МІНІСТЕРСТВООСВІТИІНАУКИУКРАЇНИ
НАЦІОНАЛЬНИЙАВІАЦІЙНИЙУНІВЕРСИТЕТ
ФАКУЛЬТЕТЕКОЛОГІЧНОЇБЕЗПЕКИ,
ІНЖЕНЕРІЇТАТЕХНОЛОГІЙ
КАФЕДРАЕКОЛОГІЇ

ДОПУСТИТИДОЗАХИСТУ
Завідувачвипускової їкафедри

_____В.Ф.Фролов
«___»_____2020 р.

ДИПЛОМНАРОБОТА

(ПОЯСНЮВАЛЬНАЗАПИСКА)

ВИПУСКНИКАОСВІТНЬОГОСТУПЕНЯМАГІСТРА

ЗАСПЕЦІАЛЬНІСТЮ101«ЕКОЛОГІЯ»
ОПП««ЕКОЛОГІЯТАОХОРОНАНАВКОЛИШНЬОГОСЕРЕДОВИЩА»

Тема:«Проблема нафтохімічного забруднення підземних вод басейну Дніпра та шляхи її вирішення на прикладі Київської області»

Виконавець:студентгрупи202 Панасюк Денис Сергійович
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(підпис)(П.І.Б.)

Нормоконтролер: _____ ЯвнюкА.А.
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КИЇВ2020

MINISTRYOFEDUCATIONANDSCIENCEOFUKRAINE
NATIONALAVIATIONUNIVERSITY
FACULTYOFENVIRONMENTALSAFETY,
ENGINEERINGANDTECHNOLOGY
ECOLOGYDEPARTMENT

APPROVEDTODEFENCE
HeadoftheGraduateDepartment
_____V.F.Frolov
«_____»_____2020

MASTERTHESIS

(EXPLANATORYNOTE)

SPECIALTY101«ECOLOGY»
TrainingProfessionalProgram“ECOLOGYANDENVIRONMENTALPROTECTION”

Theme:«The problem of petrochemical pollution of groundwater in the Dnieper basin and ways to solve it on the example of Kyiv region»

Doneby:studentgroup202 Panasyuk D.S.
(student,group,surname,name,patronymic)

ScientificSupervisor:Ph.D.inBiol.Sc.,AssociateProfessoroftheEcologyDepartment,Tetianal.Bilyk
(academicdegree,academicrank,surname,name,patronymic)

Consultantofthechapter«LabourPrecaution»: _____ Olena V. Konovalova
(signature)(S.N.P.)

StandardsInspector: _____ AndrianA.Iavniuk
(signature)(S.N.P.)

KYIV2020

НАЦІОНАЛЬНИЙАВІАЦІЙНИЙУНІВЕРСИТЕТ
Факультетекологічноїбезпеки,інженеріїтатехнологій
Кафедраекології
Напрям(спеціальність):101«Екологія»
(шифр,найменування)

ЗАТВЕРДЖУЮ
Завідувачкафедри
_____В.Ф.Фролов
«____»_____2020р.

ЗАВДАННЯ
навиконаннядипломноїроботи
Панасюк Денис Сергійович

1.Темароботи«Проблема нафтохімічного забруднення підземних вод басейну Дніпра та шляхи її вирішення на прикладі Київської області»затвердженанаказомректоравід«06»вересня2020 р.№2364/ст.

2.Термін виконанняроботи:з 06.09.2020р.по21.02.2020р

3.Вихідні даніроботи:науковалітературатарезультатипровпливзабруднення підземних вод нафтохімічними продуктамм,міжнароднііівітчизняніданніщодо впливу нафтохімічних продуктів на підземні води,літературніджерелапрометодивирішенняпроблеми.

4.Зміст пояснювальноїзаписки:аналітичнийоглядлітературнихджерелзтемати кидиплому.Розглядзабруднення води нафтохімічними продуктамм. Застосуванняданихдляоцінкистануводноїекосистеми.

5.Перелік

обов’язковогоілюстративногоматеріалу:таблиці,рисунки,діаграми.

Календарнийплан-графік

№ з/п	Завдання	Терміни виконання	Підпис керівника
1	Отриманнятемизавдання,пошукліературнихджерел тазаконодавчоїбази	06.09.2020	
2	Оформлення«чорнового»варіантупояснювальноїзапискидляпопередньогопредставленнянакафедрі	19.09.2020-09.10.2020	
3	Попереднєпредставленняроботинакафедрі	16.10.2020	
4	Підготовкаосновноїчастини(РозділI)	11.11.2020–18.11.2020	
5	Підготовкаосновноїчастини(РозділII)	19.11.2020 – 22.11.2020	
6	Підготовкаосновноїчастини(РозділIII)	23.11.2020 – 25.11.2020	
7	Підготовкаосновноїчастини(РозділIV)	26.11.2020–27.11.2020	
9	Формуваннявисновківтарекомендаційдипломноїроботи	28.11.2020–29.11.2020	
10	Оформленняпояснювальноїзаписки,допопереднього представленнянакафедрі,консультаціязнормоконтролером	30.11.2020	

№ з/п	Завдання	Термін виконання	Підпис керівника
11	Попереднєпредставленняроботинакафедрі	01.12.2020	
12	Урахуваннязауважень,рекомендаційтапідготовкадозахисту	02.12.2020 – 20.12.2020	
13	Представленняроботинакафедрі	21.12.2020	

Консультаціязокремого(мих)розділу(ів):

Консультант(посада,П.І.Б.)	Дата,підпис	
	Дано	Прийнято
К.т.н.,доценткафедриБезпекижиттєдіяльності,Коновалова О.В.		

Датавидачізавдання:«6» вересня 2020 р.

Керівникдипломноїроботи: _____БіликТ.І.
(підпискерівника)(П.І.Б.)

Завданняприйнявдовиконання:_____Панасюк Д.С.
(підписвипускника)(П.І.Б.)

NATIONALAVIATIONUNIVERSITY
Faculty ofenvironmentalsafety,engineeringandtechnology
DepartmentofEcology
Direction(speciality,major):101«Ecology»
(code,name)

APPROVEDTODEFENCE
HeadoftheGraduateDepartment
_____V.F.Frolov
«____»_____2020

MASTERTHESISASSIGNMENT

Panasyuk D.S.

Theme «The problem of petrochemical pollution of groundwater in the Dnieper basin and ways to solve it on the example of Kyiv region» approved by the Rector on October 14, 2020, № 2364/ст.

Duration of work: from 06.09.2020 to 21.12.2020

Initial data of work: scientific literature and results on the impact of groundwater pollution by petrochemical products, international and domestic data on the impact of petrochemical products on groundwater, literature sources on methods of solving the problem.

Contents of the explanatory note: analytical review of literary sources on the subject of the diploma. Consideration of water pollution by petrochemical products. Application of data to assess the state of the aquatic ecosystem.

List of required illustrative material: tables, figures, diagrams.

Calendar schedule

№ з/п	Task	Deadline	Supervisor' ssignature
1	Receivethemestask,searchtheliteratureandlegislativeframeworks	06.09.2020	
2	Making"draft"versionoftheexplanatorynoteforthepreliminarypresentationatthedepartment	19.09.2020-09.10.2020	
3	Preliminarypresentationofthediplomaworkatthedepartment	16.10.2020	
4	Preparingthemainpart(ChapterI)	11.11.2020	
5	Preparingthemainpart(ChapterII)	11.11.2020 – 18.11.2020	
6	Preparingthemainpart(ChapterIII)	19.11.2020– 22.11.2020	
7	Preparingthemainpart(ChapterIV)	23.11.2020 – 25.11.2020	
8	Preparingthemainpart(ChapterV)	26.11.2020– 27.11.2020	
9	Formulatingconclusionsandrecommendationsofthethesis	28.11.2020– 29.11.2020	
10	Considerationofremarks,recommendations,finalizingofthework,consultationwithstandardsinspector	30.11.2020	

№ з/п	Task	Deadline	Supervisor' ssignature
11	Preliminarypresentationoftheworkatthedepartment	01.12.2020	
12	Takingintoaccountthecommentsandrecommendations andtrainingtoprotect	02.12.2020–20.12.2020	
13	Presentationoftheworkatthedepartment	21.12.2020	

Consultant(s)ofcertainchapter(s):

Chapter	Consultant (academicrank,S.N.P)	Date,signature	
		Givenby	Acceptedby
LaborPrecaution	Olena V.Konovalova,Ph.D.,Assoc.Prof.oftheCivilandEngineeringSafety Department		

Dateoftaskissue:«6» september 2020

DiplomaSupervisor: _____Tetianal.Bilyk
(supervisor'ssignature)(S.N.P.)

Taskistakentoperform:_____ Panasyuk D.S.
(graduate'ssignature)(S.N.P.)

РЕФЕРАТ

Пояснювальназапискадодипломноїроботинатему«ПроблеманафтохімічногозабрудненняпідземнихводбасейнуДніпраташляхиїївирішеннянаприкладіКиївськоїобласті» містить 15 рисунків,64 літературних джерел.

Актуальність.Забрудненняпідземнихводнафтопрдуктамивнаслідокїхвитоківзрезервуарів,девонизберігаються,атакожпритранспортуванні,набулозначнихмасштабіввбасейніДніпра.Такаситуаціязагрожуєбезпеціводопостачаннягустонаселеногорегіону.Особливогостроцяпроблемапостаєу Київській області.Томуактуальноюзадачеюєпошукзаходівпозменшеннюабоусуненнюзабруднення,атакожочищеннюзабрудненихгрунтовихводвіднафтопродуктів.

Об’єктдослідження–забрудненняпідземнихводнафтохімічнимипродуктами.

Предметдослідження–заходищодозменшеннянафтохімічногозабрудненняіочищенняпідземнихвод.

Мета–визначитизабрудненняпідземнихводубасейніДніпратазапропонуватизаходищодоїхочищеннянаприкладіКиївськоїобласті.

Методидослідження-
аналітичні,порівняльні,експериментальні,статистичні.

Новизнатазначущість:на основі аналітичного дослідження виділені ефективні методи очищення підземних вод від забруднення нафтопродуктами, зокрема, застосування сорбенту “Еколан-М”.

Результатидослідженнярекомендованідлярозробкитареалізаціїкомплекснихпрограм,спрямованихназахистводногосередовища.

НАФТОПРОДУКТИ, ЗАБРУДНЕННЯ, ПІДЗЕМНІ ВОДИ, КИЇВСЬКА ОБЛАСТЬ, ОЧИЩЕННЯ ВОДИ, СОРБЕНТИ, БІОСОРБЕНТ “ЕКОЛАН-М”

ABSTRACT

Explanatorynotetothethesison"Theproblemofpetrochemicalpollutionofgroundwaterintheb Dnieperbasinandwaystosolveitontheexampleof Kievregion"contains15figures, 1 tables, 64 references.
Theobjectofresearchisthegrounwaterpollutionbypetrochemicalproducts.
Thesubjectofresearchisthemeasurestoreducepetrochemicalpollutionandgroundwatertreatment.
Thepurposeistoestablishthenatureandpatternsofchangesinthestateofaquaticecosystemsduetopollutionbypetrochemicalproducts.Todeterminetheimpactofpollutionbypetrochemicalproductsonaquaticecosystems.Analyzethecontentofpetrochemicalproductsinthefilteredsamplesofreturnwatersofgroundwatertreatmentplants.
Researchmethods-analytical,comparative,hypothetical,chromatographymethod.
Results,noveltyandsignificance:identificationofthemainsourcesofpetrochemicalproductsintheaquaticenvironment.
Theresultsofthestudyarerecommendedforthedevelopmentandimplementationofcomprehensiveprogramsaimedatprotectingtheaquaticenvironment.

LISTOFSYMBOLS,ABBREVIATIONSANDNOTIONS

NE – natural environment;

BOA - benzoxazolinone;

MPC – maximum permissible concentration;

MAC – maximum acceptrable concentration;

UNESCO-United Nations Educational, Scientific and Cultural Organization;

PAE-provisionally agreed emissions;

TAD-temporarily agreed discharges;

PP-petrochemical plant;

IPL-indicative permissible levels;

EIA-environmental impact assessment;

MPE-maximum permissible emissions;

MPL-maximum permissible level

CONTENT

INTRODUCTION

Underthepollutionofgroundwaterisnowunderstoodasanydeteriorationintheirquality

(incomparisonwithnaturalconditions),directlyorindirectlyrelatedtohumanactivities,including industrialproduction,agriculture,communalanddomesticactivities.Whenassessingthedegreeofpollutionandthequalityofnatural,includinggroundwater,theconceptofso-
called"maximumpermissibleconcentrations"(MAC)ofpollutantsisused,withtheexcessofwhichwaterbecomesunsuitableforeconomicallydrinkinguse.Groundwatercomparisonwithsurface,ingeneral,ischaracterizedbyconsiderablyhighernaturalprotectionfromvarioustypesofpollution.However,forundergroundwaters,especiallyforthecondi tionsofthefirstfromthesurfaceofthegroundwateraquifer,therearequiteafewwaysoftheirpossiblecontamination.Groundwaterpollutioncanoccurthroughtheatmosphere bylossandfurtherinfiltrationofalreadycontaminatedatmosphericprecipitation;throughcontaminatedsurfacewaterinareasoftheirabsorptionintogroundwateraquifers;atinfiltrationofpureatmosphericprecipitationandsurfacewaterthroughthecontaminatedsurfaceoftheearthandthesoillayer(withtheintroductionofmineralfertilizersandpesticides);byfiltrationofliquidproductsorwasteproductsandsewageeffluentsfromleaksfrompipelinesandnetworksoratttheplacesoftheirstorage(wastepits,settlingtanks,sludges,etc.)intheabsenceorinsufficientreliabilityofanti-
filteringmeasures;atinfiltrationofatmosphericprecipitationandsurfacewateratsitesofsolidwastestorage(communalorindustriallandfills,dumpsofminingenterprises,etc.).Thesourceofintensepollution,includingdeepundergroundwater,istheburialofliquidandsolidwastesofindustrialproduction(asarulethemostharmful,highlytoxicorradioactivewaste)bypumpingthemintodeepabsorbingwellsor"burial"inwasteminesandquarries.
Sourcesofpollutioncanbeeliminatedbutnotisolatedfromthesurfaceofthewell,drillholes,shafttrunks,aswellasdeepwells,reconnaissanceoroperational(oil,gas,industrialwater)orwellsusedtopumpindustrialwastewiththeirinsufficientlyreliableinsulationfromtheupperaquifers.
Distributionofpollutantsfromsites(foci)ofpollutionintheaquiferitselfisdeterminedbythedirectionandvelocityoftheflowofgroundwater.However,theconvectivetransferofpollutantstothegroundwaterflowisalmostalwaysaccompaniedbythemanifestationo

fanumberofchemical(leaching,precipitation,complexformation,etc.),physicalandchemical(sorption,diffusion,dispersion)andmicrobiologicalprocessesthatsignificantlyaffectthecompositionandcontentofthoseothercomponents.Inthiscase,themostsignificantaretheprocessesofchemicalandphysicalsorptionofpollutants,activeinthesoillayer,rocksoftheaerationzone,inthemostaquifersandseparatingtheweaklypermeablelayers.Thelargestsorptioncapacityisusuallycharacterizedbysoilandloosefine,includinglowpermeable,rocks(sandyloam,loam,clay,etc.);thesmallest-crackedbreeds,inwhichpracticallyallkindsofpollutionspreadrelativelyquicklyandatconsiderabledistances.

Soilandgroundwatercontaminationwithoilproducts(NP)isaseriousglobalproblem,especiallyforcountrieswithhighindustrialdevelopment.Hundredsoflargeandsmalloildepots,thousandsofkilometersofoilpipelines,miningandoilrefineriesaresourcesofsystemiclossesofpetroleumproductsthatpollutethegeologicalenvironmentovervastareas.NPinareasofthestraitsseepintothegroundand,reachingthesurfacelevelofgroundwater,spreadandpollutetheundergroundspaceinanareaoftensandhundredsofhectares,disablingwells,waterintakes.Ingeneral,inUkraine,saturatedwithobjectsofextraction,processing,storageandtransportationofoilandoilrefineries,thesituationshouldbeconsideredasacrisis.

ThebeginningofworkonthestudyofpetrochemicalpollutionofgroundwaterinUkrainewaslaidintheearly90sduetothethreatofcontaminationofthewaterintakeinKhersonandtheclosureofthewaterintakeinthecityofUsin.Thenthisproblemacquirednationalimportanceandwasconsidered,firstofall,asecological.However,duetolackoffunding,theexecutionofworkwaspracticallysuspended.

Inthesameperiodof1993-98.Anumberofprivatecompanies,atriskandattheirownexpense,providedgeologicalandenvironmentalworkatdozensofsites,including:atmilitaryaircraftbases,atlargecivilianoildepotsandrefineries,wherethemostsignificant lossesoccurred.Asaresultoftheseworks,thousandsoftonsofpreviouslylostoilwerepumpedoutoftheground,thetechnogenicloadontheundergroundhydrospheredecreasedandconditionsforthenaturalregenerationofwaterandsoilonhundredsofhectaresw

erecreated,materialsforgeologicalsurveyswereobtained,anduniquetechnologicalexperiencewasaccumulatedineliminatingsuchpollution.

However,theimplementationoftheseworkswasoftenlimitedtopumpingtheliquidphaseoftherefinery,andthenonlywithintheeconomicfeasibility,whiletheobservationwellsstillcontainalayerofliquidpetroleumproducts-uptoseveralcentimeters,whichindicatesaratherhighresidualcontamination.Achievingabsolutesoilcleaningisalong-termandexpensiveprocess,soitisextremelyimportanttodeterminetheminimumnecessarylevelofcleaningthatwouldmeetenvironmentalsafetystandardsandrealworkperformancepossibilities,arealwayspredictable.Insubstantiatingsuchforecasts,notonlythehydrodynamicsofgroundwaterflowsasafactorinthemigrationofpollutants,butalsoacomplexsetofchemicalandphysico-chemicalprocessesoccurringintheinteractionofcontaminatedwaterswith"clean"undergroundwaters,soillayer,rocksoftheaerationzone,etc.,aretakenintoaccount.etc.,andinsomecasesalsomicrobiologicalprocesses,activelyproceedingintheupperpartofthehydrogeologicalsection.Inthisregard,theorganizationofsuchworkrequires,asarule,thejointparticipationofhighlyskilledspecialistspossessingmethodsofhydrogeological(migration)calculations,hydrogeochemistry(physicalchemistry),aswellasmethodsofsoilandmicrobiologicalresearch.

Relevanceofthework

Contaminationofgroundwaterwithpetroleumproductsduetotheirleakagefromreservoirs,wheretheyarestored,aswellasduringtransportation,hasbecomesignificantintheDnieperbasin.Thissituationthreatensthesecurityofwatersupplyinadenselypopulatedregion.Thisproblemisespeciallyacuteintheregion.Therefore,theurgenttaskistofindmeasurestoreduceoreliminatepollution,aswellaspurificationofcontaminatedgroundwaterfrompetroleumproducts.

Aimandtasksofthediplomawork

Aimofthework:Theaimoftheworkwastoidentifygroundwaterpollutionin

eperbasinandproposemeasuresfortheirpurificationontheexampleofKyivregion.

Tasksofthework:

1.Toanalyzetheimportanceofgroundwaterasastrategicreserveforwatersupplyofthepopulationof Ukraineandnecessityofeffectivecleaningtechnology.

2.ToidentifythemainsourcesofgroundwaterpollutionbypetroleumproductsandtheamountofpollutionintheKievregion.

3.Todeterminethemethodsofresearchofwaterandsoilpurificationfrompetrochemicalpollution.

4.Tocarryoutexperimentalstudiesofthesorbent"Ecolan-M"intheeliminationofemergencyoilspillsandpetroleumproducts.

5.ToofferwaystosolvetheproblemofpetrochemicalpollutionofgroundwaterintheDnieperbasinontheexampleofKyivregion.

Objectofresearch:thegrounwaterpollutionbypetrochemicalproducts.

Subjectofresearch:themeasurestoreducepetrochemicalpollutionandgroundwatertreatment.

Methodsofresearch-analytical,comparative,experimentalstudies,statisticalmethodsofprocessingresults.

Personalcontributionofthegraduate:theanalysisofscientificsourceshasbeencarriedout,thetechniqueofgroundwatertreatmenthasbeenstudied,andstatisticalanalysisofthedatahasbeencarriedout.

*Scientificnovelty.*Asaresultofresearch,itwasestablishedthatforeffectivepurificationofoil-contaminatedwatersandeliminationofemergencyoilspills,itisadvisabletouseasorbent"Ecolan-M".

*Practicalvalueofthework.*Theresultsofthestudyarerecommendedforthedevelopmentandimplementationofcomprehensiveprogramsaimedatprotectingtheaquaticenvironment.

CHAPTER 1

Theproblemofpetrochemicalgroundwaterpollutionisathreattothenationalsecurity ofUkraine

The main sources of pollution and clogging of reservoirs are insufficiently treated wastewater from industrial and municipal enterprises, large livestock complexes, production waste from ore mining, hydropower construction, water

from mines, mines, waste from processing and smelting of timber, discharge of water and rail transport. processing of flax, pesticides, etc. With the beginning of the navigation period, the pollution of the river fleet by vessels increases.

Pollutants, getting into natural reservoirs, lead to qualitative changes in water, which are mainly manifested in changes in the physical properties of its chemical composition, in particular, the appearance of unpleasant odors, tastes, etc .; in the presence of substances floating on the surface of the water and deposits at the bottom of reservoirs.

Industrial wastewater is polluted mainly by waste and production emissions. Quantitative and qualitative combination of them is diverse and depends on the industry, its technological processes; they are divided into two main groups: those that contain inorganic impurities, including toxic, and those that contain poisons.

The first group includes wastewater from soda, sulfate, and nitrogen fertilizer plants, concentrators for lead, zinc, and nickel ores, etc., which contain acids, alkalis, and heavy metal ions. Sewage of this group mainly changes the physical properties of water.

Sewage of the second group is discharged by oil refineries, petrochemical plants, organic synthesis plants, coke plants, and others. The effluents contain various petroleum products, ammonia, aldehydes, resins, phenols and other harmful substances. The harmful effect of wastewater in this group is mainly in oxidative processes, as a result of which the oxygen content in the water decreases, the biochemical need for it increases, and the organoleptic parameters of the water deteriorate.

Oil and petroleum products at the present stage are the main pollutants of inland waters, waters and seas of the oceans. Once in the reservoirs, they create various forms of pollution: oil film floating on water, dissolved or emulsified in water petroleum products that have settled to the bottom, heavy fractions, etc. This changes the smell, taste, color, surface tension, viscosity of water, reduces the

oxygen content, there are harmful organic substances, water acquires toxic properties and poses a threat not only to humans. 12 ml of oil make a ton of water unfit for consumption.

Among the products of industrial production a special place for its negative impact on the aquatic environment and living organisms are toxic synthetic substances. They are increasingly used in industry, transport, utilities. The concentration of these compounds in wastewater, as a rule, is 5 mg / l at a maximum concentration limit of 0.1 mg / l. These substances can form a layer of foam in reservoirs, especially noticeable on rapids, intersections, locks. The ability to foam in these substances appears at a concentration of 1-2 mg / liter.

Phenol is a very harmful pollution of industrial waters. It is found in the wastewater of many petrochemical plants. At the same time, the biological processes of reservoirs, the process of their self-purification, and the water acquire a specific carbolic odor are sharply reduced.

Wastewater from the pulp and paper industry has a detrimental effect on the life of the population of reservoirs. Oxidation of wood mass is accompanied by the absorption of significant amounts of oxygen, which leads to the death of caviar, fry and adult fish. Fibers and other insoluble substances clog water and impair its physicochemical properties. Fish and their food - invertebrates - are adversely affected by alloys. Various tannins are released into the water from rotting wood and bark. Resin and other extractives decompose and absorb a lot of oxygen, causing the death of fish, especially juveniles and eggs. In addition, alloys heavily litter rivers, and sunken logs often completely clog their bottoms, depriving fish of spawning grounds and feeding grounds.

Nuclear power plants pollute rivers with radioactive waste. Radioactive substances are concentrated by small planktonic microorganisms and fish, then transmitted through the food chain to other animals and humans. It has been established that the radioactivity of planktonic inhabitants is thousands of times higher than the water in which they live. Wastewater with high radioactivity (100

curies per 1 liter or more) is subject to burial in underground drainage pools and special tanks.

Population growth, the expansion of old and the emergence of new cities have significantly increased the inflow of domestic sewage into inland waters. These runoff have become a source of pollution of rivers and lakes with pathogenic bacteria and helminths. Synthetic detergents widely used in everyday life pollute water bodies even more. They are also widely used in industry and agriculture. The chemicals contained in them, flowing with wastewater into rivers and lakes, significantly affect the biological and physical regime of water bodies. As a result, the ability of water to saturate with oxygen is reduced, the activity of bacteria that mineralize organic matter is paralyzed.

Of particular concern is the contamination of water bodies with pesticides and mineral fertilizers coming from the fields along with jets of rain and melt water. In connection with the intensification of animal husbandry, the effluents of enterprises in this branch of agriculture are becoming more and more apparent.

Sewage containing vegetable fibers, animal and vegetable fats, fecal mass, fruit and vegetable residues, waste from the leather and pulp and paper industry, sugar and breweries, meat and dairy, canning and confectionery industries, are the cause of organic contamination reservoirs.

In wastewater, usually about 60% of substances of organic origin, the same category of organic includes biological (bacteria, viruses, fungi, algae) pollution in municipal water, sanitary water and waste leather and enterprises that wash wool.

Also polluted during rafting, during hydropower construction, and with the beginning of the navigation period, pollution of river fleet vessels increases.

Heated wastewater from thermal power plants and other industries causes "thermal pollution", which threatens quite serious consequences: in heated water there is less oxygen, the thermal regime changes dramatically, which negatively affects the flora and fauna of reservoirs, there are favorable conditions for mass development in reservoirs blue -green algae - the so-called "water bloom".

In some regions, groundwater was an important source of fresh water. Previously, they were considered the cleanest. But now, as a result of human economic activity, many sources of groundwater are also exposed to pollution. Often this pollution is so great that their water has become unfit for drinking. Mankind consumes a huge amount of fresh water for their needs. Its main consumers are industry and agriculture. The most water-intensive industries are mining, steel, chemical, petrochemical, pulp and paper, and food. They use up to 70% of all water consumed in industry. The main consumer of fresh water is agriculture: 60-80% of all fresh water is used for its needs. In modern conditions, human needs for water for communal and household needs are greatly increasing. The amount of water consumed for these purposes depends on the region and standard of living, ranging from 3 to 700 liters per person. From the analysis of water consumption for the last 5-6 decades it follows that the annual increase in irreversible water consumption, in which used water is irretrievably lost to nature, is 4-5%. Perspective calculations show that with the maintenance of such consumption rates and taking into account population growth and production volumes by 2100, humanity can deplete all fresh water reserves. Already now the lack of fresh water is felt not only by the territories that nature has deprived of water resources, but also by many regions, which until recently were considered favorable in this respect. Currently, the need for fresh water is not met in 20% of urban and 75% of the rural population of the planet. Limited reserves of fresh water are further reduced due to their pollution. The main danger is created by sewage (industrial, agricultural and domestic), as a significant part of the used water is returned to water basins in the form of sewage. Petroleum products in natural waters - mixtures of gaseous, liquid and solid hydrocarbons of different classes contained in oil and petroleum gases and polluting natural waters.

There are: fuel, oils, solid hydrocarbons (paraffins, ceresins, ozokerites), bitumen, etc.

Petroleum products are among the most common and dangerous substances that pollute natural waters. The concept of "petroleum products" in

hydrochemistry is conditionally limited only to the hydrocarbon fraction (aliphatic, aromatic, alicyclic hydrocarbons), which is 70-90% of the sum of all substances that are part of oil and its products. Large quantities of natural gas enter natural waters during the transportation of oil by water, with the wastewater of any industrial enterprise, especially the enterprises of the oil production and refining industry, and with domestic wastewater. Some hydrocarbons enter the water as a result of lifelong and postmortem secretions by plant and animal organisms. As a result of the processes of evaporation, sorption, and biochemical and chemical oxidation, the concentration of N. in water can be significantly reduced; at the same time their chemical composition can undergo significant changes. The speed of these processes depends on the composition of the water, the temperature of the water body, and the intensity of the development of the microorganisms that utilize them, are contained in natural waters in various forms of migration: dissolved, emulsified, sorbed on solid particles of suspended solids and bottom sediments, in the form of a film on the water surface. The quantitative ratio of these forms is determined by a set of factors, the most important of which are the conditions of the flow of water into the water body, the distance from the discharge site, the flow rate and mixing of water masses, the nature and degree of pollution of natural waters. viscosity, solubility, density, boiling point of components. The last three factors are the reason why the fractionation is accompanied by a marked change in their chemical composition in various forms of migration. Usually, at the time of admission, the bulk of the neurons are concentrated in the film. As we move away from the source of contamination, there is a redistribution between the main forms of migration, which is aimed at increasing the proportion of dissolved, emulsified, sorbed N., and a corresponding decrease in their content in the film,adversely affect the human and animal body, aquatic vegetation, physical, chemical and biological state of the water body. Low-molecular-weight aliphatic, naphthenic, and especially aromatic hydrocarbons, which are part , have toxic and, to some extent, narcotic effects on the body, affecting the cardiovascular and nervous systems.

The greatest danger is posed by polycyclic condensed hydrocarbons of type 3,4 - benzpyrene, which are characterized by carcinogenic properties. The maximum concentration limit in domestic and drinking waters is 0.3 mg / dm3, and the maximum concentration limit in waters for fishery use is 0.05 mg / dm3. The presence of carcinogenic hydrocarbons in water is unacceptable.

The content in river, lake, sea, groundwater, and atmospheric sediments is usually one hundredth or tenth of a milligram per 1 dm3. The concentration of natural hydrocarbons in uncontaminated water bodies can fluctuate: in seawater from 0.01 to 0.10 mg / dm3 and above, and in river and lake waters from 0.10 to 0.20 mg / dm3. sometimes reaching 1.0 - 1.5 mg / dm3.

The content of natural hydrocarbons is determined by the trophic nature of the water body and largely depends on the biological situation in it (development and decay of phytoplankton, the intensity of bacterial activity, etc.). The nature of the distribution of natural and natural hydrocarbons along the vertical and in the water area of a water body is very complex and inconsistent. Of course, the most polluted coastal areas. Elevated concentrations are observed in the surface and bottom layers, sometimes in some areas within the water column.

1.1 Groundwater as a strategic reserve for water supply of the population of Ukraine

Groundwater is one of the most important subsoil objects. They are of strategic importance as a reliable and high-quality source of drinking water supply for the population. In addition, groundwater is a source of medical, thermal and hydromineral raw materials.

Groundwater is a mineral of national importance. They have a dual nature: on the one hand, it is a mobile mineral that circulates in rocks and its use requires extraction from the subsoil, and on the other - it is part of the total water resources of the planet, which actively interacts with surface waters, atmosphere and other components of natural resources. environment. Therefore, groundwater resources and their operational reserves depend not only on geological and hydrogeological, but also on physical and geographical factors and

anthropogenic factors that change the conditions of groundwater supply, their quality and opportunities for extraction and use.

Fig. 1.1 Grounwater of Ukraine

The distribution of groundwater on the territory of Ukraine is due to the geological structure and history of natural development of its various parts. These are separate and distinct hydrogeological regions, different in age, composition and conditions of the formations that make them up. They differ in the set of basic natural factors that determine the patterns of formation, distribution, composition and operating conditions of groundwater.

As of 01.01.2017, 635 deposits of underground drinking and technical waters have been explored and approved in Ukraine by the State Committee of the USSR and the State Committee of Ukraine,

250 mineral water deposits, 2 underground thermal power deposits

waters and 2 deposits of underground industrial waters.

During 2016, 45 new sites of underground drinking and technical water deposits were approved. The increase in the exploited operational reserves of groundwater amounted to 5.41 thousand m3 / day. 6 new sections with reserves under

categories A + B + C1 - 314.0 m3 / day, C2 - 250.0 m3 / day and 1 section of thermal energy waters with reserves under categories A + B + C1 - were approved for underground mineral water deposits. 100.0 m3 / day, C2 - 50.0 m3 / day.

Information on groundwater extraction in 2016 in the Autonomous Republic of Crimea in section 7.2.1 is not provided in connection with the annexation of the Autonomous Republic of Crimea.

Drinking and technical groundwater. The total forecast groundwater resources in Ukraine are 61689.2 thousand m3 / day, of which 57458.1 thousand m3 / day with mineralization up to 1.5 g / dm3. Provision of forecast resources of drinking groundwater of the population of Ukraine by regions is within
0.3-5.5 thousand m3 / day, and on average - 1.3 thousand m3 / day per person. The forecast groundwater resources are unevenly distributed by regions, which is due to the difference between geological-structural and physical-geographical conditions of different regions of Ukraine. The vast majority of forecast resources are concentrated in the northern and western regions of Ukraine, the resources of the southern region are limited.

At the end of 2020 1354 sites of groundwater deposits concentrated on 635 deposits of drinking and technical groundwater were explored and prepared for industrial use in Ukraine. The exploitation reserves of the explored deposits are 15384,459 thousand m3 / day in categories A + B + C1 and 946.4 thousand m3 / day in category C2.

During 2016, new areas of groundwater deposits were explored in: Zhytomyr (1), Zakarpattia (3), Kyiv (5), Luhansk (2),
Lviv (1), Poltava (3), Rivne (2), Sumy (1), Kharkiv (6), Kherson (5), Khmelnytsky (4), Cherkasy (7), Chernivtsi (1) regions and the city of Kyiv (4). Re-approved stocks at 10 sites: in Poltava (2), Cherkasy (3) and Chernihiv (5) regions. At 6 sites, changes were made to the approved reserves, with the withdrawal of reserves in favor of new sites: in Luhansk (1), Kherson (2), Khmelnytsky (2) regions and in Kyiv (1).

The average annual volume of underground drinking and technical water

production on the territory of Ukraine in 2016 amounted to 3224,424 thousand m3 / day, which is

65.54 thousand m3 / day (2.0%) more than in 2015. Production from explored deposits in 2016 amounted to 1500,133 thousand m3 / day, while in 2015 it amounted to 1505,822 thousand m3 / day. Total production and production

from the explored operational reserves of underground drinking and technical waters in the regions of Ukraine for 2020 is shown in Fig.2 and Fig.3

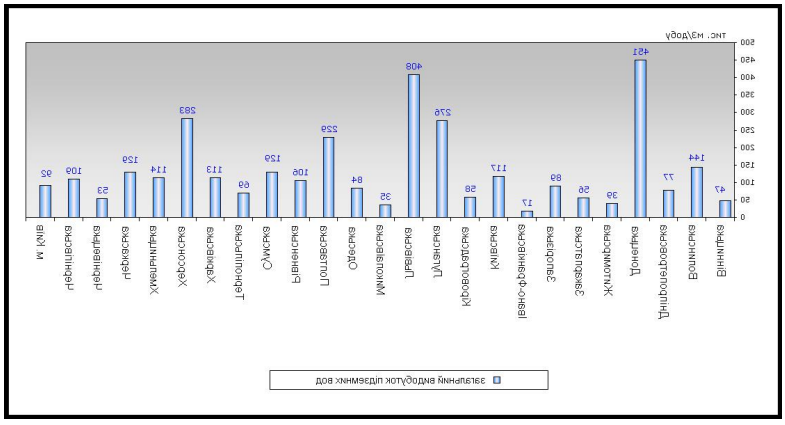

Fig.1.2 Total extraction of underground drinking and technical waters by regions of Ukraine in 2020.

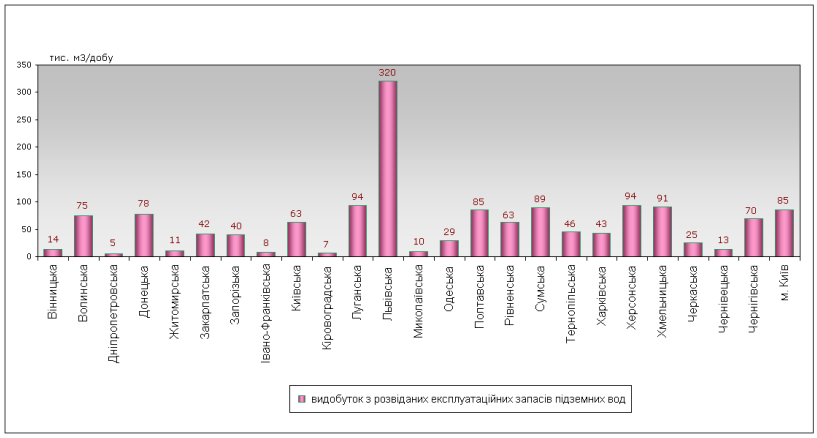

Fig.1.3 Extraction from explored operational reserves of groundwater in the regions of Ukraine in 2020.

In recent years, the total production of groundwater drinking and industrial water is constantly regressing and changed from 8395,230 thousand m3 / day in 2001 to

3324,424 thousand m3 / day in 2020 (by 60.4%). During the same period, production from explored groundwater reserves decreased from

3513,626 thousand m3 / day to 1500,133 thousand m3 / day (by 57.3%). The dynamics of total production and extraction from explored operational reserves of groundwater and technical water in Ukraine for the period 2001-2016 is given

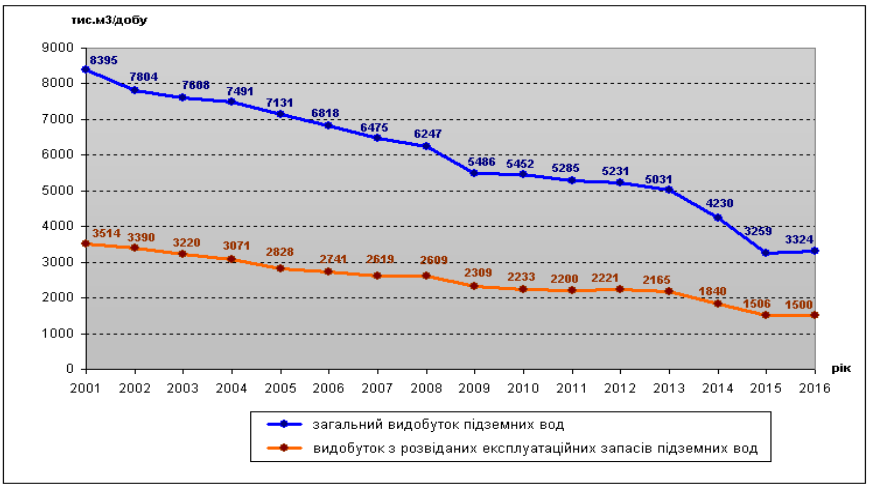

Fig.1.4 Dynamics of groundwater production in Ukraine during 2001 - 2020

The tendency to permanently reduce groundwater production is due to the reduction of groundwater drinking and technical water consumption due to the reduction of industrial production and the share of groundwater use in the overall balance of water use in Ukraine, as well as ATO within Donetsk and Luhansk regions and annexation of Crimea.

1.2 Sources of groundwater pollution by oil and oil products

In most countries of the world, many pollutants are formed as a result of the activities of the oil refining industry or heating systems with petroleum products. About 60% of their total number is accounted for by road. These pollutants are characterized as primary, which under the action of water vapor, oxygen, light and other impurities form secondary pollutants such as sulfates, ozone, nitrates and organic compounds. The combined presence of primary and secondary pollutants in the air creates so-called smog. Primary and secondary pollutants

affect not only nature but also humans. Pollutants are mostly carcinogenic. Thus, one of the root causes of air pollution is the consequences of the use of petroleum products and oil. But they are felt not only in the air.

Water - a fire extinguisher - can burn. Water - a symbol of purity - can be the most insidious poison. Water - a symbol of the center of the origin of life - can become a mortal enemy of the living. But the water itself is the least to blame. The reason may be oil and petroleum products that have fallen into the water. Oil that falls into the water is a global problem that affects the entire ecosystem as a whole. It is believed that the main sources of water pollution by oil are the tanker fleet, pipelines, drilling rigs. But this is a mistake. It's just that these sources are more obvious at first glance. Statistics show that of the millions of tons of oil that enters the oceans, only half comes from highways that run across the ocean, and the other half enters it with runoff from the land. Oil pollutes the ocean in emergencies that have occurred on tankers, ruptures of offshore pipelines, accidents on offshore drilling rigs. The scale of these catastrophes is known. Giant oil slicks spill over the surface of the water, covering hundreds of kilometers with a film of petroleum products. As a result of these accidents in 1980, about 200,000 tons of oil were released into the ocean. But at the same time, 2.5 million tons of petroleum products are annually discharged into the ocean with wash water, due to negligence in pumping oil. The permissible level of petroleum products in water is 0.005 mg / l, at a higher figure all living things can die. It cannot be said that nothing is being done to prevent oil pollution of the world's oceans. In the ports you can find ships - collectors of oil spilled in the water. Scientists have developed a technology for cleaning tankers using effective detergents. Waste-free technology is being introduced at oil refineries, and methods of extracting oil products from water are being studied. Effective methods are now being used to combat oil spilled on the surface of the water. Since oil is a liquid that does not mix with water, but spreads a thin film, it can be removed with the help of special vessels. Oil is collected in special tanks, sucked out, and clean water is poured into the sea. A mixture of sand and chalk, falling on

the oil slick, sorbs oil. Then this mass settles to the bottom. Surfactants prevent the spread of the oil slick and help remove it. Raising oil to the Earth's surface, man did not disturb the natural balance - the voids in the deposits were filled with water and the structure of the planet has not changed. But, having begun to refine oil and its use, man has caused great damage to nature. For example, consider the US spending on reducing various pollutants.Water purity is subject to international control from satellites and ships.

Today, the scale of hydrosulfurization of gasoline, kerosene and fuels reaches 500 million tons per year. Annual oil production is approaching 3 million tons, while 40-50% of this mass needs to be purified from sulfur. Although the price of petroleum products increases by 3% due to hydrotreating, the process of sulfur removal is widely implemented in this way. Hydrotreating is carried out at high hydrogen pressure and temperatures of about 400 ° C. The catalysts for this process are oxides and sulfides of tungsten, nickel, cobalt. Especially worth mentioning is the product of oil combustion - carbon monoxide (IV) - carbon dioxide. It is a link in the chain of circulation of substances in nature. It is known that if carbon dioxide disappeared from the atmosphere, life would die. Human economic activity is rapidly increasing CO2 resources. In nature, there is a mechanism for balancing its number, but the possibilities of the biosphere are not limitless. The annual combustion of fossil fuels in furnaces and engines now reaches one billion tons (in terms of carbon). Excess carbon monoxide (IV) in the atmosphere can lead to irreversible negative effects of the greenhouse effect. In order not to disturb the balance in nature, projects are proposed that impress even today with their fantastic. So, in particular, it is supposed to liquefy carbon monoxide (IV) and pump it into the depths of the ocean, from which it will return to the atmosphere in hundreds of years. But this is a struggle with the consequence, not with the cause! And the reason - the burning of oil in the furnaces of boilers and car engines. Therefore, sooner or later, if not due to lack of oil, then under the threat of harm to humanity, will have to give up the habit of wasting resources.

In the general set of measures necessary to combat pollution of sea water, there are two main ones:

- development of measures to prevent sea water pollution;

- development of measures to eliminate pollution.

In foreign practice, the system of collecting all liquid waste and containers for their storage have been widely used. The collection system can be in the form of a fibrous mass, which is used to collect oil spilled on deck, or in the form of pillows placed under the pipes, drilling pumps, compressors and other mechanisms. One of the greatest dangers to the marine environment is accidental oil spills that occur as a result of open well gushing during the drilling of oil and gas fields. To prevent such accidents or minimize them, it is necessary to choose the right drilling technology, create a system of safety and protection of the marine environment. The reliability of marine safety and security systems is ensured by the control and testing of all equipment. Identified shortcomings of equipment and technology can prevent accidents and related pollution. In recent years, special devices have been developed to collect oil from gushing wells. The United States has patented a device for collecting oil that falls on deck during an uncontrolled release. To do this, an impermeable fence 30 m high is mounted on the deck along its perimeter, which prevents oil from flowing overboard. Methods for combating underwater oil emissions are being developed, based on the idea of collecting oil and gas coming from gushing wells with the help of a special cap mounted on the underwater wellhead. Offshore fisheries must be equipped with devices for draining ballast water from oil tankers.

A significant amount of oil (approximately 10% of total pollution associated with offshore work) enters the sea due to marine pipeline accidents.

The causes of accidents are:

- corrosion of pipes, external from action of sea water, internal - from

transportation of corrosion products;

- abrasion of pipes at the point of their intersection caused by the action of waves and damage from metal fatigue;

- damage caused by construction work near pipelines, ship anchors, fishing trawls and mechanical damage from other objects;

- bottom deformations, erosion and landslides;

- damage under the action of hummock ice formations.

The maximum number of accidents is observed in shallow areas with depths up to 30 m in areas with intensive shipping and fishing. To increase the reliability of offshore pipelines, a number of measures related to design, construction and operation are required.First, it is necessary to improve the method of calculating the stability of pipelines, to use concrete, weighting coatings with high mechanical and chemical resistance to sea water, to improve the method of laying pipelines.

In areas with seismic activity, the use of offshore pipelines should be specifically justified. Restrictions on the parking of all types of vessels must be introduced along the pipeline route. The pipeline system must be provided with devices that allow to disconnect the whole pipeline or its separate parts in case of violation of the technological regime and the occurrence of an emergency situation. During the operation of the offshore pipeline it is necessary to conduct a periodic inspection of the route, especially after a storm, as well as in the case of preventive repairs of all systems and elements of the pipeline that ensure its reliability. Implementation of all these measures will significantly reduce the likelihood of accidents in offshore pipelines and related oil pollution of the marine environment.

1.3 Protection of groundwater from petrochemical pollution

Groundwater protection provides:

compliance with the laws of Ukraine and other regulations in the field of use and protection of water;

regulation of all types of economic and any other activity that affects the state of groundwater, in particular the groundwater intake of centralized and decentralized

drinking water supply, taking into account their productivity for the current period and in the future;

regulation of the procedure for the use of subsoil for the extraction of groundwater, as well as for purposes not related to the extraction of minerals, if the implementation of these purposes may lead to a negative impact on the state of groundwater;

application of water protection measures that exclude the possibility of negative impact of these enterprises and structures on the environment and, in particular, on groundwater when designing the construction of any enterprises and structures;

ensuring the organization and operation of sanitary protection zones of sources of centralized drinking water supply and mineral water intakes;

implementation of measures to prevent and eliminate leakage of wastewater and pollutants from the earth's surface, sewage systems, filter tanks, settling tanks, tailings and other structures and the ingress of these substances into groundwater horizons;

increasing the level of wastewater treatment and preventing discharge into drains, reservoirs and underground aquifers of untreated wastewater and liquid toxic waste from industrial enterprises;

compliance with environmental requirements when drilling aquifers of drinking and medical groundwater with wells for various purposes, when carrying out work on search and exploration of groundwater, as well as in the design, construction and operation of groundwater intakes;

systematic control over the condition of groundwater, in particular at water intakes and in areas of industrial and agricultural facilities;

implementation of other water protection measures provided by the current legislation of Ukraine for the protection of groundwater.

The main objects of protection include operational aquifers, which are used for domestic and drinking water supply and for the extraction of natural mineral table, medicinal table and medicinal waters, as well as water intake structures that

provide the extraction of these waters.

Water users who own water intakes provide protection of groundwater from depletion of operational reserves, depletion and pollution, compliance with the recommended mode of groundwater operation and the established zone of sanitary protection of water intakes.

Water users whose activities may adversely affect groundwater status, in particular those operating industrial, domestic and agricultural effluent or waste storage facilities, take measures to prevent groundwater contamination, including the equipment of local observation well networks to monitor the quality of these waters.

Water users, whose activities lead to direct or indirect impact on the state of groundwater, provide funding for measures to protect groundwater from pollution and depletion.

In the projects of construction and reconstruction of industrial enterprises, any constructions, in particular communal ones, water protection measures are envisaged and applied, which exclude the possibility of negative impact of the mentioned objects on the groundwater.

In order to rationally use groundwater resources, the Council of Ministers of the Autonomous Republic of Crimea, regional, Kyiv and Sevastopol city state administrations plan to develop a system of current and future water supply of utilities and industry, on the basis of which the relevant orders for groundwater exploration for drinking and commercial and technical water supply.

Groundwater exploration and assessment of operational reserves is carried out taking into account the current legislation of Ukraine with the use of technologies that prevent the negative impact on the state of groundwater during these works.

A local network of observation wells is created to control the impact of groundwater exploitation on the environment, clarify the parameters of the target aquifer according to the operation, which allows to assess the objectivity of calculating groundwater reserves during the exploration period, and establish the risk of negative changes at the water intake site as a result of the flow of

contaminated water from adjacent horizons, or the inflow of water from contaminated areas in the target horizon.

In addition, a local network of observation wells is created near objects that pollute or are potential contaminants of groundwater.

Regime level monitoring and laboratory quality control of groundwater extracted from observation wells, as well as monitoring of levels and flow rates of production wells and laboratory quality control of groundwater produced by these wells are carried out regularly in accordance with groundwater field development projects.

Water users monitor the level, flow and quality of water. In case of deterioration of water quality (increase of mineralization, hardness, appearance of bacterial or chemical pollution), as well as deviation of water intake from the project, the water user notifies the territorial bodies of the State Sanitary and Epidemiological Service of Ukraine and the State Coinspection of Ukraine and local governments.

Local network of observation wells is constructed at all industrial and agricultural facilities (surface storages (accumulators) of industrial, agricultural and domestic sewage and waste, underground burials of highly toxic substances, underground storages of oil, oil products, water sources, etc.), or whose negative impact on groundwater has already manifested itself.

The local network of observation wells is equipped with groundwater and, if necessary, with interlayer drinking water. The design and equipment of the local network of observation wells at industrial, agricultural and other sites, the implementation of observations and laboratory quality control of groundwater is carried out by a water user who pollutes groundwater or is a potential polluter.

Provision of subsoil for disposal of industrial waste and other harmful substances, discharge of wastewater is allowed only in compliance with the norms, rules and requirements provided by current legislation of Ukraine. Underground disposal of industrial waste, wastewater and other harmful substances is used, in particular, to remove from the area of intensive life of contaminated and toxic effluents that cannot be treated by modern technologies. Such disposal is carried out by

injecting effluents into isolated aquifers that do not contain fresh, mineral, balneological, thermal, industrial and other waters that are used or will be used.Underground disposal is not allowed if these effluents can contaminate aquifers that are used or can be used for domestic and drinking water supply, balneological and industrial purposes.

Underground structures for the disposal of harmful substances and industrial waste, wastewater discharge are equipped with observation wells to monitor the movement of effluents pumped through the reservoir, as well as adjacent horizons. The construction of observation wells and observations to assess the impact of these underground structures on the environment are carried out by their owners.Operation of underground structures for disposal of harmful substances and industrial waste, wastewater discharge is possible if the owner has a special subsoil use permit issued in accordance with current legislation of Ukraine for subsoil use for construction and operation of underground structures in accordance with subparagraph 9 of paragraph 8 The procedure for issuing special permits for subsoil use, approved by the resolution of the Cabinet of Ministers of Ukraine of May 30, 2011 № 615.

Enterprises, institutions and organizations that pump mine, quarry and mine water to prevent flooding of mines, quarries and mines during the extraction of minerals, are obliged to implement effective technologies to reduce the level of their mineralization before discharge into water bodies. objects, and enterprises, institutions and organizations extracting oil and gas return the associated formation waters of oil and gas fields to underground horizons.

The conditions for discharging these waters into water bodies and returning to the underground horizons of associated reservoirs of oil and gas fields are established by regional, Kyiv, Sevastopol city state administrations, the executive body of the Autonomous Republic of Crimea on environmental protection.

CHAPTER II

Materials and methods of research of water and soil purification from petrochemical pollution.

Water purification.

The technological scheme of purification includes stages of sedimentation, flotation and two stages of filtration.

And the degree of purification - the collection of oil-contaminated groundwater in the receiving tank E1 for initial preparation, sludge of the free phase of petroleum products, sediment of suspended solids.

Sedimentation methods allow to reduce the concentration of dissolved petroleum products from 100 -200 to 30-40 mg / l, which is an insufficient condition for the

next stage of utilization of these waters into the components of the underground hydrosphere. To ensure the purification of groundwater to the requirements of the MPC (less than 0.3 mg / l), our project proposes the organization of deep purification by air flotation and filtration through a fine filter and sorbent.

The sediment of water in the tank E-1 provides a reduction of oil pollution to 30-40 mg / l, and when using the tank E-3 - up to 15-20 mg / l.

Calculation of the required capacity for sewage sludge.

The estimated standard time of sludge for the separation of petroleum products is equal to - 0.1-0.25 hours, depending on the type and composition of petroleum products;

Productivity of treatment facilities reaches - 50-100 cubic meters / day;

Accepted in the project, according to the design possibilities, the settling part of the structures is not less than 35 m3 (up to 10 m3 in tank E-1 and 25 m3 in tank E-3), which exceeds and provides the required capacity for the standard time of water settling.

II stage of purification - sludge in tank E-3 and ascent and flotation in the reservoir of oil pollution with hydraulic size up to 0.05 mm / s. Flotoflocculation is carried out due to the saturation of water with air bubbles from the blower and the formation of flotation complexes "air bubble - polluting part". Pop-up foam sludge with residues of dissolved petroleum products is diverted through existing technological communications in the tank E-3. Aeration of oil-contaminated waters by air flotation contributes to the saturation of water with air, additional oxidation of dissolved petroleum products not only in the flotation tank, but also further in the adsorbers, infiltration wells and soils of the pollution zone.

III stage of purification - cleaning on the filter of fine cleaning with oil-absorbing loading from oil pollution by hydraulic size up to 0,05-0,1 mm / s. As a filter, a hydrophobic fine-fiber sorbent of the ISTC "Surface Chemistry" of the National Academy of Sciences of Ukraine, which absorbs oil pollution, is used.

Hydrophobic fibrous oil-absorbing sorbent based on inorganic materials (TU 88 of Ukraine 259-003-94-SPN “Oil-absorbing sorbent) has a high sorption loading

capacity - up to 30.0-50.0 kg / kg of petroleum products per 1 kg of sorbent and is used as a filter treatment, providing wastewater treatment to a concentration of 0.17-0.2 mg / l (Conclusion of the state sanitary and hygienic examinations №032 / 37 from 4.11.99).

IV stage of purification - additional purification on the adsorber from oil pollution by hydraulic size (0.05 mm / s and residual concentration of oil products (less than 0.1-0.005 mg / l).

In the process of oxidation of residual petroleum products in the process of air flotation, metal salts are precipitated, so guaranteed purification from residual petroleum products and metal salts before discharge into the infiltration wells is provided IV stage of purification, which is performed on a two-stage adsorber due to sorption capacity. (TU U 24.6-30631594-001-2002), after which the concentrations of contaminants in the treated water are guaranteed to meet the requirements for discharge into the system of infiltration wells for the use of treated water in the circulating water supply when washing soils in the contaminated area.

To determine the type of treatment facilities, the following initial data are used:

the total amount of wastewater coming from mechanical treatment facilities for filters up to 100 m3 / day,

the estimated filtration speed is 0.5 m / h,

estimated area of filters - 0,312 m2,

the recommended height of the filter layer is 1.6 m.

According to the above conditions and initial data, it is recommended to use a modified design of the ion exchange filter FIP I-1.0-6.0 (OST108.030. 10-84), which is intended for water treatment to provide steam boilers.

The project envisages re-equipment of the filter for activated carbon (TU U 88.290.014-94), which is reduced to the replacement of the deaf upper part of the filter with a removable one with the installation of a metal mesh with a hatch for loading coal. The filter retains the principle of bottom-up filtering. Dirt capacity of activated carbon (TU U 24.6-30631594-001-2002) with oil absorption coefficient -6

-12. The filter bicycle is installed in the process of commissioning and operation mode depending on the requirements for the degree of cleaning and the allowable values of pressure losses.

In order to increase the degree of use of the adsorption capacity of the system and the filter cycle in the project it is recommended to use activated carbon (TU U 24.6-30631594-001-2002) with biodestructive properties that allow to extend the life of coal almost unchanged during the year. not less than 5-10oC and longer. In addition, purified water after passing through bioactivated carbon increases the purification capacity of infiltration during soil washing.

In Ukraine, every year, scientists record an increase in the degradation of natural water bodies, associated with an increase in the level of their pollution due to the discharge of insufficiently treated or even untreated effluents from industrial enterprises.

The problem of rational use of water and elimination of its losses is currently one of the most urgent tasks. Not only technical progress but also its consequences are developing rapidly. And the least protected, oddly enough, was ordinary drinking water.

The problem of transboundary water basins and their water quality remains important - as evidenced by a number of man-made accidents in recent years in neighboring Romania, which have caused dangerous pollution of the Danube waters within Ukraine.

"In low-water years, the country's water deficit is almost 4 billion m3. It is especially felt in the south-eastern and southern parts of Ukraine, there are areas (300 thousand people) where drinking water is imported. Therefore, its rational use, effective treatment of polluted wastewater is of great economic importance, "said Vitaliy Yevdokymenko, senior researcher at the Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine, Candidate of Chemical Sciences.

Cavitation cleans wastewater

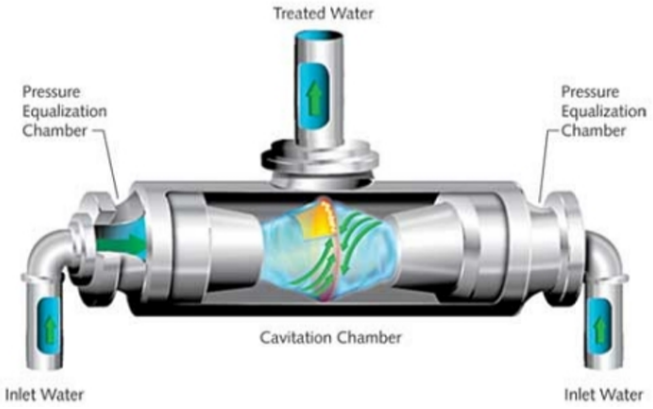

Fig. 2.1 Cooling Water Treatment Using Controlled Hydrodynamic Cavitation

This circumstance limits the use of classical biological methods of purification, and often does not allow to implement them at all. Therefore, proper wastewater treatment at these plants can be ensured by the use of reagent methods.

To intensify the reagent processes of wastewater treatment from organic compounds, in particular fatty acids, scientists have developed a cavitation method of activation of both reagents and reaction medium, ie after the introduction of reagents into wastewater. It consists in the fact that in cavitation fields there is an intensive destruction of the particles of the suspension, which causes an increase in the contact area of the reagents, and accordingly increases the rate of interaction between them. In addition, the surface of the reagent particles is updated, which also contributes to the course of their interaction with wastewater contaminants.

The study of the wastewater treatment process revealed the influence of cavitation phenomena not only on the reagents and the course of their interaction with pollutants, but also on the water itself as a dispersion medium.

Based on the obtained results, a flexible technological scheme of wastewater treatment has been developed, which provides for cavitation activation of both

reagent suspensions and wastewater directly after the addition of reagents.

Microorganisms at work

Nowadays, controlled biological treatment of wastewater in artificial conditions, which is performed in aeration tanks, biofilters and aerofilters, has become widespread. Knowing the principles of metabolism of microorganisms, you can achieve a sufficiently deep degree of purification. But the limitation for the application of a technology is its cost both during construction and during operation (energy costs, chemicals). Buildings for the removal and treatment of sludge and sludge are also of significant value. On average, it is from 30 to 50% of the cost of construction of wastewater treatment plants. However, the most difficult issue in existing wastewater treatment technologies is the treatment of sludge and sludge. Its effective solution, with the return of processed and safe biomass to the environment, is of great environmental, economic and social importance.

Currently, up to 90% of sludge and silt in Ukraine is not treated at all. They accumulate in sludge dumps, dumps, on silt sites, occupying more and more land, creating a risk of secondary pollution.

Lower in the anaerobic process growth of biomass of microorganisms almost eliminates the problem of treatment and disposal of sludge, and low electricity consumption in psychrophilic anaerobic processes means a significant reduction in total electricity consumption. The inclusion in the next stages of treatment of aerobic biofilters with modern volumetric or flat loading, combined with small aeration tanks-settlers, will provide a reliable, efficient and fairly cheap technology of municipal wastewater treatment, even with low-skilled personnel. "

In some European countries, 30–40% of the sediments formed during the treatment of municipal sewage are used in the agricultural complex. The use of sewage sludge as organic and mineral fertilizers or as fuel for public utilities will improve the economic and environmental situation that has arisen over the past

20 years during the operation of treatment plants. The application of the latest approaches in sludge dewatering involves their treatment with flocculants, followed by conditioning in geotextile containers. The humidity of such sediments can reach 70%, which allows for their mechanical removal and use of this material as a component of artificial soil.

The prospect of using anaerobic psychrophilic reactors in technological schemes of domestic wastewater treatment and the method of sludge dewatering with the use of geotextile materials in combination with coagulation treatment is shown on the example of the Kanev research site (Cherkasy region).

Specifics of wastewater treatment of food enterprises

The food industry of Ukraine covers more than 22 thousand enterprises, which employ more than a million people. "Food companies are large consumers of water, which is discharged into the environment after use with a high concentration of pollutants. It contains specific substances that pose a threat to the environment, especially to water bodies. Most food production facilities are located in small settlements, where there is usually no centralized sewerage system, raw material processing technologies are imperfect, and there are no local treatment plants.

Food effluents are characterized by a high content of organic matter and, as a rule, do not contain toxic impurities. Most organic compounds can be oxidized both chemically and biologically.

To reduce the size of treatment equipment, biological treatment can be carried out in several stages using the latest technologies and equipment. These include the use of anaerobic processes for the treatment of highly concentrated organic effluents or structures of anaerobic, aerobic and modular multifunctional reactors.

For the effective implementation of treatment processes for each company should take into account the regime of wastewater and it is desirable to have the widest range of their physical and chemical parameters. In the world, the

efficiency of wastewater treatment is determined by about 132 indicators, while in Ukraine, as in other CIS countries, a maximum of 36.

For most food industry enterprises, the actual concentrations of suspended solids significantly exceed the norm, so in this case it is advisable to use pressure flotation for pre-cleaning. This is typical of wastewater from meat and fish processing plants, which contain a large amount of fat, which adversely affects the course of biochemical processes.

Analysis of the biooxidation of organic impurities showed that the wastewater of the vast majority of food industry enterprises can be treated by biological methods using anaerobic, anoxic and aerobic processes.

Comprehensive disposal of industrial wastewater

Wastewater treatment, as well as the vast majority of environmental measures, the implementation of which is a prerequisite for the operation of any enterprise, especially the chemical industry, require significant material and energy costs. One example of the use of wastewater from different industries for mutual neutralization is the use of wastewater containing sodium hypochlorite for wastewater treatment with a high content of organic compounds. Both types of wastewater are generated at the enterprises of Kalush, Ivano-Frankivsk region, and now their treatment requires significant energy and economic costs.

Experimental studies have established the possibility of deep neutralization of organic compounds in olefin-produced effluents by hypochlorite effluents. The obtained results give every reason to expect that the proposed concept of the technological process of mutual neutralization of effluents can be implemented on a production scale.

Removal of sulfides from groundwater

Professor of the Institute of Chemistry of the Academy of Sciences of Moldova

Igor Povar dedicated his report to new processes of removal of sulfides belonging to toxic compounds from groundwater. Moldovan scientists performed a set of studies covering both adsorption and oxidation methods for water purification from sulfides. In particular, natural sorbents previously modified with copper and aluminum compounds were used. Studies performed continuously confirmed the very high efficiency of the proposed method - the degree of removal of sulfides reached 100%; At the same time, ammonium ions were extracted from groundwater at the same time - their content decreased by approximately 30%.

2.1Mechanical method of water and soil purification

It is difficult for modern Ukrainian society to imagine life without available drinking water. Centralized water supply and sewerage have long existed in every city and in many settlements and villages of Sumy region. People pay attention to water quality only when red "rusty" water flows from the taps or when it has a specific smell of chlorine. However, few people are interested in what stages the water goes through until it reaches our homes. Have you ever considered that with every shower, dishwashing and laundry you contribute to the reduction of the world's drinking water supply? Its condition is affected by household effluents with many types of household chemicals and industrial wastewater; groundwater with chemical impurities, which are widely used in agriculture, and stormwater, contaminated with fuels and lubricants, as well as many other factors. In particular, the all-Ukrainian rating "TOP-100 of the largest enterprises polluting the environment" (for discharges of polluted wastewater into water bodies) includes: Municipal enterprise "Miskvodokanal" of Sumy City Council; Municipal enterprise of production management of water supply and sewerage "Vodokanal" of Shostka city council; Municipal Enterprise "Production Department of Water Supply and Sewerage" of Konotop City Council and PJSC "SUMYKHIMPROM". In general, Sumy region ranks 7th in Ukraine in terms of discharged contaminated wastewater. It should be remembered that the regenerative possibilities of nature are not limitless, and therefore even the residents of Sumy region in the near

future risk having a significant shortage of drinking water. Everyone should think about the rational use of drinking water not only to save money on utilities, but also to preserve the fresh water of the planet. If you do not carry out high-quality treatment of industrial wastewater, the polluted environment leads to a number of problems: The wastewater of dairy or meat processing plants contains organic contaminants, helminth eggs and pathogenic microflora. Upon contact with drinking water, organic matter of animal origin can cause outbreaks of infectious diseases in humans. Untreated wastewater from industrial enterprises affects the color, odor and taste of water, disrupts the acid-base balance of the environment. Petroleum products, vegetable and animal fats when entering rivers and lakes form a film on the surfaces of reservoirs, which prevents the enrichment of water with oxygen. All this degrades the quality of water and makes it unfit for drinking and use for domestic and recreational purposes. Together with untreated wastewater from industrial enterprises in the textile, chemical or metalworking industries, toxic substances harmful to fish, animals and humans enter the reservoirs. Contaminated wastewater from industrial enterprises significantly reduces drinking water volumes. Fish is grown in such an environment, crops are watered with polluted water, and animals are watered. These are all foods that can have a direct negative impact on human health. There are many ways to treat wastewater and different types of classification. Among the methods of cleaning the most common: mechanical, physico-chemical and biological. Each of them involves a number of methods. The use of a particular method or method of water treatment is determined depending on the physical state, composition and concentration of pollutants. At water intake for household needs, purification is carried out at water treatment plants. The choice of methods and methods of purification depends on the quality of water and its purpose. Before water is fed into the water supply, it is clarified, ie suspended colloidal particles are removed from it, disinfected and decolorized, and, if necessary, softened, degassed, deodorized and decontaminated. Water clarification is carried out due to settling, filtration and coagulation. Water disinfection occurs through the action of liquid

chlorine, chlorinated lime or ozone. Along with disinfection under the action of these compounds, water discoloration occurs. Water softening is due to the action of lime on excess calcium and magnesium salts. This method is called reagent (passing water through ion-exchange filters by the cation exchange method of water softening). Reduction of iron content in water is achieved by aeration - enrichment of water with air, as a result of which air oxygen oxidizes dissolved in water salts of ferrous iron (Fe2 +) to trivalent (Fe3 +). Degassing takes place by aeration and filtration of water through a layer of active ammonium oxide. This method produces from water hydrogen sulfide, methane, excess fluorine, carbon dioxide and other gases. The release of substances from the water that give it a certain taste and smell (degassing) is carried out using activated carbon, ozone, chlorine dioxide or potassium permanganate. Wastewater treatment requires special treatment facilities and units, which are used to isolate, disinfect or neutralize contaminants. Domestic wastewater is treated mechanically and biologically. Industrial wastewater is treated together with domestic wastewater, but if the concentration of pollutants exceeds the permissible level or wastewater contains highly toxic substances, such water is pre-treated at treatment plants of relevant enterprises, institutions and only then discharged into general treatment plants. Be sure to disinfect the treated wastewater before discharging it. Mechanical treatment is used to remove insoluble substances from wastewater. It is provided by such methods as filtration, settling, filtration and centrifugation. Wastewater treatment ensures the retention of relatively large parts of contaminants, the size of which exceeds 15-20 mm. Water filtration is used to retain the smallest insoluble particles of contaminants that are in a suspended state. Sand-gravel filters or special grids are used for this purpose. Wastewater treatment from mechanical impurities is also carried out with the help of a hydrocyclone - a unit that removes suspended particles of pollutants (centrifugation) from the water during the rotation of the water tank due to the action of centrifugal forces. In order to intensify the process of mechanical treatment of domestic wastewater, they are aerated, or aeration is

combined with settling in the clarifier or biocoagulator. The physico-mechanical method is divided into chemical, physico-chemical and biochemical depending on which method of purification prevails. During chemical treatment, chemical reagents are added to wastewater, which, due to the reaction with pollutants, contribute to the precipitation of the latter or their evaporation. Chemical purification includes coagulation and neutralization. Coagulation - the process of adding to wastewater coagulant substances that promote the accelerated release of insoluble and partially soluble substances, which when settling do not precipitate. Coagulation causes the gradual sedimentation of dispersed particles and their separation from solution in the form of a precipitate. This process is called sedimentation. Neutralization - a reaction that leads to the destruction of the acidic properties of the solution with alkalis, and alkaline - with acids. Physico -chemical and biological methods of water purification are divided into two groups: regenerative and destructive. The former make it possible to extract and dispose of valuable elements and substances from wastewater. Destructive methods involve the destruction of pollutants or their disposal. Regenerative purification methods include: sorption, extraction, evaporation, flotation, ion exchange, electrolysis, crystallization, evaporation, etc. Sorption is a process as a result of which gases, vapors and soluble substances are absorbed by a certain substance (body) from wastewater. Extraction is the process of transferring substances from the aqueous phase to the organic. Evaporation is the process of evaporation of volatile pollutants due to the passage of steam through wastewater heated to 100 ° C. Flotation is the process of removing pollutants from wastewater together with air bubbles that rise to the surface. Ion exchange. This method is widely used for technological and analytical separation of mixtures of inorganic ions. Electrolysis is that current is passed through electrodes immersed in water, enhance the dissolution of the electrode material and the formation of clots of coagulate, which contributes to the sedimentation of contaminants. Crystallization is based on the formation of crystals of contaminants due to natural or artificial accelerated evaporation of the liquid. Evaporation is used in

the treatment of radioactively contaminated waters, which are mainly effluents from nuclear power plants. Destructive wastewater treatment is the oxidation of organic matter contained in wastewater. Oxidation and mineralization of organic pollutants due to aerobic biochemical processes are the essence of the biochemical method of wastewater treatment. Biological treatment takes place in natural conditions: in irrigation fields, filtration fields, biological ponds or in artificial conditions - biological filters. The method of biological wastewater treatment is based on the ability of microorganisms to use various substances contained in wastewater as a source of nutrition in the process of life. Thus microorganisms release water from pollution. Biological filters are facilities in which wastewater is filtered through a loading substance covered with a biological film formed by colonies of microorganisms. The classification of biofilters can be carried out on many grounds, the main of which are the type of loading used, the method of contact of the biofilm with treated wastewater and the method of air supply to the body of the biofilter. To determine the required degree of wastewater treatment before their release into reservoirs determine the concentrations of pollutants and the volume of water released. Thus, there are many modern methods that can treat wastewater. The use of some of them depends on the composition of contaminants in the water, its further use and the released substances. However, the use of at least one of them is a legal and moral obligation of every business entity. Because we all need to remember that we depend on the environment and harming it will come back to us three times over.

2.2Physico-chemical method of purification

These methods are used for additional purification from dissolved impurities, and in some cases from suspended solids. Many methods of physicochemical purification require preliminary deep separation of suspended solids from wastewater, for which the coagulation process is widely used.

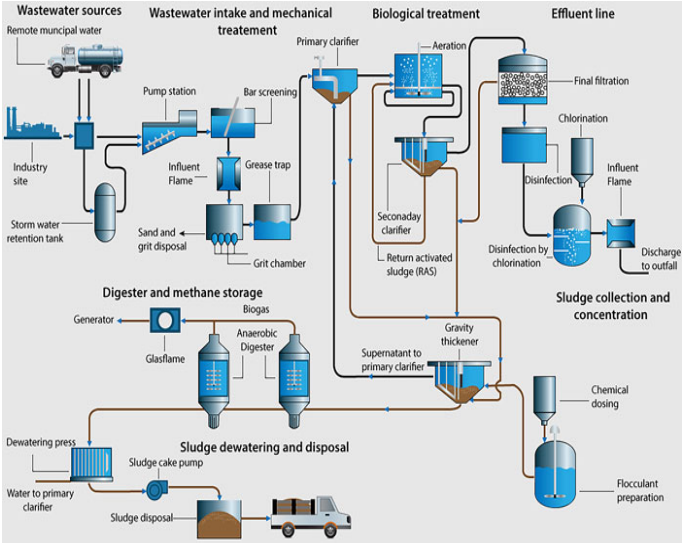

Fig. 2.2 Waste water treatment

At present, in connection with the use of circulating water supply systems, the use of physicochemical methods of wastewater treatment is significantly increasing, the main of which are:

Aeration - natural ventilation, saturation with air, oxygen (organized natural air exchange).

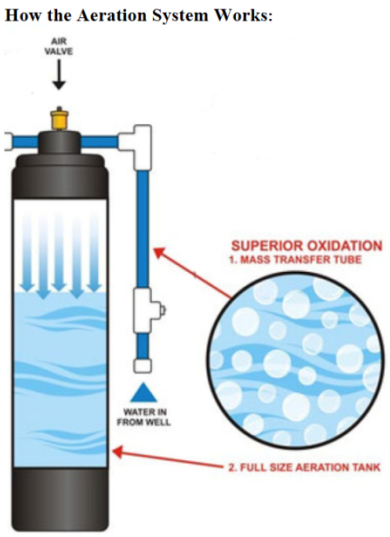

Fig. 2.3 Aeration system

Aeration is a process in which air is in close contact with water (liquid). Aeration is carried out by spraying water (liquid) in air or by passing air bubbles through water, that is, by direct contact of water and air / oxygen. Aeration can be used to oxygenate water to oxidize substances such as iron and to help remove dissolved gases such as carbon dioxide or hydrogen sulfide from the water. Aeration is the basis of the wastewater treatment process in biological treatment facilities (aeration tanks, air filters, biofilters).

Spin-on aerator from household tap

In agriculture, aeration is called loosening the earth with special means - aerators - in order to provide oxygen to the roots of plants. Organisms living in the soil aeration layer and participating in soil formation are called aerobionts .

In the field of water treatment, aeration is used to remove iron, manganese, hydrogen sulfide, and volatile substances. Several types of aeration are used:

Unpressurized - in an open container. The method has many advantages, such as simplicity and low cost, the main disadvantage of the method is its large dimensions. This method of cleaning involves taking water into a leaky aeration tank with its subsequent spraying on nozzles. This allows the flow of water to be divided into tiny droplets that interact with oxygen during flight. Thus, the process of oxidation of ferrous iron and manganese occurs. Additional saturation of water with oxygen is carried out due to the operation of a compressor (an example of such aeration can be observed in an aquarium) or an ejector, which is installed in front of the nozzles. Oxidized iron and manganese particles are retained at the bottom of the aeration tank.

Pressure head - used in combination with compressors. Aeration is carried out in a closed container under pressure created by the initial water injection and compressor. When the cleaning system is connected to the water supply system, the aeration column is filled with water, the flow sensor is triggered, the compressor starts to work, supplying air under pressure to the aeration column. After aeration, the water from the cylinder passes through a clarifier /

deferrization filter, on which oxidized particles of iron, manganese and sulfur are deposited. Then the water can be directed to the next stage of purification or directly into the water supply system and to the devices for its consumption.

Injection - water and air are pumped and mixed in the Venturi unit.

Aeration is a process of forced saturation of liquid or loose solid products with air, nitrogen or other gases in order to give them new consumer properties.

Flotation is one of the methods of mineral processing, which is based on the difference in the ability of minerals to hold on to the interface, due to the difference in specific surface energies. Hydrophobic (poorly water-wetted) particles of minerals are selectively fixed at the interface between phases, usually gas and water, and are separated from hydrophilic (well-wetted with water) particles. During flotation, gas bubbles or oil droplets adhere to particles that are poorly wetted by water and lift them to the surface.

Industrial froth flotation of copper sulphide ores

Flotation is also used to purify water from organic substances and solid suspensions, separate mixtures, and accelerate sedimentation in the chemical, oil refining, food, and other industries.Depending on the nature and method of formation of interphase boundaries (water - oil - gas), on which the separated components are fixed (see. Surfactants), several types of flotation are distinguished. Oil flotation was the first to be proposed, for which W. Hynes (Great Britain) was granted patent No. 488 in 1860 [1]. When crushed ore is mixed with oil and water, sulfide minerals are selectively wetted with oil and float with it to the surface of the water, and the rock (quartz, feldspars) is deposited. In the Russian Empire, oil flotation of graphite was carried out in 1904 in Mariupol.The ability of hydrophobic mineral particles to remain on the surface of the water, while hydrophilic ones sink in it, was used by A. Nibelius (USA, 1892) and McVisten (Great Britain, 1904) to create film flotation devices, in the process of which, from a thin layer of crushed ore, on the surface of the stream of water, hydrophilic particles fall out. Foam - in which small air bubbles are passed through a mixture of particles with water, particles of certain minerals are collected at the air-liquid

interface, adhere to air bubbles and are carried with them to the surface as part of a three-phase foam (with the addition of a foaming agent that regulates stability foam). The foam is further thickened and filtered. Water is most often used as a liquid, less often saturated salt solutions (separation of salts that make up potash ores) or melts (sulfur enrichment). Various methods have been proposed for the formation of bubbles: the formation of carbon dioxide due to a chemical reaction (S. Potter, USA, 1902), the release of gas from a solution at a decrease in pressure (F. Elmore, Great Britain, 1906) - vacuum flotation, vigorous stirring of the pulp, air passing through small holes.

For froth flotation, ore is crushed to a size of 0.5-1.0 mm in the case of natural hydrophobic non-metallic minerals with a low density (sulfur, coal, talc) and up to 0.1-0.2 mm for metal ores. Flotation reagents are added to create and enhance the difference in hydration of the separated minerals and to give the foam sufficient pulp resistance. Then the pulp enters the flotation machines. The formation of flotation aggregates (particles and air bubbles) occurs when minerals collide with air bubbles introduced into the pulp, as well as when gas bubbles emerge from the solution on the particles. The flotation is influenced by the ionic composition of the liquid phase of the pulp, gases dissolved in it (especially oxygen), temperature, and pulp density. Based on the study of the mineralogical and petrographic composition of the concentrated mineral, the flotation scheme, the reagent mode and the degree of grinding are selected, which provide a fairly complete separation of minerals. The best way to separate grains by flotation is 0.1–0.04 mm. Smaller particles separate less well, and particles smaller than 5 microns impair flotation of larger particles. The negative effect of micron-sized particles is reduced by specific reagents. Large (1-3 mm) particles are detached from the bubbles during flotation and do not float. Therefore, for the flotation of large particles (0.5-5 mm) in the USSR, methods of foam separation were developed, in which the slurry is fed to a layer of foam that retains only hydrophobized particles. For the same purpose, fluidized bed flotation machines with ascending flows of aerated liquid have been created. Froth flotation is a

much more productive process than oil and film flotation. This method is the most widely used [source unspecified 615 days]. Electroflotation, a promising method for use in the chemical industry, consists in the emergence of dispersed contaminants on the surface of a liquid due to the release of electrolytic gases and the flotation effect.

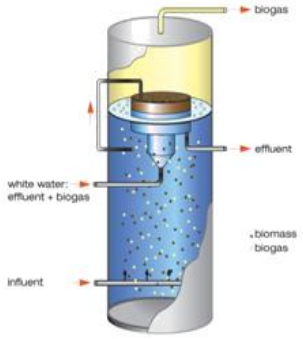

Fig.2.4 Electroflotation column

To purify water, as well as to extract components from dilute solutions, in the 1950s, a method of ion flotation was developed, which is promising for the processing of industrial wastewater, mineralized underground thermal and mine waters, as well as sea water. In ionic flotation, individual ions, molecules, fine sediments and colloidal particles interact with flotation reagents-collectors, most often of the cationic type, and are extracted by bubbles into a foam or film on the surface of the solution. Finely dispersed bubbles for flotation from solutions are also obtained by electrolytic decomposition of water with the formation of gaseous oxygen and hydrogen (electroflotation). With electroflotation, the consumption of reagents is significantly less, and in some cases they are not required. The widespread use of flotation for the beneficiation of minerals has led to the creation of various designs of flotation machines with large chambers (up to 10-30 m^3) with high productivity. The flotation machine consists of a series of

chambers arranged in series with receiving and unloading devices for pulp. Each chamber is equipped with an aeration device and a foam remover.

There are several types of flotation reagents that differ in their principle of action:

Collectors are reagents that selectively adsorb on the surface of the mineral that must be converted into foam, and impart hydrophobic properties to the particles. As collectors, substances are used, the molecules of which have an amphilic structure: a hydrophilic polar group, which is fixed on the surface of particles, and a hydrophobic hydrocarbon radical. Most often, collectors are ionic compounds; depending on which ion is active, there are anionic and cationic collectors. Less commonly used are collectors, which are non-polar compounds that are not capable of dissociation. Typical collectors are xanthates and dithiophosphates for sulfide minerals, sodium soaps and amines for non-sulfide minerals, and kerosene for coal enrichment. The collectors' consumption is hundreds of grams per ton of ore;

Regulators are reagents, as a result of selective sorption on the surface of a mineral, the latter becomes hydrophilic and incapable of flotation. Salts of inorganic acids and some polymers are used as regulators;

Foaming agents - designed to improve air dispersion and stabilize mineralized foams. Weak surfactants serve as foaming agents. The consumption of foaming agents is tens of grams per ton of ore. Activating reagents are reagents that create conditions conducive to the fixation of collectors on the surface of minerals. Depressant reagents are reagents used to prevent collectors from hydrophobizing minerals. They are designed to increase the selectivity (selectivity) of flotation when separating minerals with similar flotation properties.Sorption (from Latin sorbeo - I absorb) - the absorption of various substances from the environment by a solid or liquid. The absorbed substance in the medium is called a sorbate (sorbent), absorbing a solid or liquid - a sorbent. By the nature of sorbate absorption, sorption phenomena are divided into two types: adsorption - concentration of the sorbate at the interface or its absorption by the surface layer

of the sorbent and absorption - volumetric absorption, in which the sorbate is distributed throughout the volume of the sorbent.

In turn, two types of adsorption are distinguished - physical adsorption, in which an increase in the concentration of sorbate at the interface is due to nonspecific (that is, independent of the nature of the substance) van der Waals forces and chemical adsorption (chemisorption) due to the occurrence of chemical reactions of the sorbate with the substance of the sorbent surface. Physical adsorption is weakly specific, reversible, and its thermal effect is small (units to J / mol). Chemisorption is selective, usually irreversible, and its heat ranges from tens to hundreds (chemisorption of oxygen on metals) to J / mol.

In vacuum technology, the phenomenon of sorption is used by titanium pumps. Absorption in chemistry is a physical or chemical phenomenon or process in which atoms, molecules or ions enter a volumetric state - gas, liquid or solid. This is a different process from adsorption, since the molecules undergoing absorption are taken up by volume and not over the surface (as is the case with adsorption). A more general term is sorption, which encompasses the processes of absorption, adsorption and ion exchange. Absorption is basically the process by which something attaches another substance.

If absorption is a physical process, not accompanied by other physical or chemical processes, it usually obeys the Nernst distribution law: "in equilibrium, the ratio of the concentrations of the third component in two liquid states is constant."; {\ displaystyle {\ frac {[x] _ {1}} {[x] _ {2}}} = {\ text {constant}} = K_ {N (x, 12)}}

The volume of constant KN depends on temperature and is called the distribution coefficient. This equality is true provided that the concentrations are not too high and if the molecules "x" do not change their shape in any other of the two states. If such a molecule undergoes association or dissociation, then this equality still describes the equilibrium between "x" in both states, but only for the same form - the concentrations of all remaining forms must be calculated taking into account all other equilibria.

In the case of gas absorption, the concentration can be calculated using for example the ideal gas law, c = p / RT. Alternatively, you can use partial pressure instead of concentrations.

In many technologically important processes, chemical absorption is used instead of a physical process, for example the absorption of carbon dioxide by sodium hydroxide - such processes do not follow the Nernst distribution law. For some examples of this effect, one can consider extraction, in which one can extract a component from one liquid phase of a solution and transfer it to another without a chemical reaction. Examples of such solutions are noble gases and osmium oxide.

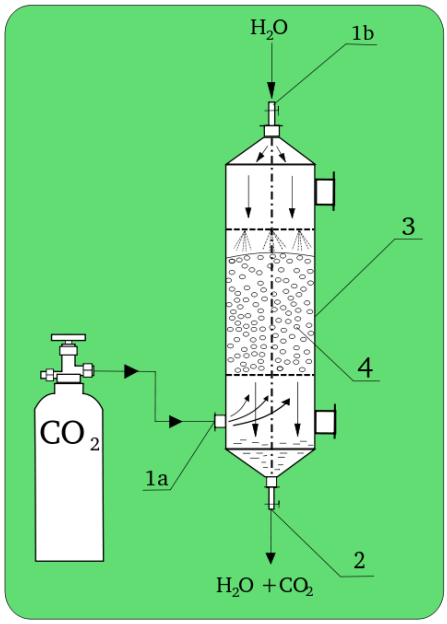

Fig.2.5 Laboratory absorber. 1a): CO2 inlet; 1b): H2O inlet; 2): release; 3): absorption column; 4): filler.

A centrifuge is a device that uses centrifugal force. It is a mechanism that ensures the rotation of the object by applying centrifugal force. They are used to separate gaseous, liquid or loose bodies of different densities, as well as in other cases requiring imitation of increased gravity.

Centrifuges are used in laboratory practice, in agriculture for cleaning grain, extruding honey from honeycombs, separating fat from milk, in industry for

enrichment of ores, in starch-treacle production, in textile production, in laundries to squeeze water out of laundry, etc. High-speed gas centrifuges are used to separate isotopes, primarily uranium isotopes in a gaseous compound (uranium hexafluoride UF6).

Separation (lat. Separatio) is various processes of separation of mixed volumes of dissimilar particles, mixtures, liquids of different densities, emulsions, solids, suspensions, solid particles or droplets in a gas. During separation, there is no change in the chemical composition of the separated substances. Separation is possible if there are differences in the characteristics of the components in the mixture: in the size of solid particles, in their masses, in shape, density, coefficients of friction, strength, elasticity, surface wettability, magnetic susceptibility, electrical conductivity, radioactivity, and others. The properties that distinguish the separation products do not have to coincide with the characteristics by which the mixture of components is separated in production. For example, when separating side rock and coal, products with the same density may contain different amounts of ash, which distinguishes high-quality coal. A very large number of individual small particles takes part in the separation process itself, among which there are particles with intermediate properties in relation to the necessary characteristics. From the initial mixture after industrial separation, absolutely pure fractions of the separated components cannot be obtained, but only products with their predominant content.

The choice of the separation method depends on the percentage composition and properties of the mixture to be separated and its constituent components, the degree to which the desired properties of the obtained products correspond to the consequences of separation and the properties of the components. Separation, as a rule, occurs not only by the main feature that distinguishes the components in the mixture, but by a number of properties. The separation processes differ from the external conditions and the apparatus in which the separation takes place.

The self-balancing effect can be observed in centrifuges designed to wring out

laundry. When speeding up, the centrifuge first starts to shake, then the peak of shaking passes, the shaking decreases, and the centrifuge reaches operating speed. If the laundry is placed too unevenly, the self-balancing effect may not occur. In this case, it becomes impossible to reach the working speed - the centrifuge goes into "runaway" (the drum starts to touch the body, making knocks). The self-balancing effect is based on the fact that a body that does not have a fixed axis of rotation rotates about its center of mass (this can be clearly seen if you spin a ballpoint pen or mobile phone lying on the table).

Technically, this is realized by elastic suspension of the centrifuge drum (often together with the drive motor) to the main body of the device. An elastic suspension (usually rubber dampers) allows the centrifuge drum to move radially (in any direction) up to several centimeters. In this case, the tilt and axial displacements are fixed relatively rigidly.

When rotating, the drum tends to rotate about its center of mass, displacing the drive axis by a certain radius (equal to the distance from the axis to the center of mass). If this distance falls within the stroke of the elastic suspension, the centrifuge drum rotates about its center of mass, and the drive axis (and suspension) moves in a circle, which is described by the center of the drum. (Due to the small diameter of the circle and the high rotation frequency, this movement is visually perceived as vibration). When the position of the center of mass changes (uneven squeezing of water), the drum starts to rotate relative to this new center, and the drive axis and suspension “follow” the changed circular movements of the center of the drum.

Self-balancing, as a rule, is used in centrifuges with a vertical drum (the suspension device is simpler and a preliminary uniform arrangement of the material is possible), however, the same effect (to some extent) is also used in automatic washing machines with a horizontal drum - in them the drum is elasticly suspended with everything a sealed water tank surrounding it, which is possible due to the relatively low drum speed. During wringing, the drum axis (together with the tank and the drive) makes circular movements relative to the current

center of mass of the drum (visible as vibration), and the elastic suspension separates (and allows) these movements from the main body, in which to increase the inertia weights are fixed in the form of solid metal or concrete blocks that make up a significant part of the total weight of the machine.

Also, in centrifuges (in particular, on some automatic washing machines), automatic balancing is sometimes used (during operation) - the displacement of pre-fixed counterweights (under the control of electronics) to bring the center of mass of the drum to the geometric axis of rotation.

Auto-balancing devices are designed for balancing fast-rotating bodies on the move, whose imbalance changes during operation. Auto-balancing devices consist of compensation weights attached to a rotating body, and / or compensation materials that fill the body cavity.

Evaporation the evaporation method of purification, is a physicochemical method of purifying industrial wastewater using steam.

Evaporation treatment is carried out by passing saturated water vapor through waste water heated to approximately 100 ° C. Passing through the water, the steam entrains the polluting volatile substances, after which it is cleaned of them when passing through the absorbing substance also heated to approximately 100 ° C and enters for reuse.

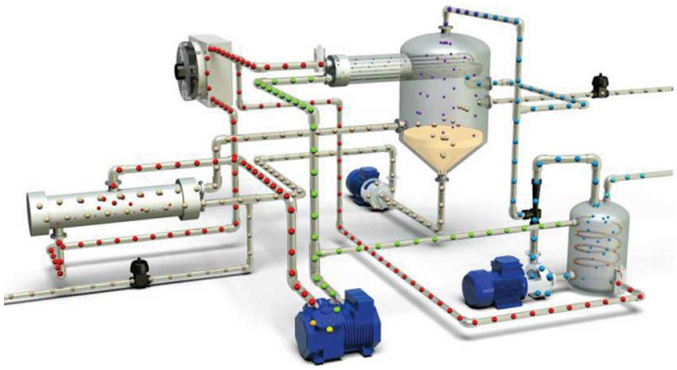

Fig. 2.6 Wastewater evaporator

Devices for cleaning in this way are called evaporation columns and consist of

two main parts - evaporation and absorption. The main advantages of the evaporation method of purification are relative simplicity with high technical and economic indicators and the absence of additional pollution in the form of reagents remaining in the water.

2.3Microbiological method of purification

Biological water treatment is a common method of wastewater treatment (domestic and industrial). It is based on the process of biological oxidation of organic compounds and accumulation in living organisms of inorganic compounds contained in wastewater. Biological oxidation of wastewater is carried out by the biocenosis of microorganisms, which includes a set of different bacteria, protozoa and a number of more highly organized organisms (algae, fungi, higher plants and animals, etc.), linked into a single complex complex relationship (metabiosis, symbiosis and antagonism). The basis of the biological method of wastewater treatment are self-treatment processes that occur in water bodies (streams and reservoirs) in natural conditions.The efficiency of biological wastewater treatment processes depends on a number of factors, some of which can be regulated in a wide range, and others, such as the composition of wastewater, are virtually uncontrollable.

Temperature is one of the main factors that ensures the efficiency and high productivity of biological treatment plants. The optimum temperature for aerobic processes occurring in biological oxidants is 20-30 ° C, and the biocenosis should be represented by various and well-developed organisms under other favorable conditions. It should be noted that for different species of organisms, in particular bacteria, the optimal temperature varies from 4 to 85 ° C.

The development of organisms is also influenced by the active reaction of the environment (pH), because a significant part of living beings thrive best in a neutral or slightly alkaline environment. The environment with pH = 6.5-7.5 is considered optimal for biological treatment. Deviation of pH outside 6 and 8.5 reduces the rate of oxidation due to the slowing down of metabolic processes in the cell.

Thus, the normal course of biological wastewater treatment processes from organic pollutants must be ensured by certain conditions. If these conditions are not met, they must be adjusted:

- change the temperature regime due to heating or cooling of wastewater;
- to carry out neutralization of sewage;
- in the absence of nutrients in wastewater, they should be added artificially in the form of superphosphate, ammonia water, ammophos, etc.

In aerobic biological treatment plants, the concentration of dissolved oxygen must be maintained at least 2 mg / l, otherwise there is a decrease in the rate of utilization of organic compounds. The required oxygen concentration in the buildings is maintained by the supply of air or technical oxygen through aeration systems and aerators.

During the operation of biological treatment plants, the concentration of toxic components, which should not exceed the MPC, is constantly monitored. In the process of biological treatment, the amount of wastewater having a certain concentration of organic pollutants is fed so as not to exceed the daily load of these pollutants per 1 m3 of treatment plant, 1 g of dry biomass or 1 g of ashless biomass. Virtually all organic matter can be oxidized under aerobic conditions, although the rate of their oxidation varies widely. Biological wastewater treatment is called complete if the BSC (biochemical oxygen demand) of treated wastewater is less than 20 mg / l and incomplete with BSC - more than 20 mg / l.

Natural and artificial structures are used for biological wastewater treatment.

Natural buildingsEdit

Natural biological wastewater treatment plants include filtration or groundwater treatment plants and phytoremediation facilities (wastewater treatment facilities with higher plants).

Filtration structuresEdit

The use of these facilities is associated with a number of restrictions due to the consumption and composition of wastewater, sanitary and hygienic requirements and methods of disposal. Soil cleaning takes into account the type of soil, terrain,

groundwater level, average annual rainfall, length of the growing season, etc. Groundwater treatment plants are used mainly for domestic wastewater treatment and are divided into small, medium and large in terms of productivity. Their capacity varies from 1 m³ of wastewater per day to 100 thousand m³ / day.

Small soil treatment facilities include:

- filter wells;
- filter trenches with natural or artificial soil layer;
-sand and gravel filters.

The average structures of soil treatment include:

- underground irrigation fields;
- underground filtration fields.

The largest structures of soil cleaning are:

- agricultural irrigation fields;
- communal irrigation fields;
- ground filtration fields.

In practice, several types of irrigation systems are used:

- solid bay;
- bay along furrows and strips;
- sprinkling and ground irrigation.

The latter method best meets epidemiological, sanitary, agro-economic, aesthetic and water management requirements. When using treatment facilities with irrigation fields and year-round intake of wastewater with seasonal regulation of their supply, the bay is carried out only during the growing season. At other times of the year, wastewater enters the storage ponds with a capacity equal to the 6-month flow of wastewater. Irrigation of agricultural land with biologically treated wastewater does not completely exclude the possibility of contamination of soil and crops with pathogenic bacteria and helminth eggs.

CHAPTER III

Ways to solve the problem of petrochemical pollution of groundwater in the Dnieper basin on the example of Kyiv region.

Environmental pollution by oil and oil products is one of the most dangerous types of pollution. Among the components of the underground hydrosphere, this type of pollution has become widespread in underground waters, which are of exceptional importance for certain regions of Ukraine in providing the population with high-quality drinking water.

Petrochemical pollution of groundwater in Ukraine is primarily associated with their vulnerability and high concentration of the technogenic complex. In terms of saturation with such objects, the Kiev region is one of the most technologically loaded regions of Ukraine. There are dozens of oil storage depots, hundreds of filling stations, oil pipelines and pumping stations on its territory. Many of these facilities caused pollution and closure of water intakes and created a problem of water supply to entire cities and regions (Uzin, Belaya Tserkov, Vasilkov, Belogorodka, etc.). Contaminated groundwater is drained into the Ros, Stugna, Irpen, and Dnieper rivers.

Despite a significant decrease in the intensity of pollution in recent years due to

a decrease in production volumes and more economical use of petroleum products, built without sufficient protection against leaks and in the absence of control over the state of the underground hydrosphere, these facilities continue to remain active sources of pollution. The impact of such objects on the environment is very large and extensive, since in addition to the direct pollution of soil and groundwater and the associated withdrawal from use of water intakes, wells, lands and reservoirs, there is a constant expansion of the areas of pollution, the formation of toxic substances and degradation of the surrounding biosphere.

As foreign and domestic experience shows, the most effective protection against the spread of pollution and its subsequent elimination is the extraction of the liquid phase of oil products and the creation of conditions for the life of the microfauna, which destroys the residues of pollution in the soil independently.

In the period 1993-99. in Ukraine, a number of private companies, on risk terms and at their own expense, obtained from the sale of oil products extracted from the contaminated zones, ensured the implementation of a significant volume of geological and environmental surveys and work at dozens of objects of petrochemical pollution, including at military aviation bases, at large civilian oil depots and refineries, where the largest losses of oil products took place. As a result of these works, tens of thousands of tons of previously lost oil products were extracted from the ground, the technogenic load on the underground hydrosphere decreased and conditions for natural regeneration of water and soil were created on hundreds of hectares, experience in eliminating such pollution was accumulated.

However, the implementation of these works is often limited to pumping out the liquid phase of oil products and then within the limits of economic feasibility. As experience and economic calculations show, after a decrease in the average well flow rate of less than 20-30 l / day of oil products, pumping becomes unprofitable. At the same time, the oil saturation of the soils is still quite high and a layer of free oil up to several centimeters is observed in the wells, which indicates a high residual pollution. At the same time, it is necessary to clearly

understand that achieving absolute soil cleaning is a long-term and expensive process, therefore it is extremely important now to determine the minimum required level of cleaning that would correspond to the safety of the environment and the real capabilities of the contractor.

The closest to this state is the level of residual oil saturation, at which there is no separation of the liquid phase of oil products from the soil. Work on the determination of such residual oil saturation for various types of rocks is currently being carried out at the Institute of Geological Sciences of the National Academy of Sciences of Ukraine. Another criterion for assessing the permissible residual pollution can be an assessment of the risk of spread and the impact of pollution on the environment and humans, calculated by the sum of indicator carcinogenic substances and the possibility of their entering the human body.

Using the example of the Kiev region, where these works are most actively carried out, one can easily imagine the state of affairs in other regions of Ukraine.

Currently, on the territory of the Kiev region, where there are more than 30 large oil depots of various subordination with a total turnover of more than 2 million tons of petroleum products per year, not counting small oil depots of automobile enterprises, gas stations, pipelines and pumping stations, geological and environmental studies were carried out only at 15 -ty. At 12 of them, serious pollution of soil and groundwater was found, which threatens or directly affects the existing water intakes, and only 4 of them are currently undergoing any work.

At the same time, petrochemical pollution continues to accumulate and expand. For example: in the Kiev region there is not a single station for the additional purification of water from oil products and all the bottom water contaminated with oil products, which is formed during the obligatory regular cleaning of tanks, is discharged into the sewer or onto the ground, polluting soils and groundwater. Based on an elementary calculation of the frequency of cleaning and the volume of the region's tank farm, this amounts to at least 100 thousand tons of water per year with an oil product content exceeding the MPC hundreds of times. There are no control and observation wells at potentially hazardous facilities and, therefore,

pollution is detected only when oil products with groundwater begin to be found in water intakes, wells and reservoirs. One of the reasons for this situation is the lack of state support and regulation of environmental programs in this area.

For a comprehensive solution to this problem, it seems necessary:

- adjusting the National Program "Monitoring, assessing and predicting the situation on the development of petrochemical pollution of groundwater in Ukraine" in order to expand the functions and organize scientific control over the development and implementation of environmental protection measures at the objects of petrochemical pollution;
- development of methodological and legislative documents regulating the performance of work at objects of petrochemical pollution;
- creation of a monitoring system for the state of groundwater at facilities of possible petrochemical pollution, that is, all potentially hazardous facilities of petrochemical pollution should be equipped with a network of control and observation (monitoring) wells;
- to receive and purify water from oil products, appropriate systems should be developed, which can be self-supporting enterprises and receive water for additional treatment on the basis of contracts with other enterprises;
- at one of the objects of petrochemical pollution, a testing ground should be created for testing and presenting technologies, for developing methods for treating water and soil, for conducting demonstrative environmental protection measures and training. Currently, joint preparatory work is underway with the Institute of Geological Sciences of the National Academy of Sciences of Ukraine on the preparation and selection of such a test site. Both domestic and foreign companies representing modern technical means or technologies for advertising purposes, or for training within the framework of international programs, or on leasing terms, could well take part in the implementation of construction programs and equipment for the landfill.

Fig. 3.1 Map of petrochemical pollution of Ukraine

3.1Features **of groundwater pollution within the Kyiv region and measures to eliminate it**

Water supply to settlements is carried out both from surface water bodies and from underground wells. The sources of surface water intake are the Ros and Desna rivers - of which, according to the Kiev regional administration, approximately 650 million m3 of water is taken annually. Water purification is carried out according to classical technology - coagulation, oxidation, mechanical purification and disinfection. Underground aquifers are at the level of 60-80 meters (Buchak horizon) and 100-120 meters (Cenomanian horizon). The water from the first is rich in abnormal amounts of manganese and iron, and from the second it contains a lot of hydrogen sulfide. 55 million m3 of water is consumed annually from underground sources. To remove iron, the circuit provides filters with catalytic material. Below we describe the situation with the water supply of the Kiev region, taking into account information from open sources and systematized data on the results of analyzes in the Ecosoft laboratory.

Tap water from surface sources

Water from Ros is fully supplied to Belaya Tserkov, Boguslav, Mironovka. Desna

feeds Brovary. The water condition in these rivers is satisfactory, with the exception of the flood period, when turbidity and color content increase, as well as the warm summer period, when blue-green algae actively reproduce. According to the report of the Kiev regional administration for 2015, Belaya Tserkov, as well as Belotserkovsky and Brovarsky districts, are on the list of “problem” districts. The results of water analysis in our laboratory are given below.

What does the analysis of water in Bila Tserkva say?

The source of water supply to Belaya Tserkov is a reservoir, which is filled from the Ros river. Belotserkovsky water utility covers a fairly large area of the city and settlements around it. It is also worth noting that due to the presence of a 130 km long water pass. The Belotserkovsky water utility even supplies the city of Uman.

Water treatment equipment has been partially modernized. Taken samples of tap water in Bila Tserkva are relatively safe. Traditional problems of supply from surface water bodies are observed - increased turbidity, color, hardness in most samples no more than 1.5 times the MPC. As for nitrates, the excess of the MPC is single and all the values detected range up to 10 mg / l. We will also write about wells. Their condition is also relatively stable, there is a characteristic increase in the level of color (18% of samples), turbidity (30% of samples) and consistently high hardness (80%) and iron (30%). Depending on the depth of the well, an excess of nitrates is observed (approximately 50% of the samples). 8 out of 10 samples from wells indicate that it cannot be used for drinking, since the level of nitrates is higher than the permissible level. It is worth noting that over the past five years, the water quality in Bila Tserkva has improved, since according to official data, until 2015, Bila Tserkva and Belotserkovsky district were among the most problematic settlements in the region. To date, a partial reconstruction of the drinking water treatment systems has been carried out, but a number of problems remain relevant - frequent accidents, turbidity, and sometimes bacteriological contamination are still observed. These problems are the result of an outdated plumbing system. To assess the information on the state of water in Mironovka and Boguslav, we do not have enough analysis data, their water supply

is also carried out from Ros. Therefore, similar problems may occur.

Water in Brovary

As we wrote above, the water in Brovary is obtained from the Desna River. According to the results of research in our laboratory, tap water is of satisfactory quality, which is associated with the high quality of the source water in the Desna River. There is no increase in toxic components in it, in some samples there is an increased turbidity and color, which is caused by aging of pipelines, as well as the presence of oxidized natural organic components.

Underground waters of the Kiev region

We have already written above that part of the region is still supplied with water from underground sources. In fact, this share is quite high. We will write about some areas in detail, because there is more information, about others very briefly.

Kiev-Svyatoshinsky district

Since we often do analyzes in this particular area, we even have the opportunity to highlight some settlements and write about them in some detail.

Irpen, Bucha, Gostomel and Vorzel use only groundwater. According to analyzes carried out in the Ecosoft laboratory, in general, 7 out of 10 tap water samples have problems with manganese and iron. Classic haze and color problems are also observed. Well water problems are similar, since, as we wrote above, the centralized water supply system is also fed from underground wells. These settlements are served by Irpen Vodokanal. At the water treatment plants that are subordinate to him, classic water purification systems with iron removal filters are installed. Boyarka, Belogorodka and other nearby settlements are also supplied with water from the wells of the Buchak and Poltava horizons; the same problems are characteristic as in the Irpen region. Despite the fact that these settlements are supplied by one water utility, there are always several water treatment plants. So, for example, in Boyarka, only 20% of water samples are contaminated with iron and salts of hardness above the permissible norm, but in Belogorodok, in almost 8 out of 10 analyzes, an increased content of iron and

turbidity is observed, otherwise - within the limits of the normative qualities. Well water in this area is characterized by an increased iron content (up to 70% of samples) and turbidity. Some samples have increased hardness and color (shallow wells). As for the wells, it is better not to drink water in them - the concentration of nitrates reaches more than 200 mg / l, which is 4 times higher than the permissible amount.

Sofievskaya and Petropavlovskaya Borschagovka are located on the border of the water supply network of Boyarsky Vodokanal and Kievvodokanal, therefore the water supply is mixed - part is purified water from the Dnieper, and part is borehole water. According to the averaged data, tap water has a higher color, in some places increased hardness and iron (1-3 out of 10 samples), which is explained by the partial coverage of needs from the Kiev water utility network.

Cherry is supplied from the same horizons, but the water treatment equipment functions more efficiently and provides water of satisfactory quality in 70-80% of cases. In general, according to the sum of the parameters, it can be concluded that neither borehole nor tap water is suitable for drinking without preliminary purification.

Water quality in Vasilkov

Vasilkovsky Vodokanal also supplies the city and its surroundings from underground wells. The situation here is deplorable, since there is not enough water and regular blackouts occur. In terms of quality, the cleaning is incomplete. The same water flows from taps in the city as from wells, practically without treatment. Increased content of iron, manganese, hardness and turbidity of water. There are frequent interruptions in the water supply system due to the lack of necessary upgrades in terms of system performance, as well as replacement of the pipeline system.

Water quality in Fastov

In Fastov, at the moment, the modernization of water treatment equipment is underway, the problems of iron, manganese, high hardness and color are only

partially resolved. Therefore, the water quality according to the research results of our laboratory does not meet the established requirements.

Fig.3.2 Iron removal system in Fastov

Fig.3.3 Station of deferrization of water of Irpen Vodokanal

3.2 The use of the sorbent "Ecolan - M" in the elimination of emergency oil spills and petroleum products

The company "ECOTERRA" offers new, highly effective technologies for combating environmental pollution with oil and oil products, based on the use of the latest development of the Institute of Microbiology and Virology of the Academy of Sciences of Ukraine and LLC "Evrosorb" - the drug "Ecolan-M" (TU U 24.6-35780370-001- 2009), combining the advantages of sorption and biodestructive methods, elimination of oil pollution. The drug "Ecolan-M" is a new improved drug of the Ecolan series and belongs to the class of biodestructive sorbents that localize oil pollution and destroy adsorbed oil products by a

biological method. "Ecolan-M" has a number of advantages over foreign and most well-known domestic drugs in Ukraine.

Ecolan-M is capable of decomposing (the process of destruction) oil and oil products to environmentally neutral compounds - aldehydes, organic acids, alcohols, carbon dioxide and water. The main advantage of the drug is its ability to almost completely localize and eliminate oil products directly at the site of application. Moreover, both the drug itself and the components of its interaction with oil products are environmentally friendly and do not require collection, special disposal and removal of waste from the place of pollution. At the end of the cleaning process from oily contaminants in the soil, a complex of fertilizers from wood ash and biomass remains at the site of application of the drug.

Ecolan-M decomposes a wide range of hydrocarbons: crude oil and its refined products, motor oil, transformer oil and other petroleum oils and lubricants, diesel and aviation fuel, gasoline, kerosene, waste petroleum products and other hydrocarbon-containing substances.

Ecolan-M is completely made from natural raw materials, environmentally friendly, and contains a whole range of safe natural strains of hydrocarbon-oxidizing microorganisms, the number of which is at least 100,000,000 (one hundred million -108) cells per 1 g of the product.

Fig.3.4 Biodegradable sorbent Ecolan-M

Specially selected highly effective compositions of strains of microorganisms are able to grow and carry out the destruction of oil and oil products in a wide range of mineralization (0.05% - 7.0%), pH of the medium (4.5 - 9.0) and temperature (+10 - +42 ° C), while the temperature range for the localization of oil and oil products by the sorbent of the preparation is from -20 ° C to + 50 ° C.

Ecolan-M is capable of destruction (liquidation) of both soluble and water-insoluble components of oil and oil products. The drug has a very low water absorption and the oil products localized by the drug are not washed off from its surface with water and are not removed by other sediments, and the drug "Ecolan-M" does not need preliminary activation before use, which makes it more effective in use and application.

The Ecolan-M preparation meets all the requirements of current and international legislation for microbial preparations intended for cleaning the environment from oil and oil products, and has the entire package of necessary permits for production, storage and use. The composition of strains of microorganisms for the manufacture of the drug "Ecolan-M" is deposited in the Depository of microorganisms of the Institute of Microbiology and Virology named after D.K. Zabolotny of the National Academy of Sciences of Ukraine.

ENVIRONMENTAL POLLUTION

Industry, transport, defense complex, almost all parts of the economic infrastructure are faced with the problems of environmental pollution with petroleum products during production, storage, processing, transportation and in emergency situations. The current scale of economic development and the associated increase in environmental pollution threaten the ecological balance and human health. This requires the search for new means of combating environmental pollution that will completely eliminate this pollution, without the need for removal, processing, disposal or disposal of waste, as well as restoration of natural ecosystems.

Environmental pollution with oil and oil products is one of the most large-scale and dangerous types of human impact on the environment.

Fig.3.5 Biosorbent Ecolan-M work process

ECOLOGICAL AND SANITARY SAFETY OF THE "ECOLAN-M"

Ecolan-M does not contain pathogenic microorganisms and toxic substances, does not pose a biological hazard during production, storage and use. The drug is harmless to humans, animals and plants - it has no medico-hygienic, toxicological and environmental contraindications. Possesses absolute microbiality, which completely eliminates the negative impact on the environment.

The Ecolan-M preparation is made from natural raw materials and contains: environmentally neutral oil-absorbing sorbent (charcoal), mineral components (sources of nitrogen, phosphorus and potassium) and natural strains of hydrocarbon-oxidizing microorganisms.

The absence of virulence, toxicity, toxicity and the ability to invade the internal organs of laboratory animals in these microorganisms indicates their non-pathogenicity and the possibility of being used in natural conditions, and the drug itself is completely safe for humans, flora and fauna.

When a biological product is introduced into an environment polluted with oil products, the population of microorganisms (bacteria) begins to grow, using oil

hydrocarbons as a nutrient medium. Therefore, as a result of the complete absorption of oil products, bacteria lose their nutrient medium and die off, creating humus on the ground, in mule water. Microorganisms also die if they are separated from the carrier (sorbent). Thus, the possibility of such a phenomenon as introduction - microbial pollution of the natural environment is excluded.

According to the results of the sanitary and epidemiological examination, the drug belongs to the fourth hazard class (low-hazard substances, GOST 12.1.007-76).

HAS THE POSSIBILITY OF APPLICATION ON DIFFERENT SURFACES AND TERRITORIES.

The use of the Ecolan-M preparation promotes effective cleaning of large areas of contaminated water and soil surfaces, which is especially important in the containment and elimination of emergency oil and oil product spills.

Ecolan-M is used for containment and elimination of pollution associated with oil and oil product spills:

On a hard surface (asphalt, concrete, slabs).

On the surface of soils, land reclamation (clay, sandy, fertile).

On the water surface (sea, river, lake, swampy areas, artificial and technological reservoirs, canals).

On the surface of the snow.

On the surface of waste drilling fluids.

When cleaning machinery, containers and tanks.

Wastewater treatment.

When cleaning underground pollution (groundwater).

When cleaning coastal areas.

When cleaning oily stains and films.

When cleaning sedimentation tanks, coolers, treatment facilities, sewerage.

When used in various filters.

Oil contamination on hard surfaces.

When cleaning hard coatings, the "Eolan-M" preparation is applied to the

contaminated surface and it, saturated with oil products, is removed from the cleaned surface and transferred to special technological sites, where it is self-cleaning as a result of biodegradation. Soil pollution by oil and oil products. Soil cleaning, land reclamation.

Directly at the spill site, work is underway to prepare the contaminated areas for the application of the Ecolan-M preparation and the optimal variant of the cleaning process is being determined. Laboratory research is possible. In case of emergency spills, the liquid fraction of oil products is localized as quickly as possible and collected from the soil surface using special equipment and mechanisms. With the help of the preparation, the soil is cleared of that part of the oil products that has managed to be absorbed into the soil. To do this, the preparation is applied to the contaminated areas and, depending on the concentration of hydrocarbons in the soil, it is further cleaned at the site of contamination or at specially equipped sites.

To carry out land reclamation, technologies are used that eliminate oil-containing pollution and have a stimulating effect to restore the fertile layer.Pollution of underground horizons (groundwater), their purification from oil products.

Contamination of groundwater with oil products (OP) is a serious, widespread and well-known problem. Hundreds and thousands of large and small oil depots, thousands of kilometers of oil pipelines, product pipelines, a large number of gas stations, storage facilities for oil products, mining, transportation and refining enterprises are sources of systemic losses of oil products that pollute the geological environment over vast areas. Oil products in the places of straits seep into the ground and, having reached the surface of the groundwater level, spread and pollute the underground space in an area of tens and hundreds of hectares, disabling wells, water intakes, polluting soils and soil, lakes, rivers and other water areas.

The work that is carried out to eliminate underground pollution is often limited to pumping out the liquid phase of the oil, and even then within the limits of economic feasibility, while a layer of liquid oil products remains in the observation

wells - up to several centimeters, which indicates a sufficiently high residual pollution. Achieving the cleaning of soils to standards that would meet environmental safety standards (MPC - maximum permissible concentration) is a long-term process.

Therefore, we organize not only geological exploration and survey work, pumping out and a whole range of measures to eliminate pollution, but also carry out additional treatment of residual pollution using biodestructive methods and technologies using the Ecolan-M biosorbent and cultural preparations. This allows you to localize and eliminate the source of further spread of pollution, the gas component of hydrocarbon compounds in the pore space and in the capillary uplift zone decreases, the content of oil products in dissolved forms decreases significantly and ultimately helps to maximize the purification of groundwater from oil pollution.Pollution of water areas with oil and oil products. Elimination of oil pollution on the water surface.

Depending on the size and nature of the pollution, protective booms can additionally be used to localize oil products on the surface of water bodies. Ecolan-M is effective for restoring the quality of water contaminated with both soluble and water-insoluble oil components, which form a film on its surface. Water purification is carried out by applying the drug directly to the contaminated surface, by spraying from the shore or from the boat. After the sorption of petroleum products, the preparation can be collected from the water surface, or, at low levels of contamination, left on it - thereby eliminating the technological process of extracting (collecting and removing) the sorbent from the water body after its use. In this case, it partially settles to the bottom of the reservoir, where the destruction of the drug by microorganisms continues to be underutilized at the first stage of refining oil products to ecologically neutral compounds that form bottom sludge.

ROBOTS FOR LOCOLIZATION AND ELIMINATION OF OIL-CONTAINING CONTAMINATIONS USING THE EKOLAN-M PREPARATION

LLC "ECOTERRA" offers a range of services related to the localization and

elimination of all types of oily pollution, cleaning territories from oil and oil products using biosorption technologies - the drug "Ecolan-M":

Elimination of accidental and technological spills.

Soil reclamation and soil cleaning.

Localization and elimination of pollution from the water surface.

Ecological and geological works to localize and eliminate pollution of underground horizons (groundwater).

Removal of oil stains and film from any surface.

Cleaning of drains.

Localization and elimination of pollution of coastal areas (coastal zones).

Cleaning from pollution of sedimentation tanks, coolers, treatment facilities, sewerage.

Localization and elimination of pollution associated with production and technological processes.

Ecological and geological surveys.

Waste collection and disposal.

Environmental audit.

DOES NOT REQUIRE THE COLLECTION, REMOVAL AND DISPOSAL OF HAZARDOUS WASTE.

Unlike traditionally used cleaning methods, such as mechanical, physicochemical, biological, the biosorption method of cleaning with the use of the Ecolan-M preparation does not require collection, removal and disposal of hazardous waste from the place of pollution after use, and subsequently eliminate pollution. It is effective both at low or medium, and at high concentrations of oil products. Residual decomposition products of petroleum products as a result of the use of Ecolan-M are environmentally neutral substances - safe aldehydes, organic acids, alcohols, carbon dioxide and water.

Tab. 1 **COMPARATIVE CHARACTERISTICS OF POLLUTION ELIMINATION METHODS**

OIL AND PETROLEUM PRODUCTS

liquidation method	Liquidation means	Features
Mechanical	Using mechanical means for eliminating contamination	Non-ecological: requires separation of oil products, removal and disposal of waste. It is ineffective in difficult conditions of use. Additional cleaning of contaminated areas is always required.
Physicochemical	Oil-absorbing sorbents	Not ecological. Produces waste accumulation. Requires additional treatment. Requires disposal.
Microbiological	Introduction of biological products (microorganisms), activation of local microflora	Ineffective at high concentration of pollution. Requires special application technologies and the creation of special conditions for use. High dependence on temperature conditions and external environment.
Biosorption with the use of the drug Ecolan-M	Oil-absorbing sorbent on which strains of oil-oxidizing bacteria are immobilized	It is completely ecological. Does not require disposal. Does not create waste. Versatile in application. Less dependent on temperature, weather and time conditions. It has an extremely high efficiency.

Substances that are well absorbed by Ecolan-M (with further destruction): Acetone, acetonitrile, amyl acetate, benzene, butanol, gasoline, 2-butanol, isopropanol, bromo-dichloromethane, bromoform, vinyl acetate, vinyl chloride, carbon disulphide, dichloroethane, diesel fuel, glycerin, hedtan, goxane, hexachloro -phenenzene, iso-hexachlorobenzene xylene, methanol, methylene, methylethylketone, methylphenol, engine oils, cutting oils, naphthalene, petroleum, nitrobenzene, styrene, tetrachloroethane, tetrachlorethylene, tetragudrofuran, toluidine, trichlorethylene, trichlorophenol, chloroformentloro, chlorofenzene, pentachylene , ethanol, ethylbenzene, ethylene glycol, phenol, carbon tetrachloride, 1,2-dichloroethane.

CHAPTER IV

LABOR PRECAUTION

Asthetopicofthediplomathesisisproblemofpetrochemicalpollutionofgroundwaterintheb Dnieperbasinandwaystosolveitontheexampleof Kyivregion,therefore,inthechapteronlaborprecautionitisnecessarytoinvestigatetheimpactofdangerousfactorsonapersonduringpetrochemicalpollution.

Classification of labor

Laborprotectionisasystemoflegislativeacts,socio-economic,organizational,technical,sanitaryandhygienicandpreventivemeasuresandmeansthatensurethesafetyofhealthandefficiencyofthepersonintheprocessofwork.

Assessmentofworkingconditionsiscarriedoutonthebasisof"Hygienicclassificationproductionenvironment,severityandintensityoftheworkprocess. BasedontheprinciplesofHygienicclassification,workingconditionsaredistributedfor4classes:

I-optimumworkingconditions-thoseconditionsunderwhichitisnotstorednotonlythehealthofworkers,butalsothepreconditionsforsupporthighlevelofefficiency.

II-acceptableworkingconditions-arecharacterizedbythefollowinglevelsfactorsofproductionenvironmentandworkprocessthatdonotexceedestablishedhygienestandardsforworkplaces,andpossiblechangesfunctionalstateofthebodythatarerestoredduringtheregulatedperiod7restoratthebeginningofthenextshiftanddonotexerciseunfavorableimpactonthehealthofworkersandtheiroffspringinthenearandremoteperiods.

III-harmfulworkingconditions-characterizedbythepresenceofharmful productionfactorsthatexceedhygienicstandardsandarecapabletohaveanadverseeffectontheorganismofworkersoritsoffspring.

IV-dangerous(extreme)-characterizedbyworkingconditionssuchlevelsoffactorsoftheproductionenvironmen

tthathaveacontinuingimpactaworkshift(orpartofit)posesahighriskofsevereformsof acuteprofessionaldefeats,poisonings,injuries,threattolife.

IntheTable4.1harmfulanddengerousfactorsofproductionispresented.

Table4.1

Listofharmfulanddangerousfactorsofproduction

Nameoffactors	**Possiblesourcesoftheiroccurrence**	**Natureofaction**
Riskofelectricshock	Powersupply	Dangerous
Firehazardofpremises	Thepresenceofflammablematerialsandsourcesofignition(electricalequipment)	Dangerousandharmful
Electromagneticradiationincludingx-ray	Thedisplayisasourceof X-ray,radiofrequency,ultravioletandinfraredradiationandsoundrangeradiation	Harmful
Staticelectricity	Dielectricsurfaceofthescreen	Harmful
Airionization	StaticelectricityandX-rays	Harmful
Increasednoiselevel	Noiseisgeneratedbythecomputer'svoltageconverter,itstechnicalperiphery,andbypeopleintheaudience	Harmful
Badlighting	Insufficientartificialandnaturallighting	Harmful
Poormicroclimateparameters	Poorheatingandventilation	Harmful
Psychophysiological stresses	Monotonouswork,overstrainofvisualanalyzers,mentaltension,inconvenienceandstaticposes	Harmful

Analysis of hazardous and harmful factors

Thesortingstationisanenclosedspacewheregarbagecansarefedtothecontainer,manualsectionandsorted.

Lightingandfumehoodsmustbeprovidedateveryworkplaceofthewastesorter.Somejobsmayberedundantandusedintheeventofanincreaseinsortinglineproductivity.Thequalitycontrolofrecyclablesandthepresenceofcontaminantsiscarriedoutvisuallybytheemployeesinvolvedinsorting.

Theemployeeisexposedtothefollowingdangerousfactors:chemical,physicalandpsychological.

Chemical:

increasedlevelsofsulfurgas,ammonia,methaneintheworkareaandinthebreathingzo

ne;
effectsonthehumanbodyofhydrogensulfide,chlorobenzene,mercury,soot,dust.

Physical:
increaseddustinessofworkareaair;
emissionsofodorlesssubstancesonwastesortingandcompostinglines;
noisefromvehiclesandequipmentforshreddingwaste;
theinfluenceofthemagneticfieldinthesortingofmetalproducts;
lackoflightintheworkplace.

Psychological:
physicaloverload,staticanddynamicstress;
neuropsychiatricoverloadofvisualanalyzers;
neuro-emotionalovervoltage.

1.3Theexperimentalpartofthediplomarobotwascarriedoutinthemainlaboratory.Inthewholelaboratorythereisacombinationofillumination,naturalilluminationthroughtheilluminationofthebackdropof8m2,aslope,awickertree.Theilluminationofworkingdevicesinthecapacityof SNiPII.4.-79shouldbeconsideredtothecategoryofrobots1a,whenthefluorescentlampsarenotused,itisguiltytofold300lux.Laboratorysizes:dozhina=7m,width=6m,height=4m;backareavikon=9.12m2twoviknameasuring1.9×2.4m)Toadjustthetemperatureregimeintheaffectedarea,thesystemisscorched.Itisrepresentedby2radiobatteries,whicharec onnectedtothecentralsystemandburnedout.Inaddition,theelectrorecordinthelaboratoryis220/380V.Forthesecurityoftheelectricstream,thiscanbecarriedoutuntilthemomentwhenTheactualvaluesoftheparametersthatcharacterizethesanitary-hygienicmindsoftherobotsinthisprimitivebullyweretakenfromtheresultsoflookingatthework-relatedtasksonthebasisofthesanitarystandards.Forthetributetothemicroclimateintheprimacyofthepromisestotheestablishmentof Ukrainiannorms.Amongthepossiblereasonsfortheincidenceoffireinthecommunity,itispossibletosee:theviolationoftherulesoffiresafetyandtheinequalityoftheelectricalwiring.Thepieceofilluminationoftheorganizationduetothestorageofluminouslampsisthedemandof65Wwarehouses.Svite

lniki,whoroztasovaniiintheprimitive,butalsodirectlight.CompliantwithГОСТ17677-82adoptedinUkraine.Instructionsofoccupationalhealthandsafetyforlaboratoryassistant:

Personsover18yearsofagewithacompletedsecondaryprofessionaleducation,whohavepassedapreliminarymedicalexaminationandhavenocontraindications,whohaveundergoneintroductorytraininginlaborprotectionandfiresafety,initialtraininginthework placeareallowedtoworkindependently.Toworkwithelectromedicalproductsandelectricalappliances,theemployeemusthavethefirstelectricalsafetygroup.Eachyear,theemployeemustundergoamedicalexaminationintheamountandtimingapprovedbyorderofthedirector.Theemployeemustcomplywiththerulesofinternallaborregulations.Theemployeemustbeprovidedwithsanitaryandhygienicclothing,overallsandotherinaccordancewiththecurrentstandardstandardsandusethemfortheirintendedpurpose.Itisnecessarytoclearlyknowandfollowtheinstructionsonfiresafety.Itisforbiddentousedeviceswithopenheatingelements.Thevictimoreyewitnessoftheaccidentmustimmediatelynotifytheheadofeachaccident.laboratory.Incaseofdetectionoffaultyequipment(medical,plumbing,lighting,ventilation,etc.)orlackofpersonalprotectiveequipment,notifythehead.laboratoryorseniorhoney.sisterlaboratory.Itisnecessarytofollowtherulesofpersonalhygiene,sanitaryandanti-epidemicregime.Whenliftingandmovingtheweight,themaximumallowableloadforwomen-10kg,formen-50kg.Attheentrancetothelaboratory,employeesarerequiredtoleaveouterwear,bags,etc.personalbelongingsinthedesignatedplace.Putonthespecialnormsestablishedbycurrentnorms.clothesandcheckthepresenceandserviceability.Itisforbiddentostoreinpocketspins,glass,cutting,pricklyobjects.Makesurethattheventilationisworking,checkthelightingoftheworkplace.Supplyandexhaustventilationinallroomsofthelaboratorymustbeturnedonnolaterthan5minutesbeforethestartofwork.Beforeoperationofelectromedicalproductsandotherelectricequipment:

·Makesurethattheelectromedicalproductisacceptedforoperationwiththeparticipationofaleadingmedicaltechnician.

·Readtheoperatinginstructionsofthemanufacturer.

·Checkupserviceabilityoftheelectricequipment,plugsockets,switches,presenceofgrounding.Avoidusinglongcordsandnumerousadapters.

·Ifyoufindafaultinelectricalequipment,notifythehead.laboratory.Groundingandtroubleshootingoftheequipmentshouldbecarriedoutbytheexpert.

ConclusiontotheChapter4

So,inthischapterthenegativeinfluencepetrochemicalpollutioninapersonwasinvestigated.Theimpactofpetrochemicalmattersonahumanwasdetermined.Somemeasuresfornegativeimpactreducingofwastewereproposed.

CONCLUSIONS

1.Theanalysisofgroundwaterimportanceasastrategicreserveforwatersupplyofthepopulationof Ukraineandnecessityofeffectivecleaningtechnologywasperformed.

2.ThemainsourcesofgroundwaterpollutionbypetroleumproductsandtheamountofpollutionintheKievregionwasidentified.

3.Themethodsofresearchofwaterandsoilpurificationfrompetrochemicalpollution wasoffered.

4.Experimentalstudiesofthesorbent"Ecolan-M"intheeliminationofemergencyoilspillsandpetroleumproductswasconducted.

5.WaystosolvetheproblemofpetrochemicalpollutionofgroundwaterintheDnieperbasinontheexampleofKyivregionwasoffered.

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