A Comparison Analysis between the Standards used in the Dnieper River Basin Clean-up and European Union Legislation

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Abstract: A recent case study involved the clean-up efforts of the Dnieper River Basin by three countries, Belarus, Russia, and Ukraine. The objective of the study was to provide a method for the identification, assessment, and prioritization of the most significant sources of pollution based on their impacts and characteristics.

Herein, the standards employed in the Dnieper case study are comparatively analyzed against the relevant EU directives. The purpose in doing so was to determine if the standards employed in this project could serve as a benchmark for the necessary environmental regulations that would be required if these three countries were admitted into the European Union.

The main discrepancies found between the standards of the Dnieper case study and the EU directive were differing measuring standards and the vagueness associated with various standards in the case study.

Keywords: Environmental hot spots, environmental regulations, Dnieper River Basin

Table of Contents

I. Introduction

A recent case study involved clean-up efforts of the Dnieper River Basin by three countries, Belarus, Russia, and Ukraine. The objective of the study was to provide a method for the identification, assessment, and prioritization of the most significant sources of pollution based on their impacts and characteristics.[1] Since the three countries are not part of the European Union (EU) but may become so in the future, the purpose of this paper is evaluate whether the standards used to identify and assess hot spots in the Dnieper Basin comply with EU legislation. If this project, in fact, does comply, and the countries are admitted to the EU, the standards employed in this project could possibly serve as a benchmark for the necessary environmental regulations that would need to be implemented under the EU.

To begin the analysis, the Treaty Establishing the European Community (EC Treaty) and Directive 2000/60/EC, which establishes a framework for Community action in the field of water policy, will be addressed. While there is a plethora of directives directly on point, no regulations were found to be.

The Treaty Establishing the European Community establishes general principles of environmental policy.[2] Article 130r states that community policy shall be based on the precautionary principle[3], the polluter pays principle[4] and on the principles that environment damage, as a priority, should be recognized at the source.[5] EU environmental laws must be

[1] UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION, *Identification, assessment and prioritization of Pollution Hot Spots*, 3 (2003).
[2] Consolidated Version of the Treaty Establishing the European Community, March 25, 1957, 298 U.N.T.S. 3.
[3] The precautionary principle ensures that a substance or activity posing a threat to the environment is prevent from adversely affecting the environment, even if there is no conclusive scientific proof linking that particular substance or activity to environmental damage. J. Cameron and J. Abouchar, "The precautionary principle: a fundamental principle in law and policy for the protection of the global environment." 14 *Boston College Int'l & Comp L R* 1.
[4] The polluter principle means that the costs of clean-up or prevention of environmental damage should be borne by the polluter. LAKASHMAN D. GURUSWAMY, ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND WORLD ORDER, 483 (2nd ed. 1999).
[5] 298 U.N.T.S. 3, Art. 130r.

expressly based on one or more of the provisions found in the Treaty.[6] In addition, Community policy shall take into account available scientific and technical data, environmental conditions in the various regions of the Community, the potential benefits and costs of actions or lack of actions, and the economic and social development of the Community as a whole and the balanced development of its region.[7]

Directive 2000/60/EC[8], as discussed below, aligns with the EC Treaty. The relevant provisions of the directive will be discussed and then comparatively analyzed against the corresponding portions of the Dnieper project. However, first, the EU's interpretation of "environmental hot spot" will be addressed and compared against the evaluation techniques of the Dnieper project.

II. European Union Legislation

A. Defining and Identifying Environmental Hot Spots

Neither the EU directives nor regulations define "environmental hot spot." However, the United Nations Environment Programme (UNEP) has recommended guidelines for hot spots assessment in accordance with the Helsinki Commission (HELCOM)[9] Hot Spot Approach.[10] Provided that the signatories to the Helsinki Convention are members of the EU, it is appropriate to suggest that the EU would adhere to these guidelines. The Hot Spot

[6] *Id.* *See also* Introduction to the Approximation of Environmental Legislation, at http://europa.eu.int/comm/environment/guide/part1.htm (last visited on May 8, 2004).
[7] *Id.* Art. 130r.
[8] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. Official Journal L 327, 22/12/2000 P. 0001-0073.
[9] HELCOM is the governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Region", more commonly known as the Helsinki Convention. The Convention was signed in 1992 by all the states bordering on the Baltic Sea and the European Community. http://www.helcom.fi/helcom.html (last visited on March 27, 2004).
[10] A Contribution to the Analysis of the HELCOM Hot Spot Approach, Report No. 9098.25/01, 3. Hamburg, 24. January 2001, at http://www.gpa.unep.org/igr/Reports/Helcom_Hot_Spot.htm (last visited on March 27, 2004).

Approach focuses on sites of major environmental concern where immediate measures should be taken.[11] UNEP discussed four principle areas for a hot spot assessment:

a. Method of the General Hot Spot Approach,

b. Criteria to assign hot spots to different classes and types,

c. Control of data collecting, monitoring, evaluation, and analysis, and

d. Acceptance of the General Hot Spot Approach.[12]

1. Methodology of General Hot Spot Approach

Traditionally, an area of environmental degradation is classified as a priority hot spot or a hot spot.[13] A hot spot or priority hot spot can be further characterized into sub-classifications, such as municipal, industrial, or combined municipal-industrial.[14] If a site does not fall under one of these two classifications, it receives no preferential status.[15]

The UNEP has criticized this "hot spot or not" approach since the system implies either that the sites excluded from a hot spot list comply with the appropriate regulations or that they are not of serious concern.[16] In addition, this system neglects the possibility that the sites excluded from the hot spot list may be more accessible and effectively remediable than designated hot spots.[17] Lastly, the classification draws too much attention to hot spots, thereby pushing successful non-hot spot remediation out of the limelight.[18] As a remedy, UNEP has

[11] *Id.* at 3.
[12] *Id.* at 3.
[13] *Id* at 4.
[14] A Contribution to the Analysis of the HELCOM Hot Spot Approach, Report No. 9098.25/01, 6. Hamburg, 24. January 2001, at. http://www.gpa.unep.org/igr/Reports/Helcom_Hot_Spot.htm (last visited on March 27, 2004).
[15] *Id.*at 6.
[16] *Id.*at 4.
[17] *Id.* at 4.
[18] A Contribution to the Analysis of the HELCOM Hot Spot Approach, Report No. 9098.25/01, 4. Hamburg, 24. January 2001, at. http://www.gpa.unep.org/igr/Reports/Helcom_Hot_Spot.htm (last visited on March 27, 2004).

suggested incorporating a "warm spot classification," an intermediate class for sites not in compliance with relevant regulations but not significantly exceeding those relegations.[19]

2. Criteria to assign hot spots to different classes and types

It is difficult to create uniform criteria for the identifications of hot spots.[20] Each state has different economic conditions, political climate, and varying aggressiveness towards environmental protection.[21] Therefore, at the present time, the criteria to identify hot spots is the responsibility of each respective State.[22]

3. Control of data monitoring, collecting, evaluation, and analysis

UNEP has recommended that the responsible operator of the respective hot spot, which is normally an industry, gather measurements.[23] However, UNEP also suggested that the employment of an independent institution or company to do the actual gathering increases the likelihood of reliable measurements and the application of uniform standards.[24] This independent institution or company should be fully supported by the local public authorities.[25]

With respect to the actual data collecting, if questionnaires are the primary source of data, the questionnaires need to be tailored to each sub-classification of hot spot, which as stated above, include municipal, industrial, or combined municipal-industrial.[26] The terms, contents, and parameters must be precisely defined.[27] Further measuring techniques, devices,

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[19] *Id.*at 4.
[20] *Id.* at 7.
[21] *Id.* at 7.
[22] A Contribution to the Analysis of the HELCOM Hot Spot Approach, Report No. 9098.25/01, 7. Hamburg, 24. January 2001, at. http://www.gpa.unep.org/igr/Reports/Helcom_Hot_Spot.htm (last visited on March 27, 2004).
[23] *Id.* at 8.
[24] *Id.* at 8.
[25] *Id.* at 8.
[26] A Contribution to the Analysis of the HELCOM Hot Spot Approach, Report No. 9098.25/01, 9. Hamburg, 24. January 2001, at. http://www.gpa.unep.org/igr/Reports/Helcom_Hot_Spot.htm (last visited on March 27, 2004).
[27] *Id.*at 9.

and standards of each party must coincide to the greatest degree possible.[28] The quality of the data is directly related to the reliability of the data analysis.[29]

4. Acceptance of the general Hot Spot Approach

Two factors have recently led the call to redefine the "Hot Spot Approach." The first is a monetary issue. Financial assistance for hot spot clean-up efforts have not fully materialized, thus many states need to better define and identify those sites that are of the highest priority.[30] The second factor stems from the fact that states with a high number of hot spots are receiving negative publicity.[31] As a remedy to the second factor, large hot spots could be subdivided into more manageable and operational remediation sites.[32] However, this "subdivision" could negatively result in a number of smaller sites falling below the hot spot criteria and thus, not receiving adequate remedial measures. This potential problem reemphasizes the necessity for an intermediate "warm" zone.[33]

B. Directive 2000/60/EC, establishing a framework for Community action in the field of water policy

Directive 2000/60/EC requires that Member States adopt a combination of emission limit values and quality objectives to control discharges into surface waters[34], which is coined the "combined approach" in the directive.[35] In accordance with the combined approach, Member

[28] *Id.* at 9.
[29] *Id.*at 11.
[30] A Contribution to the Analysis of the HELCOM Hot Spot Approach, Report No. 9098.25/01, 11. Hamburg, 24. January 2001, at. http://www.gpa.unep.org/igr/Reports/Helcom_Hot_Spot.htm (last visited on March 27, 2004).
[31] *Id.*at 12.
[32] *Id.*at 12.
[33] *Id.*at 12.
[34] Surface water is defined as all inland waters, except groundwater; transitional waters and coastal waters, except with respect to chemical status for which it shall also include territorial waters. Council Directive 2000/60/EC, Art. 2(1).
[35] *Id.* Art. 10.

States shall ensure the establishment and implementation of the emissions controls[36] based on best available techniques, or the relevant emission limit values[37], or in the case of diffuse impacts, best environmental practices as set in Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment and other previously passed directives.[38] The requirements mandated by Directive 91/271/EEC (and others) are considered "basic measures" and must be complied with fully; however, supplementary measures are also provided for in Directive 2000/60/EC that Member States may choose to adopt as part of the programme of measures.[39] They include, *inter alia*, legislative instruments, economic or fiscal instruments, emission controls, efficiency and reuse measures, and the promotion of water-efficient technologies in industry.

1. Urban Wastewater Treatment and Discharge

Pursuant to Council Directive 91/271/EEC,[40] Member States shall ensure that urban wastewater[41] entering collective systems[42] shall be subject to secondary treatment[43] before discharge.[44]

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[36] Emission controls are controls requiring a specific emission limitation or otherwise specifying limits or conditions on the effects, nature or other characteristics of an emission or operating conditions that effect emissions. Council Directive 2000/60/EC, Art. 2(41).

[37] Emission limit values are defined as the mass, expressed in terms of certain specific parameters, concentration or level of an emission that may not be exceeded during any one or more periods of time. Emission limit values may also be laid down for certain groups, families or categories of substances. Council Directive 2000/60/EC; Art. 2(40).

[38] Council Directive 2000/60/EC. *Id.* Art. 10(2) and Annex VI, Part A(vii).

[39] *Id.* Art. 11(1-3).

[40] 1991 O. J. (L 135), p. 0040-0052.

[41] Urban waste water is defined as domestic waste water or the mixture of domestic waste water with industrial waste and/or run-off water. *Id.* Art. 2(2).

[42] Collecting systems are defined as a system of conduits that collects and conducts urban wastewater. *Id.* Art. 2 (5). Member states shall ensure that all agglomerations are provided with collecting systems for urban wastewater

a. at the latest by 31 December 2000 for those with a population equivalent (p.e.) of more than 15,000 and
b. at the latest by 31 December 2005 for those with a p.e. of between 2000 and 15,000. Id. Art. 3(1).

[43] Secondary Treatment is defined as treatment of urban wastewater by a process generally involving biological treatment with a secondary settlement or other process. If not subject to secondary treatment, it must be treated by an equivalent treatment satisfying the following requirement:

a. at the latest by 01 December 2000 for all discharges from agglomerations of more than 15,000 p.e.

In addition, discharges from urban wastewater treatment plants shall satisfy the following requirements:

1. Discharges from urban wastewater treatment plants shall meet the following parameters:[45]

Parameters	Concentration	Minimum Percentage of Reduction (Reduction in relation to load of the influent)	Reference method of measurement
Biochemical oxygen demand (BOD_5 at 20ºC) without nitrification *This parameter can be replaced by a total organic carbon (TOC) or total oxygen demand (TOD) parameter if a relationship can be established between either of them and BOD_5.	25mg/l O_2	70-90%	Homogenized, unfiltered, undecanted sample. Determination of dissolved oxygen before and after five-day incubation at 20º +/- 1º, in complete darkness. Addition of a nitrification inhibitor.
Chemical oxygen demand (COD)	125 mg/l O_2	75%	Homogenized, unfiltered, undecanted sample Potassium dichromate
Total Suspended Solids *This requirement is optional.	35mg/l[3]	90%	

2. In addition, discharges from urban wastewater treatment plants into sensitive areas[46] that are subject to eutrophication[47], which are included under Directive 2000/60/EC[48], shall be required to meet the following requirements:[49]

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b. at the latest by 31 December 2005 for all discharges from agglomerations of between 10,000 and 15,000 p.e.
c. at the latest by 31 December 2005 for dischargers to freshwater and estuaries from agglomerations of between 2,000 and 10,000 p.e. *Id.* Art. 4(1).

[44] Council Directive 91/271/EEC, Art. 4(1).

[45] The values for concentration or for the percentage of reduction shall apply. *Id.* Annex I Requirements for urban waste water, Table 1.

[46] Members States are required to identify sensitive areas. A water body must be classified as a sensitive area if it fall under one of the following categories:

a. natural freshwater lakes, other freshwater bodies, estuaries and coastal waters which are found to be eutrophic or which in the near future may become eutrophic if protective action is not taken
b. surface waters intended for the abstraction of drinking water which could contain more than the concentration of nitrate laid down under the relevant provisions of Council Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States

Parameters	Concentration	Minimum Percentage of Reduction	Reference Method of Measurement
Total phosphorus	2mg/l P (10,000-100,000 p.e.[50]) 1mg/l P (more than 100,000 p.e.)	80%	Molecular absorption spectrophotometry
Total Nitrogen *sum of total Kjeldahl-nitrogen (organic N + NH_3), nitrate (NO_3)-nitrogen and nitrite (NO_2)-nitrogen	15 mg/l N (10,000-100,000 p.e.) 10 mg/l N (more than 100,000 p.e.) *Alternatively, the daily average must not exceed 20mg/l N.	70-80%	Molecular absorption spectrophotometry

The load expressed in p.e. shall be calculated on the basis of the maximum average weekly load entering the treatment plant during the year, excluding unusual situations such as those due to heavy rains.[51]

The standards established for sensitive areas are inapplicable where it can be shown that the minimum percentage of reduction of the overall load entering all urban wastewater treatment plants in that area is at least 80% for total phosphorus and at least 70% for total nitrogen.[52] Member States can also identify less sensitive areas.[53]

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c. areas where further treatment is required to fulfill Council Directives.

Council Directive 91/271/EEC. Annex II, Criteria for identification of sensitive and less sensitive areas.

[47] Eutrophication means any enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance or organisms present in the water and to the quality of the water concerned. *Id.* Art. 2(11).

[48] Directive 2000/60/EC. Annex IV(1)(iv).

[49] The stricter standards are applicable only to urban wastewater entering into collecting systems for agglomerations of more than 10,000 p.e. by December 31, 1998. *Id.* Art. 5(2).

[50] 1 p.e. (population equivalent) is defined as the organic biodegradable load having a five-day biochemical oxygen demand (BOD_5) of 60 g of oxygen per day. *Id.* Art. 2(6).

[51] Council Directive 91/271/EEC, Art. 4(4).

[52] Commission Directive 98/15/EC of 27.2.1998 amending Council Directive 91/271/EEC with respect to certain requirements established in Annex I thereof. Alternatively, the following reduction concentration can serve as the standard:

a. Total Phosphorus: 2 mg/l (10,000-100,000 p.e.), 1 mg/l (more than 100,000 p.e.)
b. Total nitrogen: 15 mg/l (10,000-100,000 p.e.), 10mg/l (more than 100,000 p.e.)

Urban wastewater treatment plants shall be designed or modified so that representative samples of the incoming wastewater and of treated effluent can be obtained before discharge to receiving waters.[54] Flow-proportional or time-based 24-hour samples shall be collected at the same well-defined point in the outlet and if necessary, in the inlet of the treatment plant, in order to monitor compliance with the requirements for discharged wastewater.[55] The minimum annual number of samples shall be determined according to the size of the treatment plant.[56] Each sample shall be collected at regular intervals during the year.[57] Extreme values for the water quality in question shall not be taken into consideration when they are the result of unusual situation, such as those due to a heavy rain.[58] Member States shall provide the Commission with all relevant information concerning the applied monitoring method.[59]

2. Industrial Waste Water

Pursuant to Directive 91/271/EEC, Member States shall also ensure that the discharge of industrial wastewater into collecting systems and urban wastewater treatment plants is subject to regulations incorporating pre-treatments as is required in order to:[60]

Id. Annex II, Criteria for identification of sensitive and less sensitive areas, Table 2.

[53] Council Directive 91/271/EEC.. Art. 6(1). Less sensitive areas are defined as a marine water body or areas if the discharge of wastewater does not adversely affect the environment as a result of morphology, hydrology or specific hydraulic conditions which exist in that area. When identifying less sensitive areas, Member States shall take into account the risk that the discharged load may be transferred to adjacent areas where it can cause detrimental environmental effects. Member States shall recognize the presence of sensitive areas outside their national jurisdiction. The following elements should be taken into consideration when identifying less sensitive areas: open bays, estuaries and other coastal waters with good water exchange and not subject to eutrophication or oxygen depletion or which are considered unlikely to become eutrophic or to develop oxygen depletion due to the discharge of urban wastewater. *Id.* Annex II Criteria for Identification of Sensitive and Less Sensitive Areas.

[54] *Id.* Annex I.B.1. Requirements for Urban Waste Water.

[55]Council Directive 91/271/EEC, Annex I, Requirements for wastewater..

[56] *Id.* Annex I(D). If the plant capacity is 2,000-9,000 p.e., 12 samples should be taken during the first year. Four samples in the subsequent years if it can be shown that the water during the first year complies with the provisions of the Directive. If one samples of the four fails, twelve samples must be taken in the following years. If the plant capacity is 10,000-49,999, twelve samples are required the first year. If the plant capacity is 50,000 or over, twenty-four samples must be taken. *Id.*

[57] *Id.* Annex I(D)(5).

[58]Council Directive 91/271/EEC, Annex I, Requirements for urban wastewater.

[59] *Id.* Annex I(D)(1).

[60] Directive 91/271/EEC. Art. 11(1).

i. protect the health of the staff working in collecting systems and treatment plants,

ii. ensure that the collecting systems, wastewater treatment plants and associated equipment are not damaged,

iii. ensure that the operation of the wastewater treatment plant and treatment of sludge are not impeded,

iv. ensure that the discharges from the treatment plants do not adversely affect the environment, or prevent receiving water from complying with other Community Directives, and

v. ensure that sludge can be disposed of safely in an environmentally acceptable manner.[61]

Member States shall reuse wastewater whenever appropriate. [62] Additionally, Member States shall ensure that biodegradable industrial wastewater from plants in the industrial sectors,[63] which does not enter urban wastewater treatment plants before discharging to receiving waters, shall (before discharge) comply with previously enacted regulations or specific authorization by the competent authority for all discharges from plants representing 4,000 p.e. or more.[64] The competent authority shall set wastewater discharge requirements in accordance with the respective industry.[65] The appropriate bodies shall also monitor industrial discharges in cases where the receiving environment is expected to be significantly affected.[66]

3. Interpretation of directive by European Court of Justice

The Commission of European Communities brought an action for declaration against the French Republic for allegedly failing to identify certain areas as sensitive areas and consequently

[61] *Id.* Annex I. Requirements for urban wastewater.
[62] *Id*. Art. 12.
[63] Industrial Sectors include milk processing, manufacture of fruit and vegetable products, manufacture and bottling of soft drinks, potato-processing, meat industry, breweries, production of alcohol and alcoholic beverages, manufacture of animal feed from plant products, manufacture of gelatine and of glue from hides, skins and bones, malt houses, and fish processing industry. Council Directive 91/271/EEC, Art. 4. Annex III, Industrial Sectors.
[64] *Id.* Art. 13.
[65] *Id.* Art. 13.
[66] *Id.* Art. 15.

failing to subject them to more stringent treatment discharges pursuant Articles 5(1) and (2) and Annex II of Directive 91/271/EEC.[67]

Prior to this action, the Commission had clarified the definition of eutrophication upon a disagreement between the French Government and the Commission regarding the scope of the definition set forth in the directive.[68] The Commission explained that one of the directive's objectives was to protect "man, fauna, flora, soil, water, air and landscapes from any significant harmful effects of the accelerated growth of algae and higher forms of plant life resulting from the discharges of urban waste water."[69] In accordance with the directive's objective, the Commission characterized eutrophication by the following four criteria

1. the enrichment of waters by nutrients, especially compounds of nitrogen and/or phosphorus;
2. the accelerated growth of algae and higher forms of plant life
3. an undesirable disturbance of the balance of organisms present in the water, and
4. deterioration of the quality of the water concerned.[70]

Further, there must be a cause and effect relationship between enrichment by nutrients and the accelerated growth of algae and higher forms of plant life.[71] The cause and effect relationship must show that the accelerated growth triggers an undesirable disturbance in the quality of the water and in the balance of organisms present in the water.[72]

With respect to the third criteria listed above, the French Government argued that "mere proliferation of a plant species is insufficient to establish an undesirable disturbance so long as

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[67] Case C-280/02, *Commission of the European Communities v. French Republic*, E.C.R. [2004] 00000, 2004 ECJ CELEX LEXIS 396, (2004).
[68] *Id.*
[69] *Id.*
[70] *Id.*
[71] *Id.*
[72] *Commission of the European Communities v. French Republic.*

there is no disruption to the balance of other organisms present."[73] In response, the Commission explained that equilibrium of an aquatic ecosystem is the result of complex interactions among all species present and the environment.[74] Any proliferation of a particular species of algae or other plant constitutes a disturbance of the balance of the aquatic ecosystem, and, accordingly, disturbs the balance of the organisms present in the water, even when other species remain stable.[75] Specie changes involving loss of ecosystem biodiversity, nuisances due to the proliferation of opportunistic macroalgae and severe outbreaks of toxic or harmful phytoplankton therefore constitute an undesirable disturbance of the balance of organisms present in the water.[76]

The Commission also elaborated on the fourth criterion, explaining that it "refers not only to the quality of the water, which produces harmful effects [on] ecosystems, but also to the deterioration of the color, appearance, taste or odour of the water."[77] Further, any other change that prevents or limits water uses such as tourism, fishing, fish farming, clamming and shellfish farming, abstraction of drinking water or cooling of industrial installations shall be considered under this criterion.[78]

The Commission then applied its interpretation of "eutrophication" to areas in the French Republic at issue, primarly the Siene-Normandy basis, to determine if they should be classified as "sensitive".

The Siene bay was evaluated first.[79] The reports and studies produced by the Commission collectively agreed that there was a cause and effect relationship between the amount and relative proportions of nutrient inputs in the Siene bay and the phytoplankton blooms

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[73] *Id.*
[74] *Id.*
[75] *Id.*
[76] *Id.*
[77] *Commission of the European Communities v. French Republic.*
[78] *Id.*
[79] *Id.*

observed each year in that area.[80] The studies showed that the area was experiencing proliferation of the phytoplankton species of the genus Dinophyisis, which produces Diarrheic Shellfish Poisoning (DSP) toxins.[81] DSP toxins are prone to accumulate in shellfish and, in turn, dangerous to human when the shellfish are consumed.[82] In addition, another species of phytoplankton, Phaeocystis, had been proliferating in certain sections of the Siene-Maritime and of Calvados and, while not toxic, gave rise to silting. Silting, in turn, damages the coast appeal to tourists.[83] Such an evolution in the structure of the phytoplankton community and the strengthening of the presence of toxic or harmful species amounted to an undesirable disturbance of the balance of organisms present in the water.[84] This evolution concerned the Seine bay in its entirety, albeit its central and eastern parts are most affected.[85] Therefore, the Court of Justice upheld the Commission's decision that the Seine bay was eutrophic and should have been identified as an area sensitive to eutrophication.[86]

Next, the water courses that flow into the Siene downstream from its confluence with the Andeller were evaluated.[87] In support of this area being deemed "sensitive," the Commission produced the SDAGE Seine-Normandy, which stated that the "major rivers of the Seine-Normandie basin are affected by algal blooms in spring and summer and numerous small watercourses are at certain points invaded by higher forms of plant life, filamentous algae, or benthis diatoms."[88] However, no specific evidence was put forth to show that the third and

[80] *Id.*
[81] *Id.*
[82] *Commission of the European Communities v. French Republic.*
[83] *Id.*
[84] *Id.*
[85] *Id.*
[86] *Id.*
[87] *Commission of the European Communities v. French Republic.*
[88] *Id.*

fourth criteria of the definition of eutrophication were met.[89] The Court of Justice held that the Commission had not established that the Siene's tributaries downstream from its confluence are eutrophic nor may become so in the near future.[90]

In a separation action, on June, 1999, the Commission of the European Communities (Commission) commenced an action against Brussels –Capital Region, the Kingdom of Belgium for its failure to comply with Directive 91/271/EEC.[91] Specifically, the Commission contended that Brussels had failed to comply with the time limits defined in the directive for secondary treatment and additional treatment for nitrogen and phosphorus of wastewater in the Brussels agglomeration before being discharged into the Senne basin, an identified sensitive area pursuant to the directive.[92]

The Belgium Government, in defense, claimed that difficulties created by the institutional reform over the past thirty years to "preserve the unity of the State and the fundamental principle of a State founded upon the rule of rule" constitute a force majeure.[93] The Commission noted that the difficulties to which the Belgium Government referred are purely domestic matters since they "result from its political and administrative organization."[94] Pursuant to settled case law, "a Member State may not plead situations in its internal legal order, including those resulting from its federal organisation, in order to justify a failure to comply with the obligations and time limits laid down in a directive."[95] Henceforth, this was not a circumstance of force majeure.[96] The

[89] *Id.*
[90] *Id.*
[91] Case C-236/99, *Commission of the European Communities v. Kingdom of Belgium*, [2000] E.C.R. I-5657, 2000 ECJ CELEX LEXIS 7164, (2000).
[92] *Id.*
[93] *Id.*
[94] *Id.*
[95] *Id.*
[96] *Id.*

Commission found that the Kingdom of Belgium had failed to fulfill its obligations under Article 17 of the directive and ordered to pay costs of Commission's pleading.[97]

III. Dnieper River Basin Case Study

This next section of the paper describes the process by which potential hot spots were evaluated in the Dnieper River Basin case study. The standards used in the case study are compared against the relevant articles of the EU directive 2000/60/EC, establishing a framework for Community action in the field of water policy.[98] If a comparative analysis is not conducted with respect to a given standard, then it can be assumed that there was not a corresponding standard addressed in the EU directive.

A. Five Steps for Hot Spot Evaluation Employed in the Study

The Dnieper Hot Spot evaluation used a multi-stage screening system to identify priority Hot Spots in a practical and cost effective manner.[99] This systematic approach consisted of five-steps.[100] The five steps include[101]:

Step 1: Identification and Preliminary Screening of Hot Spots[102]

Step 2: Detailed Evaluation of Hot Spots for those areas that passed the preliminary screening

Step 3: Prioritization of Hot Spots

Step 4: Identification of Mitigation Measures and Associated Costs

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[97] *Commission of the European Communities v. Kingdom of Belgium.*
[98] *See supra* note 8.
[99] UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION, IDENTIFICATION, ASSESSMENT AND PRIORITIZATION OF POLLUTION HOT SPOTS, 3 (2003). [hereinafter UNIDO, Identification of Hot Spots].
[100] *Id.* at 13.
[101] *Id.*
[102] This study was restricted to direct dischargers. *Id* .at 8. Pollution that is directly discharged to the surface waters of the Dnieper River Basin. *Id.*at 7. Direct discharges include municipal and industrial wastewater treatment plants, industrial complexes, manufacturing plants, mineral and recourse extraction centers, centers for large-scale livestock rearing and areas of high population density. *Id.* at 8. However, it was noted that non-point sources of pollution such as large farms, contaminated farming and industrial areas, and military bases might also be considered as Hot Spots subject to scoring, if they could be "equated" to point sources with the availability of data sufficient to proceed with the scoring process. *Id.* at 8.

Step 5: Reporting

The following is limited to an analysis of the second step. The detailed evaluation in this study was conducted using a numerical scoring method in a questionnaire format.[103] The case study outlined four areas of interest, pollution control issues, water quality issues, biodiversity issues, and economic issues.[104] These four areas were identified as Categories and were further broken into Subcategories of multiple questions (Indictors), all of which were collectively referred to as Criteria.[105] Each Indicator was scored on a scale of 0 to 5.[106] Reasonable weightings were selected to determine the relative importance of each Indicator.[107] The scores were then transferred to a Summary Scoring Sheet to calculate the total score of each Hot Spot.[108] National Hot Spot Experts (NHSE) completed the scoring sheets for each of the identified Hot Spots that passed a preliminary screening using data available in national and regional centers.[109] The International Hot Spots Experts (IHSE) provided support and guidance as needed and reviewed the work conducted.[110] During the process, a data quality assessment was conducted by the NHSE for each country for use in a sensitivity analysis of the scoring methodology.[111]

The use of questionnaires to ascertain the required information was in accordance with the UNEP's recommendation for data monitoring, collection, and evaluation.[112] The questionnaires were appropriately sub-classified into municipal and industry. Additionally, the

[103] UNIDO, Identification of Hot Spots, *supra* note 147, at 17.
[104] *Id.*
[105] *Id.*
[106] *Id.* The ranking of the severity of the impact on the environmental issues was based on the following six categories: 0-no effect, 1- slight effect, 2-moderate effect, 3- major effect, 4- sever effect, and 5- extreme effect. The range could be altered as desired to provide greater refinement of resolution. NHSE were required to review and revise the proposed weighting values. *Id.*at 17.
[107] UNIDO, Identification of Hot Spots, *supra* note 147, at 17.
[108] *Id.*
[109] *Id.*
[110] *Id.*
[111] *Id.*
[112] *See supra* notes 26-28 and accompanying text.

scoring scales (ie parameters) were precisely defined and weighted to allow for proper evaluation of each site. There were a few instances of vagueness with respect to some Indicators, as discussed hereafter.

After the scores were calculated for each site, the sites assessed with the highest numbers were deemed to be the hot spots of greatest priority.[113] The case study suggested that five hot spots were to be identified for the countries of Belarus and Russia, while ten hot spots were to be identified in the Ukraine.[114]

B. Evaluation Criteria for Municipal and Industrial Wastewater

Under the Category of Pollution Control, wastewater treatment and discharge were evaluated.[115] Industries and wastewater treatment plants directly discharging effluents to the Dnieper River watershed were evaluated with respect to two considerations: treatment, monitoring, and type of discharge and characteristics of discharge, such as its chemical composition.[116] In accordance with EU Directive 2000/60/EC, which offers as an option to use best available techniques,[117] the goal was to promote discharges of large volumes of effluent in compliance with Best Available Treatment (BAT) technologies that directly affected the river water quality.[118] Inherently, the hot spot evaluation was a command and control scheme.

The type and degree of existing wastewater treatment was considered when promoting industries to Hot Spots.[119] Credit was given to dischargers of large volumes of fully treated

[113] UNIDO, Identification of Hot Spots, *supra* note 147, at 18.
[114] *Id.*
[115] *Id.* at 25.
[116] *Id.*
[117] Directive 2000/60/EC. Art. 10.
[118] *Id.* While BAT is a term of art in legal regimes, such as its codification in the EPA statutes, *see generally* 33 USCS §1311, a point of contention is whether it includes economic costs. Directive 2000/60/EC does not comment on the inclusion of economic costs, however Directive 91/271/EEC expressly states that economic costs are to be taken into consideration.
[119] UNIDO, Identification of Hot Spots, *supra* note 147, at 25.

wastewater.[120] Thus, large wastewater treatment plants and industries were not necessarily promoted to Hot Spots based solely on size and conversely, preference was given to smaller industries having no effluent treatment.[121]

The case study did not elaborate on size or quality of treatment in place, thus it is difficult to assess whether they would have complied as "collection systems" under EU directive 91/271/EEC, which, as stated above ,is incorporated under Directive 2000/60/EC, and whether the treatment was could be classified as "secondary treatment" under the directive.

Credit was also given to dischargers who already had in place good effluent monitoring, such as flow measurement, sampling, and analytical programs, and discharged effluents intermittently or through well-designed and constructed sub-surface river outfalls and diffusers.[122] Data derived from the monitoring programs was considered more accurate and reliable.

While the EU directive mandates that Member States appoint competent authority to implement Directive 2000/60/EC, it does not specify a specific individual or entity to collect measurements.[123] The recommendations set forth by UNEP for Hot Spot evaluation suggested that the "responsible operator of the [potential] hot spot, which is normally an industry," gather measurements.[124] Hence, credit awarded to these certain facilities that collect data is reasonable at least in connection with evaluation of hot spots.

The scoring method allowed for different scales of evaluation for the same criteria where appropriate.[125] For example, flow rates from municipalities wastewater treatment plants tend to

[120] *Id.*
[121] *Id.*
[122] UNIDO, Identification of Hot Spots at 25.
[123] Directive 2000/60/EC. Art. 3(2).
[124] *See supra* note 10.
[125] UNIDO, Identification of Hot Spots at 25.

be much larger than those from industrial complexes, thus the flow rates were evaluated on different scales.[126]

1. Treatment, Monitoring, and Type of Discharge

In evaluating wastewater treatment, monitoring and type of discharge from industrial and municipal plants, nine criterions were assessed. They included normal total effluent flow rate, proportion of effluent treated, dilution and mixing, secondary contributors, method of discharge, frequency of discharge, frequency of flowing monitoring, frequency of sampling and analysis, and type of sampling.[127]

a. **Normal Total Effluent Flow Rate**

i. Industrial Wastewater

For a given industrial sector, this criterion distinguished industrial plants based on the size.[128] Wastewater generation rates are typically proportional to production rates.[129] Industries with effluent flow rates greater than 2500m^3/day were considered very large[130], 1000 m^3/day medium[131] and less than 50m^3/day small.[132] Credit was given to large industries that had implemented or achieved water conservation measures.[133]

EU directive 91/271/EEC mandates that all biodegradable industrial wastewater that does not enter urban wastewater treatment plants before discharge, shall comply with

[126] *Id.* at 26. Specifically, when evaluating a Hot Spot that was a municipal waste water treatment plant, the range of total discharge to the river went from 100,000 m^3/day or greater, which scored a 5, to equal or less than 1,000 m^3/day, which scored a 0. Conversely, when evaluating a Hot Spot that was an industry, the range of total discharge to the river when from 2500 m^3/day or greater, which scored a 5, to equal or less than 50 m^3/day, which scored a 0. Hot Spots that did not fall squarely in either of these two categories were placed in one of the two categories based on the characteristics of their effluent. For example, stormwater discharge and agricultural run-off would most likely correspond to the evaluation data for municipal wastewater treatment plants. *Id.* at 25-26.
[127] *Id.* at 26-29.
[128] *Id.* at 26.
[129] UNIDO, Identification of Hot Spots, at 26.
[130] *Id.* A large plant was given a score of 5 on the scoring sheet. *Id.* at 99.
[131] *Id.*at 26. A medium plant was given a score of 3 on the scoring sheet. *Id.* at 99.
[132] UNIDO, Identification of Hot Spots, at 26. A small plant was given a score of 0 on the scoring sheet. *Id.* at 99.
[133] *Id.* at 26.

previously enacted regulations for all discharges from plants representing 4,000 population equivalent (p.e.) or more.[134] A comparison of effluent rates measured in m^3/day to discharges measured in p.e.[135] is difficult, if not impossible. However, *speculating* that 2500 m^3/day is the rough equivalent to 4000 p.e., the industry with a flow rate of 2500 m^3/day would be awarded a score of 5, which would help to elevate to a "high priority hot spot." This designation would most likely result in regulation of the facility in accordance with the directive.

ii. Municipal Wastewater

Since municipal wastewater treatment plants' effluents tend to be larger than their industrial counterparts, the rates have been increased based on professional judgment.[136] When evaluating a Hot Spot that was a municipal waste water treatment plant, the range of total discharge to the river went from 100,000 m^3/day or greater, which scored a 5, to equal or less than 1,000 m^3/day, which scored a 0.[137] The National Experts utilized official information contained in the 2TP reports for effluent rate data.[138]

EU directive 91/271/EEC mandates the installation of collection systems for urban wastewater of greater than 15,000 p.e. by December 31, 2000 and by December 31, 2005 for urban wastewater of 2000 and 15,000 p.e. As with the industrial wastewater flow rates, the comparison between the directive's flow rate and its implication (ie implementation of a collection system) and the case study's flow rate is complicated by the fact that the directive uses a p.e. standard, while the case study uses a m^3/day standard. Thus, here again, it is difficult to say whether 100,000 m^3/day, which would score a 5 on the Dnieper case study, is the equivalent

[134] *See supra* notes 64-65 and accompanying text.
[135] P.e. means the organic biodegradable load having a five-day biochemical oxygen demand (BOD_5) of 60 g of oxygen per day.
[136] UNIDO, Identification of Hot Spots at 26.
[137] *Id.* at 99.
[138] *Id.* at 26.

to a p.e. of more than 15,000, which would require a collection system. Speculating that the two standards are roughly proportional, the standard would be allowed under the EU directive.

b. Proportion of Effluent Treated

Both continuous and intermittent effluent discharges were scored.[139] While all continuous effluent streams might have been treated, spills and clean out wastewater might not have been, thus resulting in significant adverse impacts.[140]

c. Dilution and Mixing

To account for the assimilative capacity of the river, the hydraulic flow rate of the discharge, m^3/day, was included in the evaluation.[141] This was accomplished by ranking the dilution factor, which was the ratio of low river flow to total wastewater discharge rate.[142] A minimum seven-day river flow with a recurrence interval of ten years ("7Q10") was proposed as a standard river flow criterion.[143] However, the National Experts declined to use the 7Q10 flow

[139]UNIDO, Identification of Hot Spots, *supra* note 147, at 27. The percentage of total daily effluent discharged that received treatment was scored as follows:

5- < 20%
4- < 40% to 20%
3- < 60% to 40%
2- < 80% to 60%
1- < 100% to 80%
0- 100%

*Id.*at 99.

[140] *Id.* at 27. For example, in base metal mining where processing effluents were treated but discharging from tailing dams were not. *Id.*

[141] *Id.*

[142]UNIDO, Identification of Hot Spots, *supra* note 147, at 27. The ratios were scored as follows:

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

Id. at 99.

[143] *Id.* at 27. This standard is used by industry in New York State as a guideline for monitoring industrial waste discharges. *Id.*

rate and instead opted to base the discharge dilution of 95% of the inter-season river water flow rate.[144]

d. Secondary Contributions

For both municipal wastewater treatment plants and industrial discharges, contribution to the effluent by secondary sources might have an important impact on effluent quality.[145] With respect to industry, secondary contributors[146] are supervised less than their own operations and therefore add uncertainty to effluent quality and cause great concern.[147] With respect to municipal wastewater treatment plants, the greater the portion of the effluent whose source was industrial, the increased likelihood that contaminants, such as heavy metal and petroleum products, would be present in the effluent.[148]

e. Method of Discharge

The method of discharge of treated or untreated effluent affected the location and size of the mixing zone where toxic conditions could exist.[149] Full credit was given for facilities that had no discharge by virtue of complete containment, recycling, or re-use, which is in accordance with the EU directive that mandates that Member States reuse wastewater whenever

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[144] *Id.* at 27.
[145] *Id.* at 28.
[146] UNIDO, Identification of Hot Spots, *supra* note 147, at 28. Secondary dischargers are dischargers not under the control of the point source industry. *Id.* at 100.
[147] *Id.* at 28. If the hot spot was an industry, the daily flow contribution from secondary industries were scored as follows:

5- > 40%
4- > 30% but less than 20%
3- > 20% but less than 30%
2- > 10% but less than 20%
1- 0% but less than 10%
0- 0%, no flow contribution

Id. at 100.
[148] *Id.* at 28. If the hot spot was a municipal wastewater treatment plant, the daily flow contribution from industries (excluding municipal sanitary sewage) were scored identically to the scale outlined used for secondary industries. *Id.* at 99-100.
[149] UNIDO, Identification of Hot Spots, *supra* note 147, at 28.

appropriate.[150] Discharge into the sub-surface, either control or not,[151] 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.[152]

f. Frequency of Discharge

Intermittent discharge was considered to have less of an impact than continuous discharge since, at a given time, water quality would not be negatively impacted by discharge.[153] However, intermittent discharges might be more detrimental to fish and other aquatic life if their habitat was directly impacted by the discharge and thus, suffered rapid changes in water quality.[154]

g. Frequency of Flow Monitoring

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[150] *Id.* at 28.
[151] *Id.* at 28. Uncontrolled discharges are those with no distinct point of discharge that could be readily sampled. An example of this would be if pipes were evident and discharge was by overland routes. *Id.* at 28.
[152] *Id.* at 28. The method of discharge of treated or untreated effluent was scored as follows:
5- single surface outfall
4- multiple surface outfall
3- submerged, low river flow
2- submerged, high river flow
1- submerged, outfall/diffuser
Id. at 100.
[153] UNIDO, Identification of Hot Spots, *supra* note 147, at 28. The frequency of discharge was scored as follows:
5- continuous
4-nearly continuous (more than five days per week)
3- intermittent (once per week)
2- intermittent (once per month)
1-intermittant (once per quarter)
0- intermittent (once per year or less)
Id. at 100.
[154] *Id.* at 28. The frequency of flow monitoring was scored as follows:
5- never
4-intermittent (few points of 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)
Id. at 100-101.

Continuous flow monitoring was generally preferred to intermittent flow monitoring since possible uncontrolled discharges were found and thus could be corrected.[155] However, where effluent flow remained constant, intermittent flow monitoring was acceptable.[156]

h. Frequency of Sampling and Analysis

Continuous effluent sampling and analysis was generally preferred to intermittent sampling and analysis so that possible uncontrolled discharges would be found and hopefully controlled.[157] However, where effluent quality remained constant, intermittent or grab sampling and analysis was acceptable.[158] Regardless, continuous sampling had to be done initially and periodically thereafter to confirm the invariably of effluent quality.[159]

Pursuant to the EU directive, the minimum annual number of samples shall be determined according to the size of the treatment plant.[160] Each sample shall be collected at regular intervals during the year.[161] Extreme values for the water quality in question shall not be taken into consideration when they are the result of an unusual situation, such as those due to a heavy rain.[162]

The problem with comparing the frequency of sampling mandated by the Dnieper case study and the directive is that, while the directive outlines an express number of samples that should be conducted, the Dnieper case study broadly recommends "continuous sampling,"

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[155] UNIDO, Identification of Hot Spots, *supra* note 147, at 29.
[156] *Id.* at 29.
[157] *Id.* at 29.
[158] *Id.* The number of discharges sampled are scored as follows:
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
Id. at 101.
[159] *Id.* at 29.
[160] *See supra* notes 55 & 56 and accompanying text.
[161] *See supra* note 57.
[162] *See supra* note 58.

without defining "continuous." Here, the case study's standards would need to be more refined to comply with the directive.

i. Type of Sampling

Continuous, composite sampling was preferred to grab sampling to ensure that intermittent quality spikes were recorded.[163] 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 the equivalent.[164]

Pursuant to EU directive 91/271/EEC, flow proportional or time based 24-hour samples shall be collected at the same well-defined point in the outlet to monitor compliance.[165] The Dnieper case study, in accordance with the directive, preferred composite sampling as opposed to grab sampling.

2. Characteristics of Discharge

As noted above, in addition to evaluating discharges on the basis of treatment, monitoring, and type, characteristics of the discharge were also taken into consideration.[166] Wastewater characteristics were evaluated based on the concentration of oxygen demanding or depleting material, nitrogen, ammonia, phosphorus, total suspended solids, phenols, persistent organic pollutants, oil and grease, heavy metals, and radioisotopes.[167]

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[163] UNIDO, Identification of Hot Spots at 29. The type and frequency of sampling and analysis were scored as follows:

5- none/never
4- monthly (or less frequent) grab samples and analysis
3- weekly grab samples and analyses
2- daily grab samples and analyses
1- continuous sampling, laboratory analyses
0- continuous sampling, on-line analyses

Id. at 101.
[164] *Id.* at 29.
[165] Council Directive 91/271/EEC, Annex I, D.
[166] UNIDO, Identification of Hot Spots at 30.
[167] *Id* at 30-33.

a. Oxygen Demanding or Depleting Materials

This criterion was subjective since, under certain circumstances, Biochemical Oxygen Demand (BOD_5) or Chemical Oxygen Demand (COD) discharge loads or concentrations fluctuated due to intermittent, high polluting operations.[168] Situations where effluent treatment does not exist, such as agri-food, BOD or COD concentrations were high.[169] If BOD or COD data was unavailable, total organic carbon (TOC) or dissolved organic carbon (DOC) was used.[170]

The BOD_5 concentration of the discharge was scored on the following score:

5- >240mg/l
4- 120mg/l to less than 240mg/l
3- 60mg/l to less than 120mg/l
2- 30mg/l to less than 60mg/l
1- 15mg/l to less than 30mg/l
0- less than 15mg/l[171]

This scale aligns with the required concentration for BOD_5 discharge of 25mg/l O_2 under EU directive 91/271/EEC.[172] In fact, the case study applies a slightly more stringent standard in that it awards *one* point, instead of zero, for a concentration of 25mg/l O_2.

With respect to COD concentrations, the scale applied is as follows:

5- >400mg/l
4- 200mg/l to less than 400mg/l
3- 100mg/l to less than 200mg/l
2- 50mg/l to less than 100mg/l
1- 20mg/l to less than 50mg/l
0- less than 20mg/l[173]

[168] *Id.* at 30.
[169] *Id.*
[170] *Id.*
[171] *Id.* at 101-102
[172] Council Directive 91/271/EEC, Annex I, Table 1.
[173] UNIDO, Identification of Hot Spots at 102.

The COD requirement under EU directive 91/271/EEC is 125 mg/l O_2.[174] Given that a concentration of 125 mg/l O_2 would be awarded three points under this case study, it is fair to say that, again, the case study complys with the directive and is, in fact, employing stricter standards.

b. Nitrogen

Nitrogen in the forms of nitrites, nitrates, organic nitrogen contributed to river water eutrophication.[175] Nitrate Nitrogen was scored on the following score:

5- > 30.0 mg/l
4- 25.0 mg/l to less than 30.0 mg/l
3- 20.0 mg/l to less than 25.0 mg/l
2- 15.0 mg/l to less than 20 mg/l
1- 10 mg/l to less than 15 mg/l
0- less than 10.0 mg/l.[176]

Nitrite Nitrogen was scored on the following score:

5- > 0.5 mg/l
4- 0.4 mg/l to less than 0.5 mg/l
3- 0.3 mg/l to less than 0.4 mg/l
2- 0.2 mg/l to less than 0.3 mg/l
1- 0.1 mg/l to less than 0.2 mg/l
0- less than 0.1 mg/l.[177]

With respect to the EU directive, the parameters set forth concern the sum of the total nitrogen[178], and thus do not establish independent parameters for nitrates and nitrites. The directive requires 15 mg/l for 10,000-100,000 p.e.[179] If more than 100,000 p.e., the requirement is 10 mg/l.[180] Provided that the Dnieper case study evaluates the chemical compounds separately and different measurement standards are employed, it is difficult to make an accurate comparison to the EU directive's parameters. Furthermore, the EU directive's parameters for nitrogen are

[174] Council Directive 91/271/EEC, Annex I, Table 1.
[175] UNIDO, Identification of Hot Spots at 30.
[176] *Id.* at 104.
[177] *Id.*
[178] Total nitrogen means the sum of total Kjeldahl-nitrogen (organic N +NH_3), nitrate (NO_3) nitrogen, and nitrite (NO_2) nitrogen. Council Directive 91/271/EEC, Annex I, Table 2.
[179] *Id.*
[180] *Id.*

only applicable to those discharges from urban wastewater treatment plants into sensitive areas that are subject to eutrophication. The Dnieper case study evaluates nitrogen regardless of the discharge's location.

c. Ammonia

Ammonia was included because of it acute toxicity to aquatic life particularly at higher pH.[181] No scoring method was provided for Ammonia.

d. Phosphorus

Phosphorus in the form of ortho-phosphates and condensed phosphates contributed to water eutrophication.[182] Phosphorus was scored on the following score:

5- > 5.0 mg/l
4- 4.0 mg/l to less than 5.0 mg/l
3- 3.0 mg/l to less than 4.0 mg/l
2- 2.0 mg/l to less than 3.0 mg/l
1- 1.0 mg/l to less than 2.0 mg/l
0- less than 1.0 mg/l.[183]

The EU directive prescribes parameters for phosphorus of 2 mg/l for 10,000 to 100,000 p.e. If greater than 100,000 p.e., the parameter is 1mg/l.[184] Upon comparison of these parameters to the scale used in the Dnieper case study, there is a collective agreement on the optimal level of phosphorus for discharges. However, the EU directive factors in a population equivalent (p.e.), which as stated herein, means the organic biodegradable load having a five-day biochemical oxygen demand (BOD_5) of 60 g of oxygen per day.[185] The Dnieper case study looks primarily to the proportion of milligrams to liters. It is most likely reasonable to suggest

[181] UNIDO, Identification of Hot Spots, at 31.
[182] *Id.*
[183] *Id.* at 103.
[184] Council Directive 91/271/EEC, Annex I, Table 2.
[185] *Supra* note 50.

then, that the level of phosphorus used in the Dniper will have to be modified to comply with the directive.

Similarly to nitrogen, the EU directive's parameters for phosphorus are only applicable to those discharges from urban waste waster treatment plants into sensitive areas that are subject to eutrophication. The Dnieper case study evaluates phosphorus regardless of the discharge's location.

e. Total Suspended Solids

Total Suspended Solids (TSS) impact water clarity, and build up on sediment at points of discharge and impair movement downstream.[186]

TSS concentrations were scored as follows:

5- >240mg/l
4- 120mg/l to less than 240mg/l
3- 60mg/l to less than 120mg/l
2- 30mg/l to less than 60mg/l
1- 15mg/l to less than 30mg/l
0- less than 15mg/l.[187]

EU directive 91/271/EEC requires a concentration 35mg/l[188], whereas the case study awards a score of 2 for such measurement. The case study suggested that a concentration less than 15 mg/l is most favorable, thus is it reasonable to conclude that the concentration levels for TSS comply with the directive.

f. Phenols

This non-specific phenol parameter was useful for initial evaluation of wastewaters, particularly from petroleum and petrochemical plants.[189] Phenols were also good indicators of

[186] UNIDO, Identification of Hot Spots at 31. Suspended solids containing toxic organics and heavy metals were scored under their respective criteria. *Id.*
[187] *Id.* at 102.
[188] Council Directive 91/271/EEC, Annex I, Table 1.
[189] UNIDO, Identification of Hot Spots at 31.

water contamination from organic chemical facilities and the presence of other organic compounds.[190] At low concentrations, phenols impart objectionable taste and odor to drinking water.[191]

Phenols concentrations were scored as follows:

5- > 16 mg/l
4- 0.08 mg/l to less than .16 mg/l
3- 0.04mg/l to less than 0.08 mg/l
2- 0.02 mg/l to less than 0.04 mg/l
1- 0.01 mg/l to less than 0.02 mg/l
0- less than 0.01mg/l.[192]

g. Persistent Organic Pollutants

Persistent Organic Pollutants (POPs) are those organic compounds that do not readily biodegrade in the natural environment and therefore tend to accumulate in sediment and aquatic life.[193] There compounds include specific pesticides and herbicides, PCB, polyaromatic hydrocarbons (PAH), halogenated organic compounds, and others.[194]

The type and concentration of organic compounds discharged depends on the industry.[195] While many of these compounds can be detected at trace amounts, the intent of this study was to identify those discharges containing relatively high concentrations associated with their use as raw materials and generation as unrecovered or untreated byproducts or products.[196]

POPs concentrations were scored as identically to Phenols (see above).

[190] *Id.*
[191] *Id.*
[192] *Id.* at 106.
[193] *Id.* at 31.
[194] UNIDO, Identification of Hot Spots at 31.
[195] *Id.*
[196] *Id.* at 32.

h. Oil and Grease

Oil and grease were either subject to discharge limits set for animal or vegetable oil and grease or mineral or synthetic oil and grease.[197] Discharge limits were usually more stringent for mineral or synthetic oil and grease since animal and vegetable oil and grease are typically more biodegradable.[198] However, both were aesthetic quality criteria.[199]

Oil and grease concentrations were scored identically to Phenols (see above).[200]

i. Heavy Metals

The eight heavy metals of concern are iron, copper, zinc, nickel, chromium, cadmium, lead and mercury.[201] Dissolved metals primarily affect toxicity to aquatic life and drinking water and aesthetics, such as taste.[202] Metal concentrations and loads were determined by combining dissolved and solid.[203] Each heavy metal was evaluated individually, rather than collectively.[204]

j. Radioisotopes

The main radioisotopes of concern were Ce137 and Sr90, which arise from the nuclear power industry.[205] Radioisotopes were not measured with specificity, but rather on a more generalized basis.[206] If it was very likely that radioisotopes were potential, confirmed, or suspected, the score given was three.[207] If it was likely, two points were given.[208] If it was

[197] *Id.*
[198] *Id.*
[199] UNIDO, Identification of Hot Spots at 32.
[200] *Id.* at 105.
[201] *Id.* at 32.
[202] *Id.*
[203] *Id.*
[204] UNIDO, Identification of Hot Spots at 32.
[205] *Id.*
[206] *Id.* at 110.
[207] *Id.*
[208] *Id.*

possible, but unlikely, one point was awarded.[209] Finally, if it was not possible, then no points were given.[210]

IV. Conclusion

The Dnieper case study's approach to the collection and evaluation of data for hot spots was in accordance with the recommendations of UNEP. However, some of the standards employed in connection with the evaluation would not comply under EU directive 91/271/EEC, while others might.

The main reasons for noncompliance under the EU directive were the differing measuring standards (m^3/day as opposed to p.e.) and the vagueness associated with some of the standards in the case study, such as type and degree of existing wastewater and continuous sampling. The most congruency was found with respect to the allowable levels of chemicals, such as BOD_5 and COD. The case study measured the levels of many other chemicals that are not required under the EU directive.

There was however one noticeable difference with respect to the application of the concentration requirements of nitrogen and phosphorus. The EU directive's concentration levels were triggered only if the urban wastewater was discharged into a sensitive area that is subject to eutrophication. The case study's concentration scales for both elements were applied to every hot spot. From a monetary standpoint, it may be advantageous to limit the application of these requirements to discharges into sensitive areas. However, given that this case study focuses on a river basin, this distinction may not need to be drawn since it is possible that the entire area would fall within the definition of a sensitive area subject to eutrophication under the EU directive. If that assumption was made, it should be expressly set forth in the case study.

[209] UNIDO, Identification of Hot Spots at 110.
[210] *Id.*

This case study serves as a basis for drafting environmental regulations that comply with the EU directive. However, measurement standards need to conform to the EU standards and some conditions, as stated above, need to be refined.