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KNOWLEDGE MANAGEMENT OF WATER TREATMENT IN NUCLEAR AREA: THE BELARUSIAN STATE UNIVERSITY CASE STUDY

Prof Dzmitry Hrynshpan, Head of the Laboratory RIPCP

Prof. Tatsiana Savitskaya, Vice –Dean for Science, Faculty of Chemistry

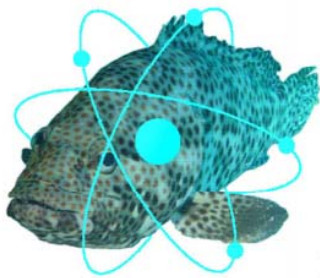
Dr. Iryna Kimlenka, Ass.professor, Faculty of Chemistry

14th CHERNE WORKSHOP, May-June, 29 -1, 2018



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Historical digression



CHERNE 2015

11th Workshop on European Collaboration for Higher
Education and Research in Nuclear Engineering and
Radiological Protection

1-5 June 2015 Belarusian State University, Minsk





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Forward to CHERNE's future



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The leading educational center in Belarus



Founded on
October 30, 1921

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- **32000** students, **8000** professors (teaching staff)
- **24** Faculties and Educational Institutions
- **Lyceum**
- **College**
- **3** Scientific-experimental Stations
- **4** Research Institutes
- **41** Research Laboratories
- **9** Scientific Centers
- **11** Unitary Enterprises
- **3** Museums





Water Knowledge background and level at BSU

- New solutions and great experience in natural and waste water treatment
- Compulsory course “Water Chemical Regime” in the curriculum for students of “High energy chemistry” specialty
- Intensive course “Water issues at NPP” in English for foreign students



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**We have counted 4 reasons
for CHERNE students to join
course “Water issues at NPP”**



Reason 1

The Unique Research and Educational Complex



Since 1931

Faculty of Chemistry

Since 1978

Research Institute
for Physical and
Chemical Problems



Face to face with Science





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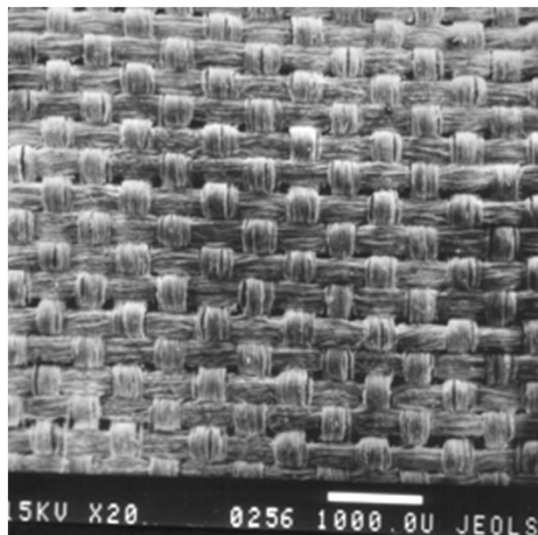
RIPCP achievements: **Film-fabric filtering materials**



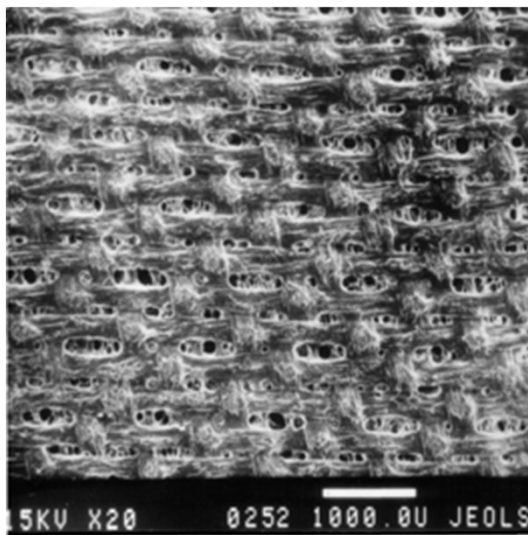
The materials possess high productivity and selectiveness. Designed to purify **water, milk, juices, syrups, drinks, wines, vodkas, liquors, perfume-cosmetic liquids, organic solvents, air and other media from mechanical impurities**



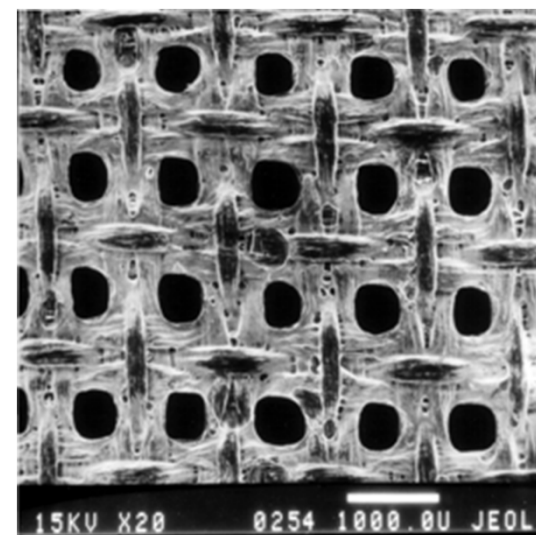
Filtering materials' structure



viscose



polyester



polyester



Filters with cartridges

ADVANTAGES:

- Large endurance
- Simplicity in maintenance
- Long-term service
- Regeneration
- Variety of use and installation



THE UNIQUE COMBINATION OF
the very high productivity (1–100 m³/h)
filtering capacity (1 – 10 μm)
extremely small sizes (90X120X800 mm)
multi-regeneration





**New possibilities for obtaining
drinking water from the polluted
sources in the emergencies**

**Individual
portable
kit IPK**

*for obtaining 10-100 dm³
of drinking water*

**Mobile
autonomous
water treatment unit
MAWTU**

*for obtaining 2500 dm³
of drinking water*



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Individual Portable Kit



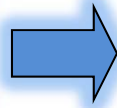
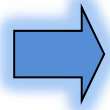
Size 200×150×25 mm
Weight , up to 100 g

Individual set for obtaining of drinking water from the polluted sources



- Disinfectant soluble tablets at the source of active chlorine
- Quick-dispersancy carbonic coagulant
- Portable multi-regenerating funnel-type filter
- Packaging

*Size 200×150×25 mm
Weight , up to 100 g*



Water treatment: At the exhibitions in Venezuela and Korea



Composite reagents and filtering materials for water treatment



Sorbent + coagulant + flocculant



Carbon coagulant



Coagulant + flocculant

Mobile water treatment unit





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Oil Spills Removal





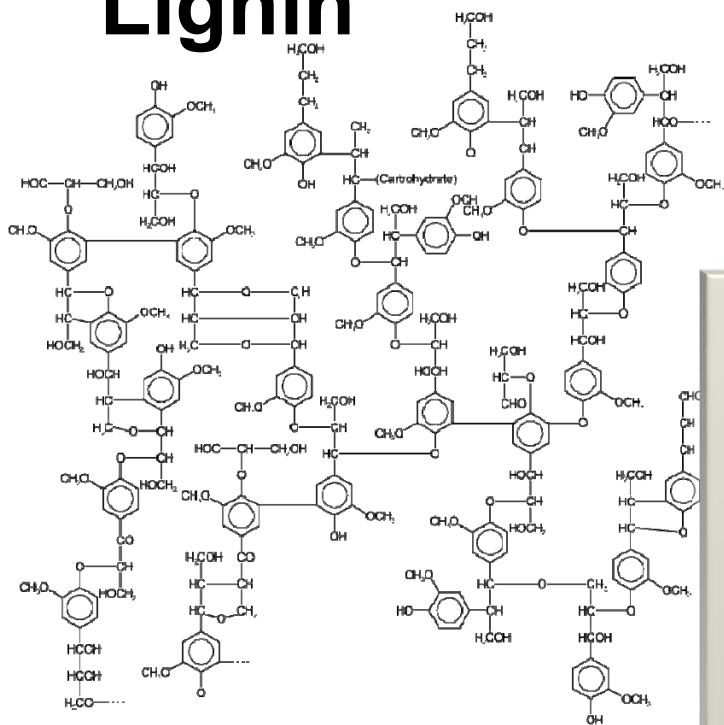
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Ecological problem:





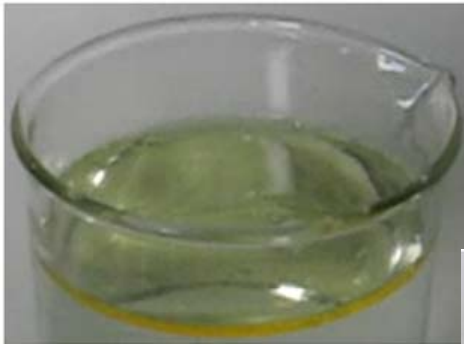
Lignin



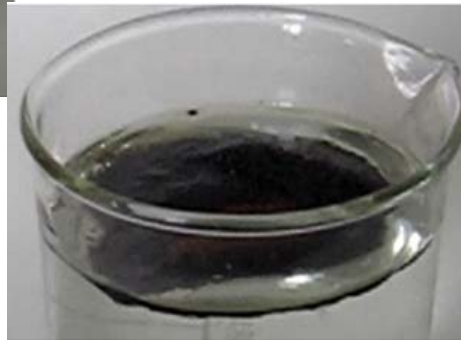
Lignosorb has rather high bulk density and can be applied for removal of the oil spills manually or mechanically with conventional sprayers .



Lignosorb transforms liquid oil into the solid product



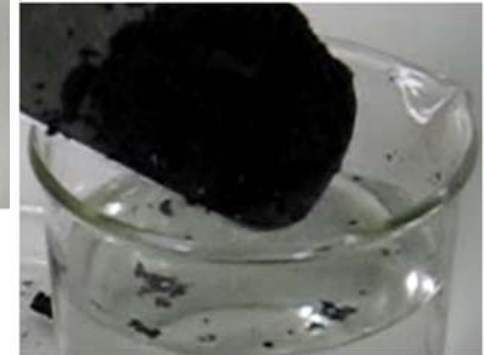
Oil product



Sorption of oil product by Lignosorb



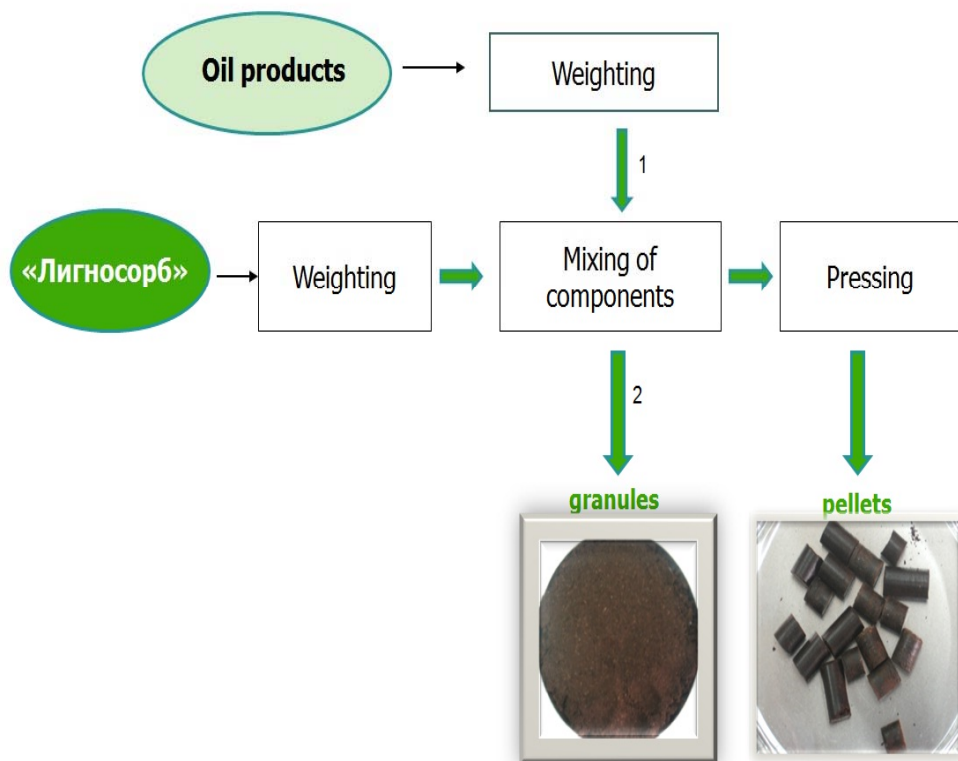
Solid product formation



Removing product from the surface



General Technological Scheme of the Process





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Oil Waste Utilization





Composite fuel higher calorific value

Sample	Higher calorific value, MJ/kg
Lignosorb+ crude oil	38.8
Lignosorb + diesel fuel	32.3
Lignosorb+industrial oil	32.1
Lignosorb	22.7
Brown coal	10.5
Black coal	20.9
Anthracite	26.8

2016 year

2000 tons of Lignosorb have been produced

Solid composite fuel pellets





Dry cleaning of tanks oil by **Lignosorb**



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Laundry waste water

SAS

Lemon acid

Oxalic acid

^{60}Co , ^{90}Sr , ^{54}Mn , $^{134,137}\text{Cs}$

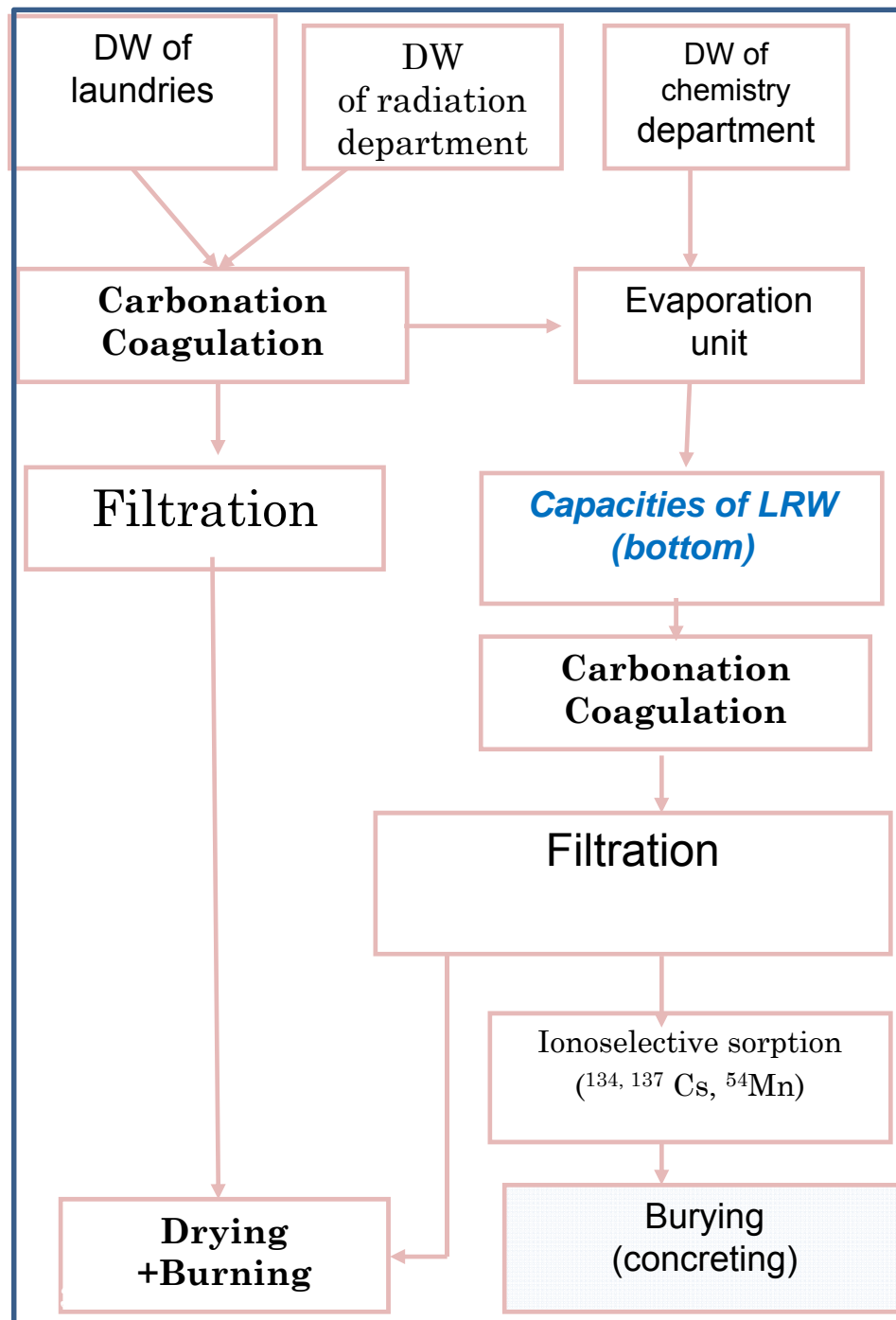
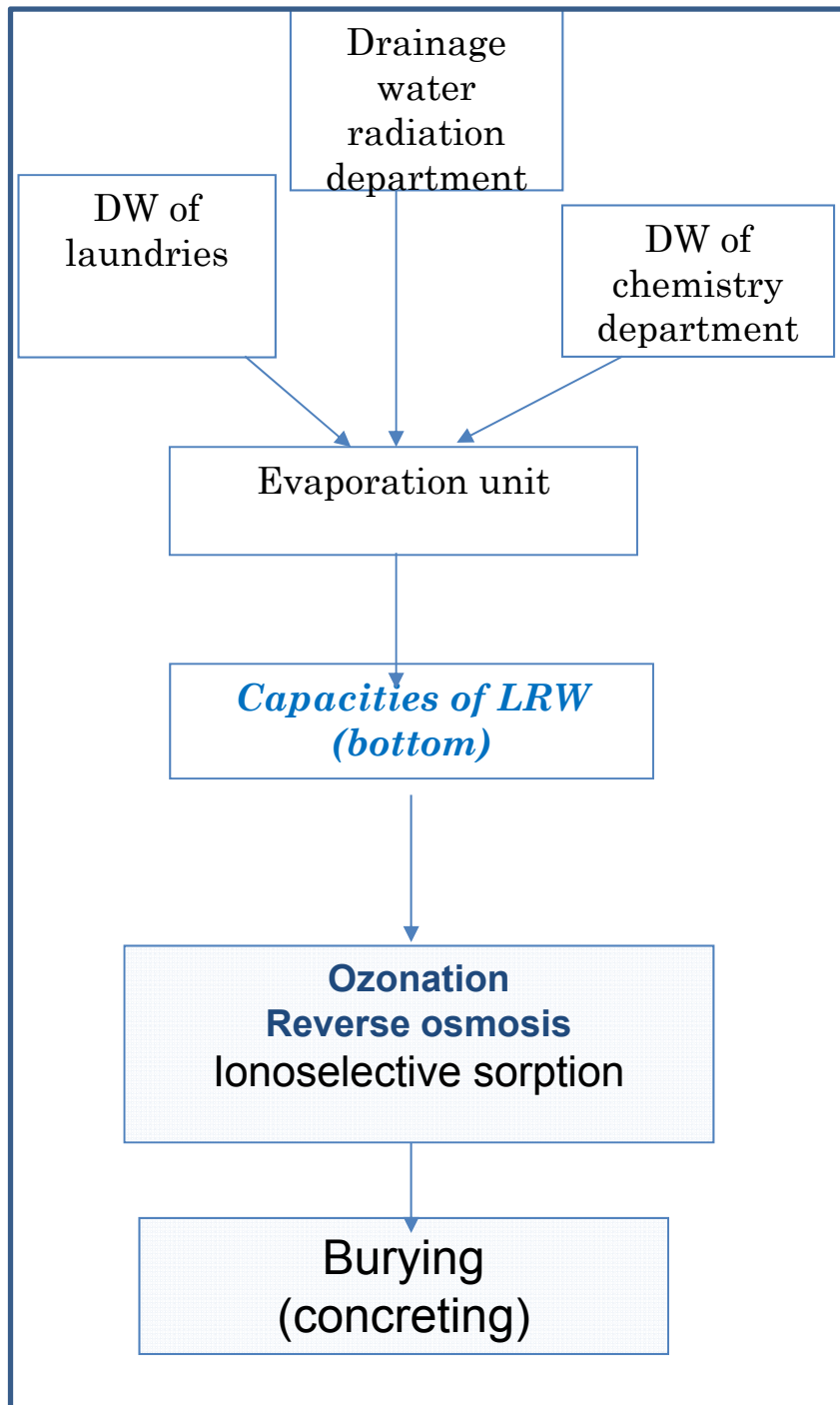
Complex ^{60}Co -EDTA

Weighted particles

Specific activity

$A \sim 3.7 \cdot 10^2 - 10^4 \text{ Bk/dm}^3$







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Reason 2:

Course “Water Chemical Regime”

Innovative teaching technologies

- **Cooperative learning**

POSITIVE INTERDEPENDENCE

INDIVIDUAL ACCOUNTABILITY

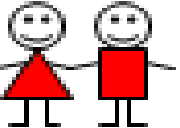
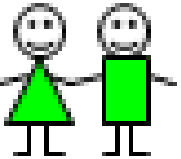
FACE-TO-FACE INTERACTION

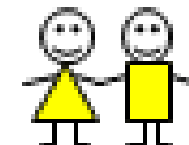
DEVELOPMENT OF INTERPERSONAL SKILLS

GROUP PROCESSING



Videolabs: MODELING OF NPP LAUNDRY WASTE WATER TREATMENT

- ***First couple:*** Water treatment by the adsorption – coagulation method including adsorption by the activated carbon, coagulation and filtration 
- ***Second couple:*** Water treatment by the adsorption –coagulation method including adsorption by the modified activated carbon, coagulation and filtration
- ***Third couple:*** Water treatment by the oxidati 
ion-exchange method



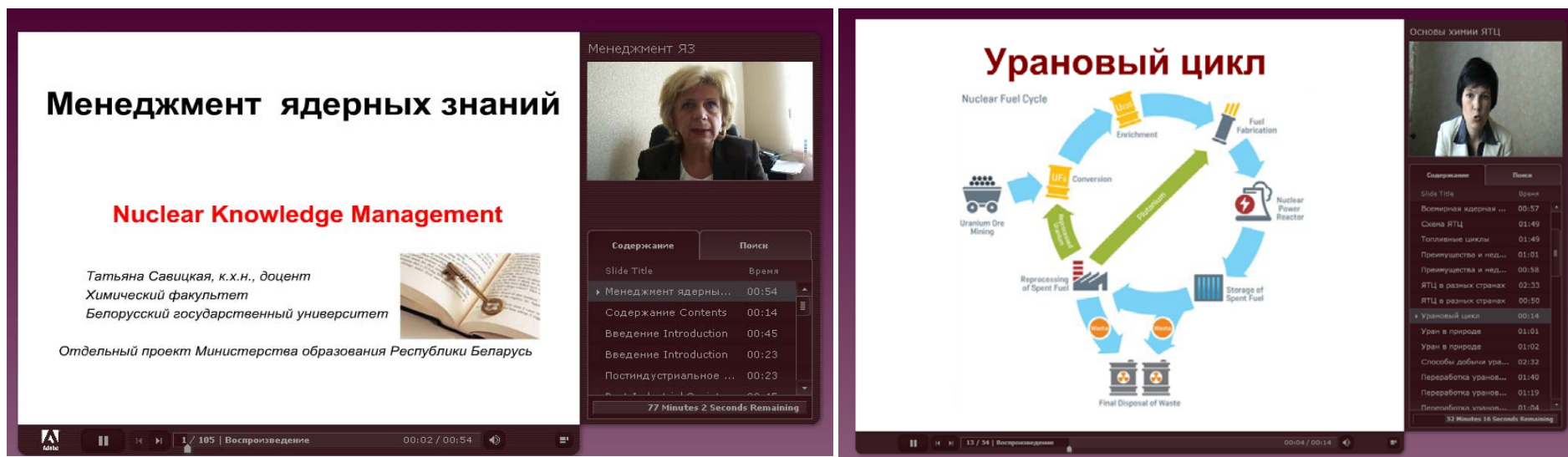
Innovative teaching technologies

Video methodological
support for labs



Innovative teaching technologies

- Lectures in podcasting



Менеджмент ядерных знаний

Nuclear Knowledge Management

Татьяна Савицкая, к.х.н., доцент
Химический факультет
Белорусский государственный университет

Отдельный проект Министерства образования Республики Беларусь

Менеджмент ЯЗ

Содержание	Время
Slide Title	Время
Менеджмент ядерны...	00:54
Содержание Contents	00:14
Введение Introduction	00:45
Введение Introduction	00:23
Постиндустриальное ...	00:23

77 Minutes 2 Seconds Remaining

Урановый цикл

Nuclear Fuel Cycle

Урановый цикл

Уран в природе

Уран в природе

Способы добычи ура...

Переработка уранов...

Переработка уранов...

Лицевалка уранов...

Содержание	Время
Slide Title	Время
Вспирная ядерная ...	00:57
Схема ЯТЦ	01:49
Топливные циклы	01:49
Преимущества и нед...	01:01
Преимущества и нед...	00:38
ЯТЦ в разных странах	02:33
ЯТЦ в разных странах	00:50
Урановый цикл	00:14
Уран в природе	01:01
Уран в природе	01:02
Способы добычи ура...	02:32
Переработка уранов...	01:40
Переработка уранов...	01:19
Лицевалка уранов...	01:04

32 Minutes 16 Seconds Remaining

Podcast = audio+video+multimedia presentation



Innovative teaching technologies

- **Virtual labs: Belarus – France (CEA)**



Reason 3: Intensive course “Water issues at NPP”

IC: Intensive course, at least 1 week/2 ECTS

Main objective: This course plans to give an overview of issues of the water chemistry support at operating NPP. The aim of this course is to introduce participants on water related safety issues at NPP. It attempts to provide basic knowledge on water pollution and treatment to students and give them hand experience of water treatment.

Short description: The course combines lectures, labs, extracurricular activity

CONTENTS

1. Water at NPP
2. Methods of waste water treatment
3. Measurement techniques and analysis of Chernobyl samples
4. Corrosion issues of NPP
5. Intercultural communication skills



Extracurricular activity

- Excursion to NPP under construction
- Excursion to the Water purification plant
- Excursion to the Water museum
- Training in different procedures of natural and wastewaters treatment



Prerequisites: basic knowledge in chemistry

Working method: 26-30 hours /1 week

The educational strategy of this course is active learning based on the principles of cooperative learning and peer-lead team learning (two Belarusian student as a tutor of international students in each team).

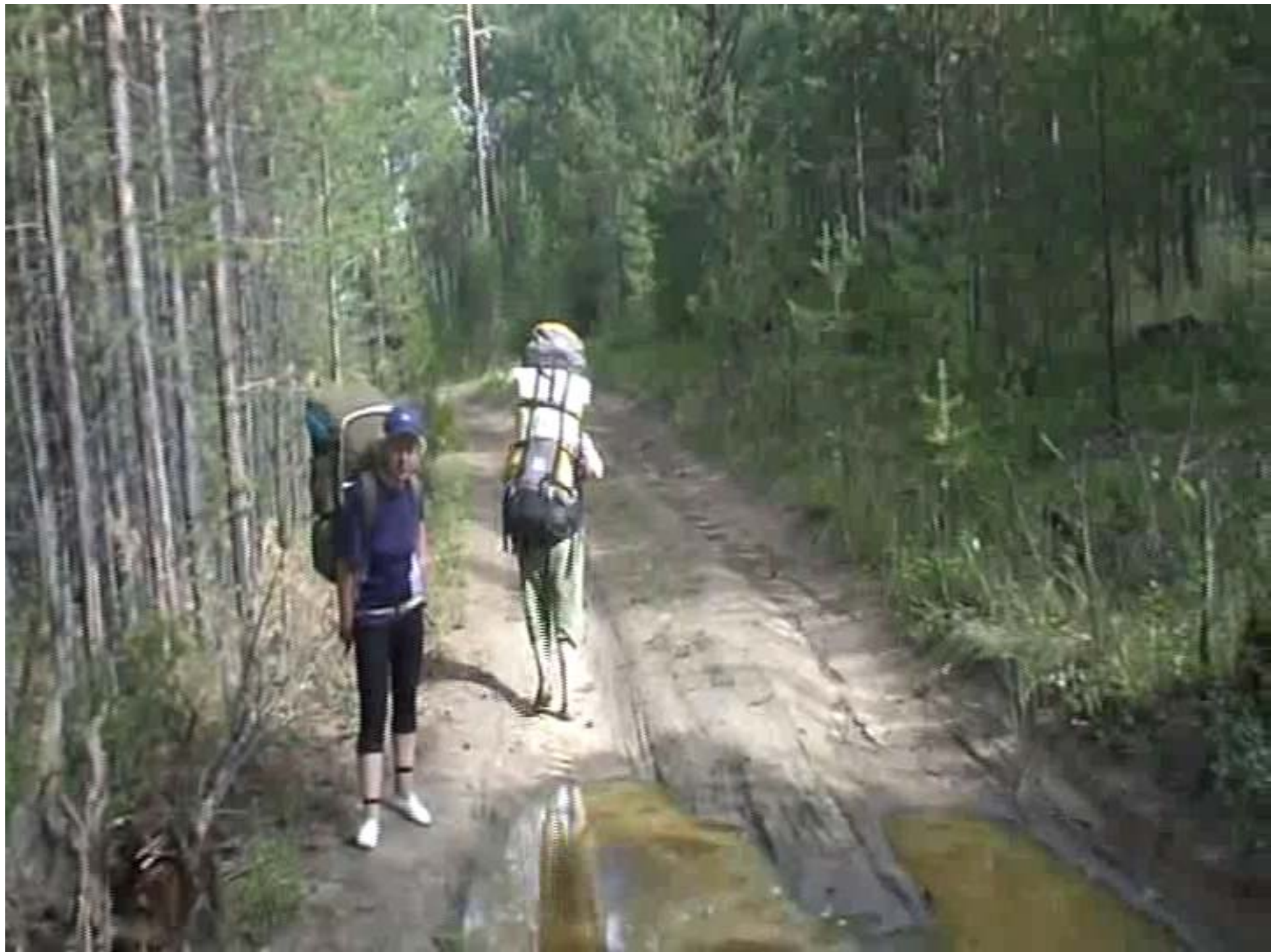
12 students

Expected learning outcomes: Different aspects of water chemistry are considered (e.g. technologies of waste water treatment, measurement techniques of model and real water samples, corrosion at NPP). 36 hours of laboratory are scheduled within the course. The participants realize measurements of real samples contaminated as a result of Chernobyl catastrophe, modeling of waste water treatment.



Training in different procedures of natural and wastewaters treatment









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Reason 4: Minsk is beautiful city!

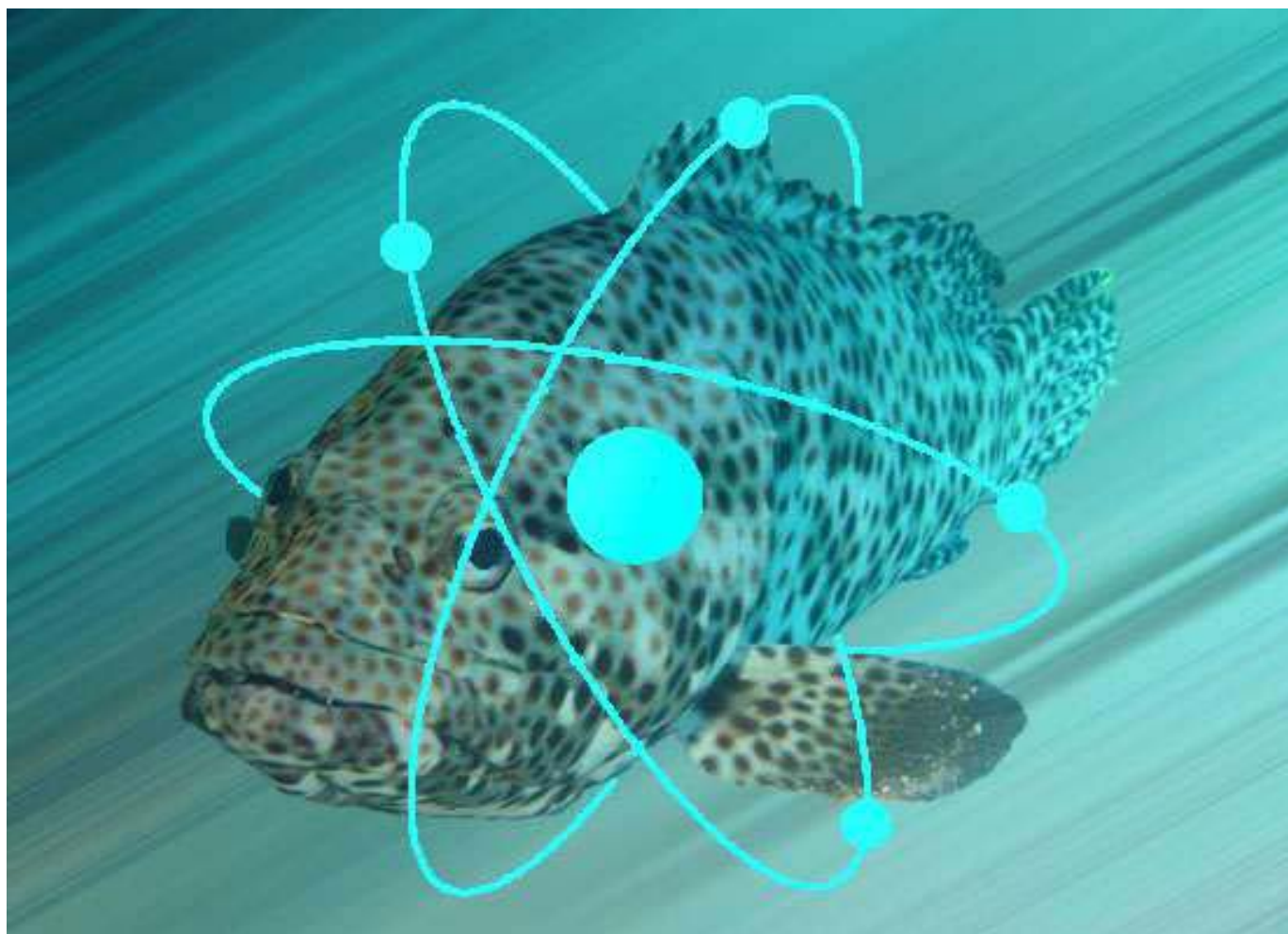


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**THANK YOU
FOR YOUR ATTENTION**