted for an individual hot spot and rolled up into an individual country's investment portfolio.

Project categories were developed based on items identified in scoring schemes for water quality and pollution control, as well as sectors/habitats identified in the literature.

A range of financial instruments has been identified. Compared to Danube portfolios, categories have been allocated toward implementation of user feeds and dedicated revenues (from taxes and similar instruments), as well as explicit identification of "private industry funding." The latter has been included as a means of assessing the public-private partnership potential of a specific portfolio element.

8.7.2. Using the Worksheets – Approach and Terminology

For each individual Hot Spot, the "Individual Hot Spot Worksheet" needs to be completed. For the timeframes identified, "Actual Investments," "Planned Investments" and "Incremental Investments," by type of project have to be completed. Twelve (12) types of projects have been identified.

1. Municipal Waste Water / Treatment – water (for distribution – public and industrial) and wastewater treatment (for discharge) undertaken by Municipal treatment facility (Vodocanals).
2. Industrial Waste Water / Treatment – water and wastewater treatment undertaken for Industrial usage only.
3. Water Supply / Resources – projects undertaken to protect the integrity and quality of water supply/resources used as intake for treatment for subsequent public and industrial distribution.
4. Agriculture, Industrial, Solid Waste water pollution – mitigation activities to reduce contaminants generated from agricultural, industrial and solid waste facility discharges
5. Industrial Production Processes – activities using cleaner and/or less water intensive technologies which ultimately reduce contaminants in industrial discharges
6. Agricultural Water Utilization (including irrigation) – projects that rationalize agricultural water use and promote conservation and better containment of waste.
7. Wetlands & Protected Areas – any undertakings to reduce risks, from water pollution, to these environmentally sensitive areas.
8. Fishing & Aquaculture – activities that improve the sustainability of these activities and reduction of risk to fish stocks.
9. Water-related Recreational – Water-based (directly and/or proximity) projects undertaken within the hot spots to enhance the areas recreational and/or tourism appeal.
10. Other Structural / Non-specified – activities that involve a construction/physical plant component that cannot be classified in the previous nine (9) categories, but are directly involved in mitigating pollution and/or improving water conservation.

11. Water Quality Control Programmes – monitoring, measurement, regulatory and enforcement activities targeted at improving water quality.
12. *Water Sector Related Studies – research projects, not directly related with monitoring, that evaluate opportunities for pollution control and mitigation by specific industries/businesses that have water intensive processes (including vodocanals).*

Should any of these projects be or planned to be undertaken, the number of projects related to each of the twelve (12) types of projects, the total funding dedicated/required and the specific funding sources need to be identified. Referring to the worksheet, for each project type, by "Actual," "Planned" and "Incremental" investment:

- Number of projects – the total number of projects within a hot spot directly attributable to a specific project type.
- Total Capital Requirements – total (sum of) funding required for the total number of projects for a specific project type.
- National Funding Sources – funding obtained within country from a variety of public, private and dedicated sources, through a variety of funding instruments (e.g. grants and loans) specifically dedicated to the total number of projects by project type.
- International Funding – by funding sources, grants and loans provided by international funding agencies for the total number of projects by project type.
- Non-specified Funding Portfolios – funding sources that are neither nationally or international agency-based. Typically, obtained from international corporations and investment funds.

Once these sheets are completed for each hot spot, they are rolled up, by individual riparian country, by the summary sheets. Summary sheets by project type and financial instruments are automatically calculated.

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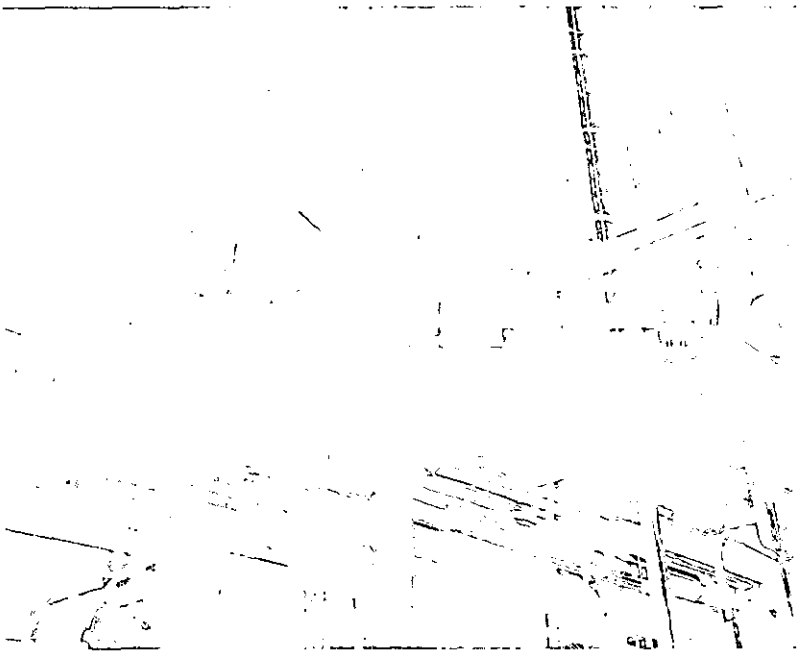
ANNEX - 1



WORK SHEET – POLLUTION CONTROL ISSUES

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
1.0	**General**			
1.1a	If the Hot Spot is a municipal waste water treatment plant, what is the total average daily flow discharged to the river? 5 – more than *100,000* m^3/d 4 – > 50,000 but less than 100000 m^3/d 3 – > 10,000 but less than 50,000 m^3/d 2 – > 5,000 but less than 10,000 m^3/d 1 – > 1,000 but less than 5,000 m^3/d 0 – equal to or less than 1,000 m^3/d			
1.1b	If the Hot Spot is an industry, what is the normal total effluent flow rate ? 5 – more than 2500 m^3/day 4 – 2000 – 2500 m^3/day 3 – 1000 – 1999 m^3/day 2 – *500* –999 m^3/day 1 – 50 – 499 m^3/day 0 – less than 50 m^3/day			
1.2	What percentage of the total daily effluent discharged receives treatment? 5 – < 20% 4 – < 40 to 20% 3 – < 60 to 40% 2 – < 80 to 60% 1 – < 100 to 80% 0 – 100%			
1.3	What is dilution ratio, low river flow:total daily wastewater discharge rate? 5 – less than 5:1 4 – more than 5:1 but less than 10:1 3 – more than 10:1 but less than 20:1 2 – more than 20:1 but less than 40:1 1 – more than 40:1 but less than 80:1 0 – more than 80:1			
1.4a	If the Hot Spot is a municipal wastewater treatment plant, what is daily flow contribution from industries (not			

Hot Spot Evaluation: Pollution Control			
	Hot Spot: **Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**
	municipal sanitary sewage),? 5 – > 40% 4 – > 30% but less than 40% 3 – > 20% but less than 30% 2 – > 10% but less than 20% 1 – > 0 but less than 10% 0 – 0%, no flow contribution		
1.4b	If the Hot Spot is an industry, what is daily flow contribution from secondary industries (dischargers not under the control of the point source industry)? 5 – > 40% 4 – > 30% but less than 40% 3 – > 20% but less than 30% 2 – > 10% but less than 20% 1 – > 0 but less than 10% 0 – 0%, no flow contribution		
1.5	What is the method of discharge of treated or untreated effluent? 5 – single surface outfall 4 – multiple surface outfall 3 – submerged, low river flow 2 – submerged, high river flow 1 – submerged outfall / diffuser		
1.6	What is the frequency of discharge? 5 – continuous 4 – nearly continuous (more than 5 days per week) 3 – intermittent (once per week) 2 – intermittent (once per month) 1 – intermittent (once per quarter) 0 – intermittent (once per year or less)		
1.7	What is the frequency of flow monitoring? 5 – never 4 – intermittent (few points of		

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
	discharge) 3 – intermittent (most points of discharge) 2 – continuous (few points of discharge) 1 – continuous (some points of discharge) 0 – continuous (all points of discharge)			
1.8	Which discharges are sampled? 5 – none 4 – few points of discharge 3 – most points of discharge 2 – few points of discharge 1 – some points of discharge 0 – all points of discharge			
1.9	What is the type/frequency of sampling and analysis? 5 – none/never 4 – monthly (or less frequent) grab samples and analyses 3 – weekly grab samples and analyses 2 – daily grab samples and analyses 1 – continuous sampling, laboratory analyses 0 – continuous sampling, on–line analyses			
1.10	Is the effluent from all discharge points subject to flow controls. 5 – no controls on any all discharge points 3 – some controls on some discharge points 1 – some controls on all discharge points 0 – all discharge points controlled			
2.0	**Wastewater Characteristics**			
2.1a	What is the BOD_5 concentration of the discharge?			

Hot Spot Evaluation: Pollution Control			
	Hot Spot: **Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**
	5 – > 240 mg/l 4 – 120 mg/l to < 240 mg/l 3 – 60 mg/l to < 120 mg/l 2 – 30 mg/l to < 60 mg/l 1 – 15 mg/l to < 30 mg/l 0 – < 15 mg/l		
2.1b	If BOD_5 is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high BOD_5 2 – effluent has moderate BOD_5 1 – effluent has low BOD_5 0 – no BOD_5		
2.2a	What is the COD concentration of the discharge? 5 – > 400 mg/l 4 – 200 mg/l to < 400 mg/l 3 – 100 mg/l to < 200 mg/l 2 – 50 mg/l to < 100 mg/l 1 – 20 mg/l to < 50 mg/l 0 – < 20 mg/l		
2.2b	If COD is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high COD 2 – effluent has moderate COD 1 – effluent has low COD 0 – no COD		
2.3a	What is the total suspended solids (TSS) concentration of the discharge? 5 – > 240 mg/l 4 – 120 mg/l to < 240 mg/l 3 – 60 mg/l to < 120 mg/l 2 – 30 mg/l to < 60 mg/l 1 – 15 mg/l to < 30 mg/l 0 – < 15 mg/l		
2.3b	If TSS is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high TSS		

Hot Spot Evaluation: Pollution Control			
	Hot Spot: **Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**
	2 – effluent has moderate TSS 1 – effluent has low TSS 0 – no TSS		
2.4a	What is the total dissolved solids (TDS) concentration of the discharge? 5 – > 1000 mg/l 4 – 800 mg/l to < 1000 mg/l 3 – 700 mg/l to < 800 mg/l 2 – 600 mg/l to < 700 mg/l 1 – 500 mg/l to < 600 mg/l 0 – < 500 mg/l		
2.4b	If TDS is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high TDS 2 – effluent has moderate TDS 0 – effluent has low TDS		
2.5a	What is the Total Phosphorus concentration of the discharge? 5 – > 5.0 mg/l 4 – 4.0 mg/l to < 5.0 mg/l 3 – 3.0 mg/l to < 4.0 mg/l 2 – 2.0 mg/l to < 3.0 mg/l 1 – 1.0 mg/l to < 2.0 mg/l 0 – < 1.0 mg/l		
2.5b	If Total Phosphorus is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high phosphorus 2 – effluent has moderate phosphorus 1 – effluent has low phosphorus 0 – no phosphorus		

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
2.6a	What is the Ammonium Nitrogen (NH_4–N) concentration of the discharge? 5 – > 16.0 mg/l 4 – 12.0 mg/l to < 16.0 mg/l 3 – 8.0 mg/l to < 12.0 mg/l 2 – 4.0 mg/l to < 8.0 mg/l 1 – 2.0 mg/l to < 4.0 mg/l 0 – < 2.0 mg/l			
2.6b	If NH_4–N is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high NH_4–N 2 – effluent has moderate NH_4–N 1 – effluent has low NH_4–N 0 – no NH_4–N			
2.7a	What is the Nitrate Nitrogen (NO_3–N) concentration of the discharge? 5 – > 30.0 mg/l 4 – 25.0 mg/l to < 30.0 mg/l 3 – 20.0 mg/l to < 25.0 mg/l 2 – 15.0 mg/l to < 20.0 mg/l 1 – 10.0 mg/l to < 15.0 mg/l 0 – < 10.0 mg/l			
2.7b	If NO_3–N is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high NO_3–N 2 – effluent has moderate NO_3–N 1 – effluent has low NO_3–N 0 – no NO_3–N			
2.8a	What is the Nitrite Nitrogen (NO_2–N) concentration of the discharge? 5 – > 0.5 mg/l 4 – 0.4 mg/l to < 0.5 mg/l 3 – 0.3 mg/l to < 0.4 mg/l 2 – 0.2 mg/l to < 0.3 mg/l 1 – 0.1 mg/l to < 0.2 mg/l 0 – < 0.1 mg/l			
2.8b	If NO_2–N is not measured, is it likely, based on effluent characteristics, that:			

Hot Spot Evaluation: Pollution Control			
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**
	3 – effluent has high NO_2–N 2 – effluent has moderate NO_2–N 1 – effluent has low NO_2–N 0 – no NO_2–N		
2.9a	What is the concentration of Oil Products (mineral or synthetic) in the discharge? 5 – > 16.0 mg/l 4 – 8.0 mg/l to < 16.0 mg/l 3 – 4.0 mg/l to < 8.0 mg/l 2 – 2.0 mg/l to < 4.0 mg/l 1 – 1.0 mg/l to < 2.0 mg/l 0 – < 1.0 mg/l		
2.9b	If oil products are not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high oil product conc. 2 – effluent has moderate oil product conc. 1 – effluent has low oil product conc. 0 – no oil product conc.		
2.10 a	What is the concentration of Persistent Organic Pollutants (POPs) in the discharge? (Dibutylphthalate, Diethylhexylphthalate, Other Phthalates, *Dechlorane (mirex)*, *Polychlorinated* Biphenyl (PCB), Polybrominated Biphenyl (PBB), Dichlorodiphenyltrichloroethane (DDT) and Metabolites) 5 – MDLs exceeded by 160% and higher 4 – MDLs exceeded by 80% 3 – MDLs exceeded by 40% 2 – MDLs exceeded by 20% 1 – above MDLs 0 – less than method detection limits (MDLs)		
2.10	If POPs are not measured, is it likely that:		

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	Country:	Region:	Id #
No.	Issue	Raw Score	Supporting Comments or Explanations	
b	3 – POPs are present in the effluent in high concentrations 2 – POPs are present in the effluent in moderate concentrations 1 – POPs are present in the effluent in low concentrations 0 – POPs are not present			
2.11 a	What is the concentration of Phenols in the discharge? 5 – > 0.16 mg/l 4 – 0.08 mg/l to < 0.16 mg/l 3 – 0.04 mg/l to < 0.08 mg/l 2 – 0.02 mg/l to < 0.04 mg/l 1 – 0.01 mg/l to < 0.02 mg/l 0 – < 0.01 mg/l			
2.11 b	If Total Phenols are not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high phenols 2 – effluent has moderate phenols 1 – effluent has low phenols 0 – no phenols			
2.12 a	What is the concentration of Polyaromatic Hydrocarbons (PAH) in the discharge? (Naphthalenes, Phenanthrenes, Pyrenes, Chrysene or Triphenylene or Benzanthracene, Benzopyrenes or Perylene or Benzofluoranthenes) 5 – > 0.16 mg/l 4 – 0.08 mg/l to < 0.16 mg/l 3 – 0.04 mg/l to < 0.08 mg/l 2 – 0.02 mg/l to < 0.04 mg/l 1 – 0.01 mg/l to < 0.02 mg/l 0 – < 0.01 mg/l			
2.12 b	If PAHs are not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high PAHs 2 – effluent has moderate PAHs 1 – effluent has low PAHs 0 – no PAHs present			
2.13 a	What is the concentration of Fats & Oils (animal or vegetable) in the discharge? 5 – > 150 mg/l 4 – 75.0 mg/l to < 150.0 mg/l			

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
	3 – 25.0 mg/l to < 75.0 mg/l 2 – 5.0 mg/l to < 25.0 mg/l 1 – 1.0 mg/l to < 5.0 mg/l 0 – < 1.0 mg/l			
2.13 b	If not measured, is it likely that: 3 – effluent has high levels of fats & oils 2 – effluent has moderate levels of fats & oils 1 – effluent has low levels of fats & oils 0 – no fats & oils present			
2.14 a	What is the concentration of Iron (Fe) in the discharge? 5 – > 1.5 mg/l 4 – 1.2 mg/l to < 1.5 mg/l 3 – 0.9 mg/l to < 1.2 mg/l 2 – 0.6 mg/l to < 0.9 mg/l 1 – 0.3 mg/l to < 0.6 mg/l 0 – < 0.3 mg/l			
2.14 b	If Iron is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high Iron 2 – effluent has moderate Iron 1 – effluent has low Iron 0 – no Iron present			
2.15 a	What is the concentration of Copper (Cu) in the discharge? 5 – > 0.13 mg/l 4 – 0.11 mg/l to < 0.13 mg/l 3 – 0.09 mg/l to < 0.11 mg/l 2 – 0.07 mg/l to < 0.09 mg/l 1 – 0.05 mg/l to < 0.07 mg/l 0 – < 0.05 mg/l			
2.15 b	If Copper is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high Copper 2 – effluent has moderate Copper 1 – effluent has low Copper 0 – no Copper present			
2.16	What is the concentration of Zinc (Zn) in			

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
a	the discharge? 5 – > 0.11 mg/l 4 – 0.09 mg/l to < 0.11 mg/l 3 – 0.07 mg/l to < 0.09 mg/l 2 – 0.05 mg/l to < 0.07 mg/l 1 – 0.03 mg/l to < 0.05 mg/l 0 – < 0.03 mg/l			
2.16 b	If Zinc is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high Zinc 2 – effluent has moderate Zinc 1 – effluent has low Zinc 0 – no Zinc present			
2.17 a	What is the concentration of Nickel (Ni) in the discharge? 5 – > 0.11 mg/l 4 – 0.09 mg/l to < 0.11 mg/l 3 – 0.07 mg/l to < 0.09 mg/l 2 – 0.05 mg/l to < 0.07 mg/l 1 – 0.03 mg/l to < 0.05 mg/l 0 – < 0.03 mg/l			
2.17 b	If Nickel is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high Nickel 2 – effluent has moderate Nickel 1 – effluent has low Nickel 0 – no Nickel present			
2.18 a	What is the concentration of Chromium (Cr) in the discharge? 5 – > 0.16 mg/l 4 – 0.14 mg/l to < 0.16 mg/l 3 – 0.12 mg/l to < 0.14 mg/l 2 – 0.10 mg/l to < 0.12 mg/l 1 – 0.08 mg/l to < 0.10 mg/l 0 – < 0.08 mg/l			
2.18 b	If Chromium is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high Chromium			

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
	2 – effluent has moderate Chromium 1 – effluent has low Chromium 0 – no Chromium present			
2.19 a	What is the concentration of Cadmium (Cd) in the discharge? 5 – > 0.010 mg/l 4 – 0.008 mg/l to < 0.010 mg/l 3 – 0.006 mg/l to < 0.008 mg/l 2 – 0.004 mg/l to < 0.006 mg/l 1 – 0.002 mg/l to < 0.004 mg/l 0 – < 0.002 mg/l			
2.19 b	If Cadmium is not measured, is it likely, based on effluent characteristics, that: 3 – effluent has high Cadmium 2 – effluent has moderate Cadmium 1 – effluent has low Cadmium 0 – no Cadmium present			
2.20 a	What is the concentration of Mercury (Hg) in the discharge? 5 – > 0.010 mg/l 4 – 0.008 mg/l to < 0.010 mg/l 3 – 0.006 mg/l to < 0.008 mg/l 2 – 0.004 mg/l to < 0.006 mg/l 1 – 0.002 mg/l to < 0.004 mg/l 0 – < 0.002 mg/l			
2.20 b	If Mercury is not measured, is it likely, based on effluent characteristics, that: 5 – effluent has very high Mercury 4 – effluent has high Mercury 3 – effluent has moderate Mercury 2 – effluent has low Mercury 1 – effluent has very low Mercury 0 – no Mercury present			
2.21 a	What is the concentration of Lead (Pb) in the discharge? 5 – > 0.22 mg/l 4 – 0.19 mg/l to < 0.22 mg/l 3 – 0.16 mg/l to < 0.19 mg/l			

Hot Spot Evaluation: Pollution Control			
	Hot Spot: **Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**
	2 – 0.13 mg/l to < 0.16 mg/l 1 – 0.10 mg/l to < 0.13 mg/l 0 – < 0.10 mg/l		
2.21 b	If Lead is not measured, is it likely, based on effluent characteristics, that: 5 – effluent has very high Lead 4 – effluent has high Lead 3 – effluent has moderate Lead 2 – effluent has low Lead 1 – effluent has very low Lead 0 – no Lead present		
2.22	Is there a potential, confirmed or suspected, that radioisotopes (Ce137, Sr90) are present in the effluent above background levels? 3 –very likely 2 – likely 1 – possible but unlikely 0 – not possible		
3.0	**Wastewater Loadings**		
3.1a	Estimate BOD_5 as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%		
3.1b	If BOD_5 is not measured, is it likely that: 3 – effluent has high BOD_5 loading 2 – effluent has moderate BOD_5 loading 1 – effluent has low BOD_5 loading 0 – no BOD_5 loading		
3.2a	Estimate COD as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1%		

Hot Spot Evaluation: Pollution Control			
	Hot Spot: **Country:**		**Region:** **Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**
	2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%		
3.2b	If COD is not measured, is it likely that: 3 – effluent has high COD loading 2 – effluent has moderate COD loading 1 – effluent has low COD loading 0 – no COD loading		
3.3a	Estimate Total Suspended Solids (TSS) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%		
3.3b	If TSS is not measured, is it likely that: 3 – effluent has high TSS loading 2 – effluent has moderate TSS loading 1 – effluent has low TSS loading 0 – no TSS loading		
3.4a	Estimate Total Dissolved Solids (TDS) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%		
3.4b	*If TDS is not measured, is it likely that:* 3 – effluent has high TDS loading 2 – effluent has moderate TDS loading 1 – effluent has low TDS loading 0 – no TDS loading		
3.5a	Estimate Total Phosphorus as a percentage of the loading at the national		

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
	boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.5b	If phosphorus is not measured, is it likely that: 3 – effluent has high phosphorus loading 2 – effluent has moderate phosphorus loading 1 – effluent has low phosphorus loading 0 – no phosphorus loading			
3.6a	Estimate Ammonium Nitrogen (NH_4–N) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.6b	If NH_4–N is not measured, is it likely that: 3 – effluent has high NH_4–N loading 2 – effluent has moderate NH_4–N loading 1 – effluent has low NH_4–N loading 0 – no NH_4–N loading			
3.7a	Estimate Nitrate Nitrogen (NO_3–N) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5%			

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	Country:	Region:	Id #
No.	Issue	Raw Score	Supporting Comments or Explanations	
	3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.7b	If NO_3–N is not measured, is it likely that: 3 – effluent has high NO_3–N loading 2 – effluent has moderate NO_3–N loading 1 – effluent has low NO_3–N loading 0 – no NO_3–N loading			
3.8a	Estimate Nitrite Nitrogen (NO_2–N) concentration as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.8b	If NO_2–N is not measured, is it likely that: 3 – effluent has high NO_2–N loading 2 – effluent has moderate NO_2–N loading 1 – effluent has low NO_2–N loading 0 – no NO_2–N loading			
3.9a	Estimate the loading of Oil Products (mineral or synthetic) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.9b	If oil products are not measured, is it likely that:			

Hot Spot Evaluation: Pollution Control				
	Hot Spot: **Country:**		**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
	3 – effluent has high oil product loading 2 – effluent has moderate oil product loading 1 – effluent has low oil product loading 0 – no oil product loading			
3.10 a	What is the loading of Persistent Organic Pollutants as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.10 b	If POPs are not measured, is it likely that: 3 – POPs are present in the effluent with high loadings 2 – POPs are present in the effluent with moderate loadings 1 – POPs are present in the effluent with low loadings 0 – POPs are not present			
3.11 a	Estimate Phenols as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.11 b	If Total Phenols are not measured, is it likely that: 3 – effluent has high phenol loadings 2 – effluent has moderate phenol loadings 1 – effluent has low phenol loadings 0 – no phenol loadings			
3.12	Estimate Polyaromatic Hydrocarbons			

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
a	(PAH) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.12 b	If PAHs are not measured, is it likely that: 3 – effluent has high PAH loadings 2 – effluent has moderate PAH loadings 1 – effluent has low PAH loadings 0 – no PAH loadings present			
3.13 a	Estimate Fats & Oils (animal or vegetable) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.13 b	If Fats & Oils are not measured, is it likely that: 3 – effluent has high loadings of fats & oils 2 – effluent has moderate loadings of fats & oils 1 – effluent has low loadings of fats & oils 0 – no fats & oils present			
3.14 a	Estimate Iron (Fe) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
3.14 b	If Iron is not measured, is it likely that: 3 – effluent has high Iron loading 2 – effluent has moderate Iron loading 1 – effluent has low Iron loading 0 – no Iron present			
3.15 a	Estimate Copper (Cu) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.15 b	If Copper is not measured, is it likely that: 3 – effluent has high Copper loading 2 – effluent has moderate Copper loading 1 – effluent has low Copper loading 0 – no Copper present			
3.16 a	Estimate Zinc (Zn) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.16 b	If Zinc is not measured, is it likely that: 3 – effluent has high Zinc loading 2 – effluent has moderate Zinc loading 1 – effluent has low Zinc loading 0 – no Zinc present			
3.17 a	Estimate Nickel (Ni) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1%			

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	Country:	Region:	Id #
No.	Issue	Raw Score	Supporting Comments or Explanations	
	2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.17 b	If Nickel is not measured, is it likely that: 3 – effluent has high Nickel loading 2 – effluent has moderate Nickel loading 1 – effluent has low Nickel loading 0 – no Nickel present			
3.18 a	Estimate Chromium (Cr) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.18 b	If Chromium is not measured, is it likely that: 3 – effluent has high Chromium loading 2 – effluent has moderate Chromium loading 1 – effluent has low Chromium loading 0 – no Chromium present			
3.19 a	Estimate Cadmium (Cd) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			

Hot Spot Evaluation: Pollution Control			
	Hot Spot: **Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**
3.19 b	If Cadmium is not measured, is it likely that: 3 – effluent has high Cadmium loading 2 – effluent has moderate Cadmium loading 1 – effluent has low Cadmium loading 0 – no Cadmium present		
3.20 a	Estimate Mercury (Hg) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%		
3.20 b	If Mercury is not measured, is it likely that: 3 – effluent has high Mercury loading 2 – effluent has moderate Mercury loading 1 – effluent has low Mercury loading 0 – no Mercury present		
3.21 a	Estimate Lead (Pb) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%		
3.21 b	If Lead is not measured, is it likely that: 3– effluent has high Lead loading 2 – effluent has moderate Lead loading 1 – effluent has low Lead loading 0 – no Lead present		

Hot Spot Evaluation: Pollution Control				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
3.22 a	Estimate radioisotope (Ce137, Sr90) as a percentage of the loading at the national boundary? 5 – > 5% 4 – 1% to 5% 3 – 0.1% to 1% 2 – 0.01% to 0.1% 1 – 0.01% to 0.001% 0 – 0%			
3.22 b	If radioisotopes are not measured, is it likely that: 3– effluent has high radioisotope loading 2 – effluent has moderate radioisotope loading 1 – effluent has low radioisotope loading 0 – no radioisotopes present			

ANNEX - 2

WORK SHEET - WATER QUALITY ISSUES

Hot Spot Evaluation: Water Quality Issues				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
1.0 Drinking Water Supply				
1.1	Are municipal drinking water withdrawals located downstream of the Hot Spot? 5 – within 1 km downstream 4 – within 3 km downstream 3 – within 10 km downstream 2 – within 25 km downstream 1 – greater than 25 km downstream			
1.2	What is the relationship to the river of the municipal drinking water withdrawals located downstream of the Hot Spot (i.e., are the well supplies under the direct influence of river (surface) water quality as opposed to groundwater quality)? 5 – α*=100% or high connectivity to the river source (i.e. under direct influence of surface water) 4 – α=75 % or moderate 3 – α=50 % or average 2 – α=25 % or low 0 – α= 0 % or absent or no connectivity between well supply and river * α is an estimate of the connectivity of a well supply to the river based on subsurface stratigraphy, physical relationship and distance to the river, and contaminant migration time.			
1.3	What is the population being supplied with drinking water from the river within 25 km downstream of Hot Spot? 5 – greater than 500,000			

Hot Spot Evaluation: Water Quality Issues			
	Hot Spot: **Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**
	4 – 100,000 to 500,000 3 – 50,000 to 100,000 2 – 10,000 to 50,000 1 – less than 10,000		
2.0	**Recreation** (for recreational fishing see 3.0)		
2.1	Are recreational areas frequented by swimmers (i.e. formally established or locally–recognized beach facilities) located near the Hot Spot? 5 – within 1 km downstream or immediately adjacent upstream 4 – within 3 km downstream 3 – within 5 km downstream 2 – within 10 km downstream 1 – greater than 10 km downstream		
2.2	Are there areas located near the Hot Spot where other aquatic recreational activities take place (i.e. rowing, sailing, etc.)? 5 – within 1 km downstream or 1 km upstream 4 – within 3 km downstream 3 – within 5 km downstream 2 – within 10 km downstream 1 – greater than 10 km downstream		

Hot Spot Evaluation: Water Quality Issues				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Raw Score**	**Supporting Comments or Explanations**	
2.3	Have there been any commonly acknowledged or formally documented illnesses that have been attributed to bathing or other water-based recreational activities downstream of the Hot Spot? 5 – illnesses requiring hospitalization 2 – illnesses requiring moderate medical intervention (eye, ear and throat infections; rashes; gastro-intestinal problems) 1 – as above without medical intervention required 0 – none reported or no bacteriological releases associated with Hot Spot discharge			
2.4	With respect to any illnesses reported in 2.3, was the Hot Spot confirmed as the source? 5 – confirmed source 4 – strongly suspected source 1 – potential source (illnesses not attributed to a specific upstream source) 0 – no illnesses reported or no bacteriological releases associated with Hot Spot discharge			

3.0 Fishing – Recreational			
3.1	Are there any designated recreational areas located near the Hot Spot which are licensed for recreational fishing or have water quality conditions deteriorated to a point where this activity is no longer sustainable? 5 – no licensed recreational fishing areas *established downstream as a direct* consequence of the Hot Spot discharge 4 – no licensed recreational fishing areas established downstream due to poor water quality conditions not attributed to a specific source 3 – licensed recreational fishing areas located within 5 km downstream or 5 km upstream of Hot Spot 2 – licensed recreational fishing areas located within 25 km downstream 1 – licensed recreational fishing areas located greater than 25 km downstream		

4.0 Fishing – Commercial			
4.1	Are there any designated areas located near the Hot Spot which are licensed for commercial fishing or have water quality conditions deteriorated to a point where this activity is no longer sustainable? 5 – no licensed commercial fishing areas established downstream as a direct consequence of the Hot Spot discharge 4 – no licensed commercial fishing areas established downstream due to poor water quality conditions not attributed to a specific source 3 – licensed commercial fishing areas located within 5 km downstream or 5 km upstream of Hot Spot 2 – licensed commercial fishing areas located within 25 km downstream 1 – licensed commercial fishing areas located greater than 25 km downstream		
5.0 Agricultural Water Taking			
5.1	Are there areas downstream of the Hot Spot where water takings for agricultural purposes are frequently being carried out? 5 – high* utilization within 5 km downstream or moderate* utilization within 2 km downstream of Hot Spot 4 – high* utilization within 10 km downstream or moderate* utilization within 5 km downstream of Hot Spot 3 – moderate* utilization within 10 km downstream of Hot Spot 2– low* utilization within 10 km downstream of Hot Spot 0 – no appreciable utilization within 10 km downstream of Hot Spot * definition of high, moderate and low utilization to be determined on a relative scale for each country.		

6.0 Sediment Quality			
6.1	Is there an area of sediment contamination* downstream of the Hot Spot? 5 – where the Hot Spot is the confirmed source 4 – where the Hot Spot is the suspected source 1 – where the source of contamination is not known however the Hot Spot is potentially a contributing source 0 – no sediment contamination* noted * "contamination" is defined as sediment pollutant concentrations at least five (5) times the respective sediment background concentration		
7.0 Transboundary Issues			
7.1	Is the national boundary located near the Hot Spot? 5 – within 10 km downstream 4 – within 15 km downstream 3 – within 20 km downstream 2 – within 30 km downstream 1 – greater than 30 km downstream		

ANNEX - 3

WORK SHEET - BIODIVERSITY ISSUES

Hot Spot Evaluation: Environmental, Biodiversity & Natural Areas Issues			
	Hot Spot: Country:		Region: Id #
No.	Issue	S C	Supporting Comments or Explanations
1.0 General			
1.1	Is the Hot Spot located near a wildlife sanctuary? 5 – within 1 km of an important wildlife sanctuary 4 – within 3 km of an important wildlife sanctuary 3 – within 5 km of an important wildlife sanctuary 2 – within 10 km of an important wildlife sanctuary 1 – within 15 km of an important wildlife sanctuary 0 – greater than 15 km upstream of an important wildlife sanctuary		
1.2	Is the Hot Spot located near a national park? 5 – within 1 km of a national park 4 – within 3 km of a national park 3 – within 5 km of a national park 2 – within 10 km of a national park 1 – within 15 km of a national park 0 – greater than 15 km upstream of a national park		
1.3	Is the Hot Spot located near an area frequented by rare or endangered aquatic species)? 5 – within 1 km of an area frequented by rare or endangered aquatic species 4 – within 3 km of an area frequented by rare or endangered aquatic species 3 – within 5 km of an area frequented by rare or endangered aquatic species 2 – within 10 km of an area frequented by rare or endangered aquatic species 1 – within 15 km of an area frequented by rare or endangered aquatic species 0 – greater than 15 km upstream of an area frequented by rare or endangered aquatic species		

Hot Spot Evaluation: Environmental, Biodiversity & Natural Areas Issues

	Hot Spot:	**Country:**		**Region:**	**Id #**
No.	**Issue**			**Supporting Comments or Explanations**	
1.4	Is the Hot Spot located near an unprotected area of ecological significance (areas of spawning, nesting, etc.) 5 – within 1 km of an unprotected area of ecological significance 4 – within 3 km of an unprotected area of ecological significance 3 – within 5 km of an unprotected area of ecological significance 2 – within 10 km of an unprotected area of ecological significance 1 – within 15 km of an unprotected area of ecological significance 0 – greater than 15 km upstream of an unprotected area of ecological significance				
1.5	Is the Hot Spot located near an unprotected Environmentally Sensitive Area (ESA-areas of high biodiversity based on the number of species, biotic indices, professional judgement, etc.) 5 – within 1 km of an ESA 4 – within 3 km of an ESA 3 – within 5 km of an ESA 2 – within 10 km of an ESA 1 – within 15 km of an ESA 0 – greater than 15 km upstream of an ESA				

Hot Spot Evaluation: Environmental, Biodiversity & Natural Areas Issues				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**Score**	**Supporting Comments or Explanations**	
1.6	Is the Hot Spot the source of adverse impacts on the nearest environmental features (i.e., Environmentally Sensitive Area, Wildlife Sanctuary or National Park)? 5 – proven impacts with adverse effects 4 – proven impacts with suspected adverse effects 3 – proven impacts with unknown effects 3 – suspected impacts with suspected adverse effects 2 – suspected impacts with unknown effects 1 – unknown impacts 0 – no impacts			

Hot Spot Evaluation: Environmental, Biodiversity & Natural Areas Issues				
	Hot Spot:	Country:	Region:	Id #
No.	Issue	S c	Supporting Comments or Explanations	
2.0 Aquatic Species (Fish)				
2.1	Is the Hot Spot the source of adverse impacts on the habitat of any fish species? 5 – proven impacts with adverse effects 4 – proven impacts with suspected adverse effects 3 – proven impacts with unknown effects 3 – suspected impacts with suspected adverse effects 2 – suspected impacts with unknown effects 1 – unknown impacts 0 – no impacts			
2.2	Have any fish kills been attributed to the hotspot (i.e. numerous fish deaths occurring at a given time)? 5 – officially confirmed periodic fish kills for which the Hot Spot is the confirmed source 4 – officially confirmed periodic fish kills with unknown causes 4 – one or two events of officially confirmed fish kills which the Hot Spot is the confirmed source 3 – one or two events of officially confirmed fish kills with unknown causes 2 – periodic unconfirmed fish kills with unknown causes 1 – one or two evens of unconfirmed fish kills with unknown causes 0 – no fish kills			
2.3	Is the Hot Spot the source of adverse impacts on the reproduction of any fish species (reproductive impacts)? 5 – proven impacts with adverse effects 4 – proven impacts with suspected adverse effects 3 – proven impacts with unknown			

Hot Spot Evaluation: Environmental, Biodiversity & Natural Areas Issues				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**S C**	**Supporting Comments or Explanations**	
	effects 3 – suspected impacts with suspected adverse effects 2 – suspected impacts with unknown effects 1 – unknown impacts 0 – no impacts			

Hot Spot Evaluation: Environmental, Biodiversity & Natural Areas Issues				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**	**S C**	**Supporting Comments or Explanations**	
3.0 Aquatic Species (Benthic)				
3.1	Have benthic studies been conducted in the area of the Hot Spot to identify impacts on abundance, diversity and /or community structure? 5 – confirmed adverse impact where the Hot Spot is the confirmed source of impacts 4 – confirmed adverse impacts where the Hot Spot is the suspected source of impacts 3 – confirmed adverse impacts where no cause is known 2 – no benthic studies conducted but adverse impacts suspected and Hot Spot is a potential source of impacts 1 – no benthic studies conducted 0 – no adverse impacts observed			
3.2	Is the Hot Spot located within 1 km of an area with a high Biotic Index (by Woodiwiss)? 5 – with a Biotic Index of 10 (very clear) 4 – with a Biotic Index between 7 and 9 (clear) 3 – with a Biotic Index between 5 and 6 (moderately polluted) 2 – with a Biotic Index of 4 (polluted) 1 – with a Biotic Index between 2 and 3 (dirty) 0 – with a Biotic Index between 0 and 1 (very dirty)			
4.0 Aquatic Species (Waterfowl)				
4.1	Is the Hot Spot the source of adverse impacts on the nesting area or other habitat type of any waterfowl? 5 – proven impacts with adverse effects 4 – proven impacts with suspected			

Hot Spot Evaluation: Environmental, Biodiversity & Natural Areas Issues				
	Hot Spot:	**Country:**	**Region:**	**Id #**
No.	**Issue**		**Supporting Comments or Explanations**	
	adverse effects 3 – proven impacts with unknown effects 3 – suspected impacts with suspected adverse effects 2 – suspected impacts with unknown effects 1 – unknown impacts 0 – no impacts			
4.2	Is the Hot Spot located within an area frequented by migratory species? 5 – confirmed multiple migratory species, more than 3 4 – confirmed migratory species, 1–3 3 – unconfirmed multiple migratory species, more than 3 2 – unconfirmed migratory species 1–3 1 – potential for migratory species 0 – no migratory species			
5.0 Plant Species				
5.1	Is the Hot Spot the source of adverse impacts on any plant species? 5 – proven impacts with adverse effects 4 – proven impacts with suspected adverse effects 3 – proven impacts with unknown effects 3 – suspected impacts with suspected adverse effects 2 – suspected impacts with unknown effects 1 – unknown impacts 0 – no impacts			

ANNEX - 4

WORK SHEET - ECONOMIC ISSUES

	Item	Importance (1-100)	Weight under sub-category (1-100)	Weight of sub-category
1.1	Has hot spot had a negative impact on downstream water supply requiring additional treatment to meet **potable (drinking) water** quality standards? (Assume: Increased annual treatment cost include labour, energy, chemicals and/or alternative sources, most recent comparable year across all countries)		50	70
1.2	Is the average cost of treatment for **potable (drinking) water** significantly higher than the national average cost for treatment? (Assume treatment benchmark: treatment costs per 1,000 m^3 of potable water, most recent comparable year across all countries)		5	
1.3	Has hot spot had a negative impact on downstream water supply requiring additional treatment to meet **industrial** quality needs/standards? (Assume: Increased annual treatment cost include labour, energy, chemicals and/or alternative sources, most recent comparable year across all countries		20	
1.4	Is the average cost of treatment for **industrial** water significantly higher than the national average cost for treatment? (Assume treatment benchmark: treatment costs per 1,000 m^3 of industrial water, most recent comparable year across all countries)		5	
1.5	What level of investment will be required in the hot spot to meet EU standards outlined in the Water Framework Directive? (Assume 2001 dollars)		20	
2.1	Are there increased average operating and investment cost, in fertilizers and chemicals, on a per unit basis in grain/fruit/vegetable production? (Assume, costs tracked on $ yield per hectare over last 10 years, real dollars)		50	10
2.2	Has there been a substantial loss in arable land, directly related to the effects of pollution, within the vicinity of the hot spot? (Assume a 5 km radius)		50	
3.1	Hot spot industries' operation and output makes a substantial contribution to GNP. (Annual, assume most recent comparable years across all countries)		25	10
3.2	Hot spot industries are significant exporters and (net) foreign exchange earners. (Annual, assume most recent comparable years across all countries)		25	
3.3	Hot spot generates substantial tax revenues (business and personal) for the government. (Annual, assume most recent comparable years across all countries)		25	
3.4	Hot spot is a major employer of citizens. (Assume most recent comparable employment surveys across all countries)		25	
4.1	An industrial sector within the hot spot has a dominant share of **regional** industrial employment. (Assume most recent comparable employment surveys across all countries)		50	10
4.2	Hot spot has significant employment share of a specific **industrial sector** in the country. (Assume most recent comparable employment surveys across all countries)		50	

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