

MONITORING ODPADNIH VODA IN ZAHTEVANE STOPNJE ČIŠČENJA NA KOMUNALNIH ČISTILNIH NAPRAVAH MONITORING OF WASTEWATER AND THE REQUIRED DEGREES OF TREATMENT FOR MUNICIPAL WASTEWATER TREATMENT PLANTS

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V prispevku so prikazane zahteve po monitoringu komunalnih in nekaterih industrijskih odpadnih voda za plačevanje ekološke takse v državi. V Sloveniji je bilo v letu 1996 in 1998 sprejetih več uredb, ki urejajo to področje. Podane so zahteve iz teh uredb in naše izkušnje pri spremljanju tehnološkega delovanja čistilnih naprav (ČN). Povzete so nekatere maksimalne dovoljene koncentracije onesnažil, ki se izpuščajo v vodotok ali v kanalizacijo. Prikazane so zahtevane stopnje čiščenja na komunalnih ČN. Podali smo primerjavo med zahtevami naše zakonodaje za kakovost iztokov iz komunalnih ČN z zakonodajo ZRN in EZ.

Ključne besede: monitoring, komunalne odpadne vode, čistilne naprave, zakonodaja

Requirements on the monitoring of urban and some industrial wastewaters for the payment of the discharge tax to the State are presented in this contribution. Several decrees that regulate this field were adopted in the years 1996 and 1998. Requirements from these decrees and our experience from the monitoring of the technical operation of wastewater treatment plants (WWTPs) are explained. Some data on the maximal permitted concentration of pollutants discharged in a watercourse and collecting system are reviewed. Requirements on the degrees of treatment in municipal WWTPs are discussed. A comparison between the requirements of our legislation and that of Germany and the EU for the quality of the discharges from municipal WWTPs is also presented.

Key words: monitoring, urban wastewater, wastewater treatment plants, legislation

1. UVOD

Po svetu in pri nas že vrsto let spremljamo kakovost vodotokov, jezer in morja (pri nas to izvaja Hidrometeorološki zavod pri MOP). Nadzor nad onesnaževalci pa je bil bolj ali manj stihijski. V Sloveniji je bilo v letu 1996 na podlagi *Zakona o varstvu okolja* [1] sprejetih več uredb, ki urejajo to področje.

Emisijski monitoring ali monitoring odpadnih vod je postopek, ki ga izvaja pooblaščen oseba. Metodologijo vzorčenja in merjenja parametrov in količin odpadnih vod, vsebino poročila o emisijskem monitoringu ter način sporočanja podatkov ministrstvu, ki je pristojno za varstvo okolja, opravlja v skladu s *Pravilnikom o prvih meritvah in obratovnem monitoringu odpadnih vod ter o pogojih za njegovo izvajanje* [2]. Obliko poročila

1. INTRODUCTION

The quality of watercourses, lakes and seas has been monitored all over the world, as well as in our country (provided by the Hydrometeorological Institute of the MEPP), for many years. The control of causers of pollution has been more or less unplanned. Several decrees that regulate this field were adopted in Slovenia in 1996 on the basis of the *Environmental Protection Act* [1].

Emission monitoring or operational monitoring of wastewater is a procedure provided by a competent authority. This authority implements the methodology of sampling, the measurement of parameters and the amount of wastewater, the content of the report on emission monitoring and the method and form of notifying data to the MEPP, who is competent in environmental protection, in accordance with the *Regulation on the initial measurements and operational monitoring of waste water and the conditions for its*

predpisuje Uredba o obliki poročila o občasnih in trajnih meritvah v okviru obratovalnega monitoringa odpadnih vod [3].

Izvedba emisijskega monitoringa obsega:

- merjenje količine odpadne vode med vzorčenjem,
- vzorčenje odpadne vode,
- merjenje parametrov odpadne vode: merjenje temperature in pH vrednosti odpadne vode med vzorčenjem in analiza vzorca odpadne vode,
- vrednotenje emisije snovi, emisijskega deleža oddane toplote ter izračun letne količine odpadne vode in letne količine nevarnih snovi,
- izračun emisijskega faktorja ali učinka čiščenja odpadne vode, če je s predpisi o emisiji snovi za posamezni vir onesnaženja ali komunalno oziroma skupno čistilno napravo za te veličine določena mejna vrednost,
- izdelavo poročila o opravljenih meritvah.

Emisijski monitoring zahteva od vsakega onesnaževalca, da dokaže količino onesnaženja. V Sloveniji mora po podatkih MOP-a opravljati emisijski monitoring približno 800 onesnaževalcev.

V Sloveniji se je emisijski monitoring prvič izvajal v letu 1996 samo na KPK. Že za leto 1997 pa so bili zahtevani parametri naslednjih težkih kovin: živo srebro, kadmij, krom, nikelj, svinec, in baker ter njihove spojine, izražene kot kovine. Z navedenimi uredbami so kemijski postopki in analize zelo natančno in kakovostno definirani. Ker so analize, izražene kot koncentracije, le prvi del za določitev letne mase onesnaženja, menimo, da je za drugi del, to je za meritve pretokov in njihov nadzor slabo ali neprofesionalno poskrbljeno (neurejenost merskih mest, nekvalificiranost za odčitavanje ali meritev pretokov brez nadzora idr.).

Poleg emisijskega monitoringa je pomemben imisijski monitoring, ki obravnava varstvo voda celovito, in sicer tako, da za onesnaževalce ugotovimo in določimo

implementation [2]. The form of the report is prescribed by the Decree on the form of the report of periodical and continuous measurements in the scope of the operational monitoring of waste waters [3].

Implementation of emission monitoring includes:

- measurement of the amount of wastewater during sampling,
- sampling of wastewater,
- measurement of the parameters of wastewater: measurement of temperature and the pH value of wastewater during sampling and analysis of the sample of wastewater,
- evaluation of the emission of substances, the emission fraction of discharged heat and calculation of the annual amount of waste water and annual amounts of dangerous substances,
- calculation of the emission fraction and the effect of wastewater treatment when the limit value of these parameters is set by regulations on the emission of substances for an individual source of pollution or a municipal, respectively, mixed wastewater treatment plant,
- elaboration of the report on the accomplished measurements.

Emission monitoring requires that causer of pollution prove the amount of pollution it causes. There are approximately 800 causers of pollution in Slovenia which must provide emission monitoring.

Emission monitoring for COD only was implemented in Slovenia for the first time in 1996. Then in 1997, the parameters of the following heavy metals were required: mercury, cadmium, chromium, nickel, lead and copper and their compounds expressed as metal. Chemical procedures and analyses are defined very precisely and according to the high quality standards by the decrees mentioned. While analytical results, expressed as concentrations, are only the first factor in the determination of the annual amount of a pollutant, it is, in our opinion, very poorly and unprofessionally provided for in the second portion, which is for the measurements of flows and their control. Some examples are: disorganised measuring sites, unprofessional reading of results or flow measurements without control etc.

Besides emission monitoring, immission monitoring, which deals comprehensively with water protection, is also important, so that the necessary degree of treatment and the hierarchy of construction of municipal

potrebno stopnjo čiščenja in hierarhijo graditve komunalnih čistilnih naprav v posameznih porečjih. Trenutno se imisijski monitoring, ki upošteva tudi samočistilno sposobnost odvodnikov, pri nas ne izvaja.

2. IZVEDBA EMISIJSKEGA MONITORINGA

V okviru emisijskega monitoringa mora obravnavano podjetje zagotavljati izvedbo trajnih meritev količin odpadne vode, če so za vir onesnaženja določene s predpisi o emisiji snovi in toplote pri odvajanju odpadnih voda iz virov onesnaženja in občasnih meritev temeljnih in dodatnih parametrov ter količin odpadne vode med vzorčenjem.

Občasne meritve se izvajajo med obratovanjem ali uporabo vira onesnaženja ali komunalne ali skupne čistilne naprave v enakomernih časovnih presledkih v koledarskem letu oziroma v obdobju obratovanja ali uporabe, kadar ne obratuje ali se ne uporablja skozi celo koledarsko leto.

Letna pogostost občasnih meritev in čas vzorčenja reprezentativnega vzorca odpadne vode za komunalne ali skupne čistilne naprave [2] sta podana v preglednici 1.

WWTPs in an individual river basin is stated and determined for each causer pollution. Currently, the immission monitoring that also takes into account the self-purification capability of a recipient, has not yet been implemented in Slovenia.

2. IMPLEMENTATION OF IMMISION MONITORING

Regulations regarding the emission of substances and heat in the drainage of wastewater from pollution sources require that the responsible enterprise must ensure the implementation of permanent measurements of the amount of wastewater or periodical measurements of the basic and additional parameters and the amount of wastewater during sampling within the scope of emission monitoring.

Periodical measurements are implemented during the operation or use of a pollution source or a municipal or mixed WWTP in regular time intervals in a calendar year or within the time of operation or use, when it does not operate for the entire calendar year.

The annual frequency of periodical measurements and the sampling time of the representative sample of wastewater for a municipal or mixed WWTP [2] are given in Table 1.

Preglednica 1. Pogostost občasnih meritev in čas vzorčenja reprezentativnega vzorca odpadne vode za komunalne ali skupne čistilne naprave [2].

Table 1. Frequency of the periodical measurements and the sampling time of the representative sample of wastewater for a municipal or mixed WWTP [2].

Zmogljivost komunalne ali skupne čistilne naprave [PE] <i>Capacity of a municipal or mixed waste water treatment plant [PE]</i>	Letna pogostost meritev [-] <i>Annual frequency of measurement [-]</i>	Čas vzorčenja reprezentativnega vzorca [ure] <i>Sampling time of the representative sample [hour]</i>
≤ 50	1	2
51-200	2	2
201- 2000	2	6
2001- 10000	4	24
10001- 50000	8	24
> 50000	12	24

Letna pogostost občasnih meritev in čas vzorčenja reprezentativnega vzorca odpadne vode za vir onesnaženja [2] pa sta določena v preglednici 2.

Annual frequency of the periodical measurements and sampling time of the representative sample of wastewater for a pollution source [2] are determined in Table 2.

Preglednica 2. Pogostost občasnih meritev in čas vzorčenja za vir onesnaženja [2].

Table 2. Frequency of periodical measurements and the sampling time for a pollution source [2].

Letna količina tehnološke odpadne vode [1000 m ³ /leto]	Letna pogostost meritev [-]	Čas vzorčenja reprezentativnega vzorca [ure]
Annual amount of industrial waste water [1000 m ³ /year]	Annual frequency of measurements [-]	Sampling time of the representative sample [hour]
< 4	1	6
4 - 10	2	6
10 - 50	3	6
50 - 200	4	24
200 - 500	6	24
> 500	12	24

Če ima vir onesnaženja, ki odvaja tehnološke odpadne vode, več iztokov v kanalizacijo ali neposredno v vode, se pri določitvi letne pogostosti občasnih meritev in časa vzorčenja upošteva vsota letnih količin tehnološke odpadne vode iz vseh iztokov.

Trajne meritve količine odpadnih vod mora povzročitelj zagotoviti, če je letna količina tehnološke odpadne vode iz vira onesnaževanja na posameznem iztoku večja od 100000 m³/leto. Če ima vir onesnaževanja več iztokov in v nobenem letna količina tehnoloških odpadnih vod ne presega 100000 m³/leto, letna količina tehnoloških odpadnih vod vseh iztokov skupaj pa presega 100000 m³/leto, mora povzročitelj zagotoviti trajne meritve količine odpadnih vod na iztoku, ki ima največjo letno količino tehnoloških odpadnih vod. Izvajalec javne službe mora zagotoviti trajne meritve količine odpadnih vod na iztoku komunalne ali skupne čistilne naprave, če je zmogljivost čiščenja več kot 10 000 PE.

Emisija snovi in toplote se določa na iztoku odpadne vode iz vira onesnaževanja ali čistilne naprave v kanalizacijo ali neposredno v odvodnik brez predhodnega razredčevanja odpadne vode.

When a pollution source from which industrial wastewater is discharged, has several outlets in the collecting system or discharges directly into a body of water, the sum of the annual amounts of industrial wastewater from all outlets must be considered for the determination of the annual frequency of periodical measurements and the sampling time.

Permanent measurements of the amount of wastewater must be ensured by the causer of pollution when the annual amount of industrial wastewater from a pollution source on a separate outlet is higher than 100.000 m³/year. When a pollution source has several outflows and the annual amount of industrial wastewater in none exceeds 100.000 m³/year, but the annual amount of industrial wastewater from all outlets together exceeds 100.000 m³/year, the originator of the pollution must ensure continuous measurements of the amount of wastewater on the outlet that has the highest annual amount of industrial wastewater. A public service manager must ensure permanent measurements of the amount of wastewater on the outflow of a municipal or mixed wastewater treatment plant when the treatment capacity is higher than 10.000 PE.

The emission of substances and heat is determined by the outflow of wastewater from the pollution source or a wastewater treatment plant into the sewage system or directly into a body of water without preliminary dilution.

3. MEJNE VREDNOSTI PARAMETROV ODPADNE VODE

Emisija snovi ali toplote v posamezni meritvi presega predpisane mejne vrednosti odpadnih vod, če so izmerjene ali izračunane vrednosti večje od predpisanih mejnih vrednosti.

Mejne vrednosti parametrov odpadne vode za iztok v vodotok ali iztok v kanalizacijo so podane v Prilogi 1 Uredbe o emisiji snovi in toplote pri odvajanju odpadnih voda iz virov onesnaženja [4]. Preglednica 3 pa nam podaja po en parameter kot primer.

3. LIMIT VALUES OF THE PARAMETERS OF WASTEWATER

The emission of substances or heat of the particular measurement exceeds the regulated limit values for wastewater when the measured or calculated values are higher than the regulated limit values.

Limit values of the parameters of wastewater for the discharge into a watercourse or sewage system are given in Appendix 1 of the Decree on the emission of substances and heat in the drainage of wastewater from pollution sources [4]. Some parameters are given in Table 3 as an example.

Preglednica 3. Prikaz opisa mejnih vrednosti za izpust v vodotok ali v kanalizacijo [4].
 Table 3. Presentation of some limit values for discharge into a watercourse or discharge into the sewage system [4].

Parameter	Izražen kot <i>Expressed as</i>	Enota <i>Unit</i>	Mejne vrednosti <i>Limit values</i>	
			Iztok v vode <i>Discharge into a watercourse</i>	Iztok v kanalizacijo <i>Discharge into the sewage system</i>
I. SPLOŠNI PARAMETRI <i>I. GENERAL PARAMETERS</i>				
4. Usedljive snovi <i>4. Settleable substances</i>		mg/l	0,5	10
II. BIOLOŠKI PARAMETRI <i>II. BIOLOGICAL PARAMETERS</i>				
7. Biološka razgradljivost <i>7. Biodegradability</i>		%	-	(c)
III. ANORGANSKI PARAMETRI <i>III. INORGANIC PARAMETERS</i>				
18. Krom šestvalentni <i>18. Chromium(VI)</i>	Cr	mg/l	0,1	0,1
IV. ORGANSKI PARAMETRI <i>IV. ORGANIC PARAMETERS</i>				
38. KPK <i>38. COD</i>	O ₂	mgO ₂ /l	120	-

Količine v vode izpuščenih nevarnih snovi so podane v Prilogi 2 [4]. Preglednica 4 pa nam podaja dva parametra kot primer.

The amounts of dangerous substances released into a recipient are given in Appendix 2 [4]. Two parameters are given as an example in Table 4.

Preglednica 4. Prikaz zapisa količin v vode izpuščenih nevarnih snovi v enem letu [4].
 Table 4. Presentation of the amounts of dangerous substances released in one year [4]

Parameter	Izražen kot <i>Expressed as</i>	Enota <i>Unit</i>	Količina izpuščene nevarne snovi <i>Amount of dangerous substance released</i>
III. ANORGANSKI PARAMETRI <i>III. INORGANIC PARAMETERS</i>			
18. Krom šestvalentni <i>18. Chromium(VI)</i>	Cr	g/leto <i>g/year</i>	100
IV. ORGANSKI PARAMETRI <i>IV. ORGANIC PARAMETERS</i>			
46. Fenoli <i>46. Phenols</i>	C ₆ H ₅ OH	g/leto <i>g/year</i>	100

Za obrate, ki proizvajajo kovinske izdelke, Uredba o emisiji snovi pri odvajanju odpadnih vod iz objektov in naprav za proizvodnjo kovinskih izdelkov [5] določa posebne zahteve v zvezi z emisijo snovi pri odvajanju tehnoloških odpadnih vod iz objektov in naprav. Posebne mejne vrednosti parametrov za odvajanje v kanalizacijo:

The Decree on the emission of substances in the discharge of wastewater from plants and facilities for the production of metal products [5] regulates special requirements concerning the emission of substances in the discharge of industrial wastewater from plants and facilities producing metal products. There are special limit values of the parameters for the drainage into a sewage system:

14. Kadmij <i>14. Cadmium</i>	Cd	mg/l	0.2	0.2
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Za obrate, ki proizvajajo, predelujejo in obdelujejo tekstilna vlakna, Uredba o emisiji snovi pri odvajanju odpadnih vod iz objektov in naprav za proizvodnjo, predelavo in obdelavo tekstilnih vlaken [6] določa posebne zahteve v zvezi z emisijo snovi pri odvajanju tehnoloških odpadnih vod iz objektov in naprav. Posebne mejne vrednosti parametrov za odvajanje v kanalizacijo:

The Decree on the emission of substances in the discharge of wastewater from plants and facilities for the production, processing and treatment of textile fibre [6] regulates special requirements concerning the emission of substances in the drainage of industrial wastewater from industrial plants and facilities producing, processing and treating textile fibres. Special limit values of parameters for the drainage into a sewage system follow:

13. Cink <i>13. Zinc</i>	Zn	mg/l	3.0	3.0
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Uredba o emisiji snovi pri odvajanju odpadnih voda iz komunalnih čistilnih naprav [7] določa posebne zahteve v zvezi z emisijo snovi pri odvajanju odpadnih vod iz komunalnih čistilnih naprav:

- mejne vrednosti parametrov odpadne vode,
- mejne vrednosti učinka čiščenja odpadne

The Decree on the emission of substances in the discharge of wastewater from municipal wastewater treatment plants [7] regulates the emission of substances in the drainage of urban wastewater from municipal wastewater treatment plants:

- limit values of the parameters of wastewater
- limit values of the effect of treatment of

vode,
 – posebne ukrepe v zvezi z načrtovanjem in obratovanjem komunalnih čistilnih naprav.
 Mejne vrednosti parametrov odpadnih voda za **obstoječe komunalne čistilne naprave** [7] ne glede na njihovo zmogljivost so podane v preglednici 5.

wastewater
 – special measures concerning the planning and operation of municipal wastewater treatment plants
 The limit values of the parameters of wastewater for **existing municipal wastewater treatment plants** [7] without respect to their capabilities are given in Table 5.

Preglednica 5. Mejne vrednosti parametrov odpadnih voda za **obstoječe komunalne čistilne naprave** [7].

Table 5. Limit values of the parameters of wastewater for **existing municipal wastewater treatment plants** [7].

Parameter	Izražen kot <i>Expressed as</i>	Enota <i>Unit</i>	Mejne vrednosti za obstoječe KČN <i>Limit values for existing WWTPs</i>
BPK ₅ BOD ₅	O ₂	mg/l	30
KPK COD	O ₂	mg/l	160
Amonijev dušik <i>Ammonium nitrogen</i>	N	mg/l	15
Celotni fosfor <i>Total phosphorous</i>	P	mg/l	10

Mejne vrednosti parametrov odpadnih voda za **nove komunalne čistilne naprave in za komunalne čistilne naprave v rekonstrukciji** [7] so glede na njihovo zmogljivost čiščenja, podane v preglednici 6.

Limit values of the parameters of wastewater for **new municipal wastewater treatment plants and municipal wastewater treatment plants in reconstruction** [7] with respect to their treatment capacities are given in Table 6.

Preglednica 6. Mejne vrednosti parametrov odpadnih voda za **nove komunalne čistilne naprave in za komunalne čistilne naprave v rekonstrukciji** [7].

Table 6. Limit values of the parameters of wastewater for **new municipal wastewater treatment plants and municipal wastewater treatment plants in reconstruction** [7].

Parameter	Izražen kot <i>Expressed as</i>	Enota <i>Unit</i>	Zmogljivost KČN izražena v [PE] <i>Capacity of a municipal WWTP in [PE]</i>			
			< 2000	2001 - 10000	10001- 100000	> 100000
Neraztopljene snovi <i>Suspended solids</i>		mg/l	-	60	35	35
Amonijev dušik <i>Ammonium nitrogen</i>	N	mg/l	-	10	10	10
KPK COD	O ₂	mg/l	150	125	110	100
BPK ₅ BOD ₅	O ₂	mg/l	30	25	20	20

Mejna vrednost za učinek čiščenja komunalne čistilne naprave, ki ne sme biti manjši od 80 odstotkov, velja namesto mejne vrednosti za KPK iz preglednice 6 v primeru, če v mesečnem povprečju iz analize 24-urnega vzorca izhaja, da je vrednost KPK v surovi odpadni vodi na iztoku iz mehanske stopnje čiščenja večja od:

- 625 mg/l za KČN s kapaciteto čiščenja več kot 2 000 PE
- 550 mg/l za KČN s kapaciteto čiščenja več kot 10 000 PE ali
- 500 mg/l za KČN s kapaciteto čiščenja več kot 100 000 PE.

Mejna vrednost za učinek čiščenja komunalne čistilne naprave, ki ne sme biti manjši od 90 odstotkov, velja namesto mejne vrednosti za BPK₅ iz preglednice 6 v primeru, če v mesečnem povprečju iz analize 24-urnega vzorca izhaja, da je vrednost BPK₅ v surovi odpadni vodi na iztoku iz mehanske stopnje čiščenja večja od:

- 250 mg/l za KČN s kapaciteto čiščenja več kot 2 000 PE ali
- 200 mg/l za KČN s kapaciteto čiščenja več kot 10 000 PE.

Mejne vrednosti za koncentracijo in učinek čiščenja celotnega dušika in celotnega fosforja, če se odpadne vode iz novih KČN ali KČN v rekonstrukciji iztekajo v:

- zajezone površinske vode, ki se skladno z določbami [4] štejejo za vodotok,
- ustja rek, ki se izlivajo v obalno morje,
- druge površinske vode, kjer je mogoče ugotoviti ali pričakovati evtrofikacijo

ter skladno z dopolnilom [8] k uredbi [7] tudi v:

- površinske vode, ki so namenjene za pripravo pitne vode in presegajo mejne imisijske vrednosti nitratov, določene s predpisi o kakovosti površinskih voda,
- vode na območjih, kjer je skladno s predpisi s področja voda in varstva narave obvezno terciarno čiščenje odpadne vode,

so podane v preglednici 7.

Limit values that cannot be less than 80 % for the efficiency of treatment of a municipal wastewater treatment plant are valid instead of the limit value for COD from Table 6 in the case when it comes out of the monthly average of the 24-hour sample analysis that the COD value in raw wastewater in the outflow from the mechanical (primary) phase of the treatment is higher than:

- 625 mg/l for a municipal WWTP with a treatment capacity higher than 2 000 PE
- 550 mg/l for a municipal WWTP with a treatment capacity higher than 10 000 PE
- 500 mg/l for a municipal WWTP with a treatment capacity higher than 100 000 PE

Limit values for the efficiency of treatment of a municipal wastewater treatment plant that cannot be less than 90 % are valid instead of the limit value for BOD₅ from Table 6 in the case when it comes out of the monthly average of the 24-hour sample analysis that the BOD₅ value in raw wastewater in the outflow from the mechanical (primary) phase of treatment is higher than:

- 250 mg/l for a municipal WWTP with a treatment capacity higher than 2 000 PE or
- 200 mg/l for a municipal WWTP with a treatment capacity higher than 10 000 PE

Limit values for concentration and the efficiency of treatment of total nitrogen and total phosphorous when waste water from a new municipal WWTP or municipal WWTP in reconstruction is discharged into:

- stemmed water bodies which are considered in agreement with the regulations [4] as watercourses,
- estuaries draining into coastal seas,
- other surface waters in which it is possible to state or expect eutrophication,

and according to Amendment [8] to Decree [7] also into:

- surface waters intended for the preparation of drinking water and exceeding the limit immission values of nitrates determined by regulations on the quality of surface waters,
- water bodies in the areas where the tertiary treatment of wastewater is obligatory according to the regulations concerning waters and the protection of nature,

are given in Table 7.

Preglednica 7. Minimalne zahteve za izpust komunalnih odpadnih vod v Sloveniji
v občutljiva območja [7].

Table 7. Minimal requirements for the discharge of urban wastewater in Slovenia [7].

			Zmogljivost KČN izražena v [PE] Capacity of a municipal WWTP in [PE]			
Parameter	Izražen kot <i>Expressed as</i>	Enota <i>Unit</i>	< 2000	2001 - 10000	10001- 100000	> 100000
Celotni dušik <i>Total nitrogen</i>	N	mg/l	-	18	15	10
Učinek čiščenja celotnega dušika <i>Effect of treatment of total nitrogen</i>		%	-	65	70	80
Celotni fosfor <i>Total phosphorus</i>	P	mg/l	-	3	2	2
Učinek čiščenja celotnega fosforja <i>Effect of treatment of total phosphorus</i>		%	-	70	80	80

4. IZPUSTI IZ KOMUNALNIH ČN IN PRIMERJAVA Z DRUGIMI

Kontrola izpustov iz KČN je zelo pomembna, saj z njo na eni strani ugotavljamo obremenitve ostalih onesnaževalcev, ki so priključeni na kanalizacijski sistem, po drugi strani pa nam zahtevane stopnje varujejo odvodnike. Kakovost izpustov iz KČN nam v fazi projektiranja tudi neposredno določa stopnjo čiščenja in s tem investicijsko vrednost ČN.

V preglednici 8 so podane minimalne zahteve za izpust komunalnih odpadnih vod v ZRN [9].

Pri tem so posamezni razredi opredeljeni z:

1. velikostni razred: do 60 kg BPK₅/dan ali približno 1 000 PE
2. velikostni razred: od 60 do 300 kg BPK₅/dan ali 1 000 – 5 000 PE
3. velikostni razred: od 300 do 1200 kg BPK₅/dan ali 5 000 – 20 000 PE
4. velikostni razred: od 1200 do 6000 kg BPK₅/dan ali 20 000 – 100 000 PE
5. velikostni razred: nad 6000 kg BPK₅/dan ali nad 100 000 PE

4. DISCHARGES FROM MUNICIPAL WWTPS AND COMPARISON WITH OTHERS

The monitoring of effluents from a municipal WWTP is very important on one side because the loads of other sources of pollution which are connected to the collecting system are discovered with its aid, and on the other side, because recipients are protected by the required degrees. The quality of discharges from a municipal WWTP also directly determines the degree of treatment in the planning stage, and consequently, the investment costs.

Minimal requirements for the discharge of urban wastewater in Germany are given in Table 8 [9].

Particular dimension classes are determined as follows:

1. Dimension class: to 60 kg BPK₅/day or approximately 1 000 PE
2. Dimension class: from 60 to 300 kg BPK₅/day or 1 000 – 5 000 PE
3. Dimension class: from 300 to 1200 kg BPK₅/day or 5 000 – 20 000 PE
4. Dimension class: from 1 200 to 6 000 kg BPK₅/day or 20 000 – 100 000 PE
5. Dimension class: over 6 000 kg BPK₅/day or over 100 000 PE

V preglednici 9 so podane zahteve Smernic EZ [10] za izpuste iz KČN.

Requirements of EU Directives for the discharges from a municipal WWTP [10] are given in Table 9.

Preglednica 8. Minimalne zahteve za izpust komunalnih odpadnih vod v ZRN [9].
Table 8. Minimal requirements for the discharge of municipal wastewater in Germany [9].

Parameter	Izražen kot <i>Expressed as</i>	Enota <i>Unit</i>	Velikostni razred KČN Dimension class of a municipal WWTP				
			1.raz. <i>1.cl.</i>	2.raz. <i>2.cl.</i>	3.raz. <i>3.cl.</i>	4.raz. <i>4.cl.</i>	5.raz. <i>5.cl.</i>
KPK <i>COD</i>		mg/l	150	110	90	90	75
BPK ₅ <i>BOD₅</i>		mg/l	40	25	20	20	15
Amonijev dušik <i>Ammonium nitrogen</i>		mg/l	-	-	10	10	10
Celotni fosfor <i>Total phosphorous</i>		mg/l	-	-	-	2	1

Preglednica 9. Zahteve Smernic EZ [10] za izpuste iz KČN.
Table 9. Requirements of EU Directives for the discharges from municipal WWTPs [10].

Parameter	Izražen kot <i>Expressed as</i>	Enota <i>Unit</i>	Koncentracija <i>Concentration</i>	Učinek čiščenja <i>Effect of treatment</i>
BPK ₅ <i>BOD₅</i>	O ₂	mg/l	25	70-90 %
KPK <i>COD</i>	O ₂	mg/l	125	75 %
Celotne netopne snovi <i>Total suspended solids</i>		mg/l	35 ^{a)}	90 % ^{b)}
Celotni fosfor <i>Total phosphorous</i>	P	mg/l	2 ^{c)}	80 %
Celotni dušik <i>Total nitrogen</i>	N	mg/l	15 ^{d)}	70-80 %

Legenda:

- a) za KČN od 2000 do 10000 PE pod 60 mg/l in pod 35 za KČN, večje od 10000 PE
- b) za KČN od 2000 do 10000 PE pod 70% in pod 90% za KČN, večje od 10000 PE
- c) 1 mg/l za KČN večje od 10000 PE
- d) 10 mg/l za KČN večje od 10000 PE

Iz primerjav preglednic 7, 8 in 9, čeprav niso čisto kompatibilne, vidimo, da so naše zahteve za KČN nad 100000 PE za celotni

Legend:

- a) for municipal WWTPs from 2 000 to 10 000 PE under 60 mg/l and under 35 for municipal WWTPs larger than 10 000 PE
- b) for municipal WWTPs from 2 000 to 10 000 PE 70% and under 90% for municipal WWTPs larger than 10 000 PE
- c) 1 mg/l for municipal WWTPs larger than 10 000 PE
- d) 10 mg/l for municipal WWTPs larger than 10 000 PE

From a comparison of Tables 7, 8 and 9, though they are not quite compatible, it is

fosfor nekoliko nižje (2 mg/l celotnega fosforja) kot v ZRN in EZ pa (1 mg/l), za celotni dušik pa so zahteve enake.

V preglednici 10 so prikazani roki za program ureditve in sanacijski program odvajanja komunalne odpadne vode po kanalizaciji ter roki za sekundarno, terciarno in ustrezno čiščenje odpadne vode, kot je določeno v *Uredbi o spremembah in dopolnitvah uredbe o emisiji snovi pri odvajanju odpadnih vod iz komunalnih čistilnih naprav* [8] za različne velikosti in občutljivosti območja poselitve.

evident that the requirements for total phosphorous in municipal WWTPs over 100000 PE are less stringent (2 mg/l) in Slovenia than in Germany and the EU (1 mg/l), while the requirements on nitrogen are the same.

Deadtimes for the regulation and sanitation program for the discharging of urban wastewater into a collecting system, and the secondary, tertiary and appropriate treatment of wastewater as it is regulated by the *Decree on the changes and the amendments of the decree on the emission of substances in the drainage of wastewater from municipal wastewater treatment plants* [8] for different sizes and sensitivities of agglomeration areas is presented in Table 10.

Preglednica 10. Roki za program ureditve in sanacijski program odvajanja komunalne odpadne vode po kanalizaciji ter roki za sekundarno, terciarno in ustrezno čiščenje odpadne vode kot je določeno v uredbi [8].

Table 10. Deadtimes for the regulation and sanitation program for the discharging of urban wastewater into a collecting system, and the secondary, tertiary and appropriate treatment of waste water [8].

Velikost območja poselitve [PE] <i>Agglomer. area in [PE]</i>	PROGRAM UREDITVE (do konca leta) <i>REGULATION PROGRAM (to the end of the year)</i>				SANACIJSKI PROGRAM (do konca leta) <i>SANITATION PROGRAM (to the end of the year)</i>			
	Odvajanje odpadne vode po kanalizaciji <i>Collect. System</i>	Sekund. čiščenje <i>Second. Treatment</i>	Terciarno čiščenje <i>Tertiary Treatment</i>	Ustrezno čiščenje <i>Apprpr. Treatment</i>	Odvajanje odpadne vode po kanalizaciji <i>Collect. system</i>	Sekund. čiščenje <i>Second. treatment</i>	Terciarno čiščenje <i>Tertiary Treatment</i>	Ustrezno čiščenje <i>Apprpr. treatment</i>
< 2000				2005*				2015*
2000 - 10000		2010 2005*				2015* 2017		
2000 - 15000	2005				2015			
10000 - 15000		2005				2015		
> 10000	1998*		1998*		2008*		2008*	
> 15000	2000	2000			2010	2010		
> 100000					2005	2005		

* zahteve za občutljiva območja

* *requirements for sensitive areas*

5. ZAKLJUČEK

V članku smo prikazali, kakšna je kontrola onesnaževalcev z odpadnimi vodami odvodnikov v Sloveniji. Podane so zahteve iz ustreznih uredb in nekatere naše izkušnje pri spremljanju tehnološkega delovanja ČN. Pogrešamo predvsem imisijski pristop k obravnavi onesnaževanja naših rek, jezer in morja. Povzete so nekatere maksimalne dovoljene koncentracije snovi, ki se izpuščajo v vodotok ali v kanalizacijo. Prikazane so zahtevane stopnje čiščenja na komunalnih čistilnih napravah (ČN). Podali smo primerjavo zahtev naše zakonodaje z zakonodajo v ZRN in EZ ter roke za izvedbo kanalizacij in čistilnih naprav v Sloveniji.

5. CONCLUSION

The situation of the control of the causers of pollution and the discharging of wastewater into recipients in Slovenia was presented. Some requirements from the regulations and our experiences regarding the control of the technical operation of wastewater treatment plants (WWTPs) are provided. Slovenia is especially missing the immission approach to the treatment of the pollution of our rivers, lakes and sea. Some maximal allowed concentrations of pollutants discharged into a watercourse or in a collecting system are reviewed. The required degrees of treatment in municipal wastewater treatment plants (WWTPs) are shown. A comparison of the requirements of Slovene legislation with legislation in Germany and the EU and deadtimes for the construction of collecting systems and wastewater treatment plants in Slovenia is presented.

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