Radioactive Waste Characterization in Ukraine

Yuliya Balashevska

SSE Ecocenter

Chernobyl, Ukraine

ДСП «ЕКОЦЕНТР»

Life's Little
Instruction Book

511 suggestions, observations, and reminders
on how to live a happy and rewarding life

Remember that the more you know,
the less you fear.

— H. Jackson Brown —

AZ QUOTES

CONTENT

- Waste Characterization: a waste of time and money?

- How we do characterization in Ukraine

- Examples of past work

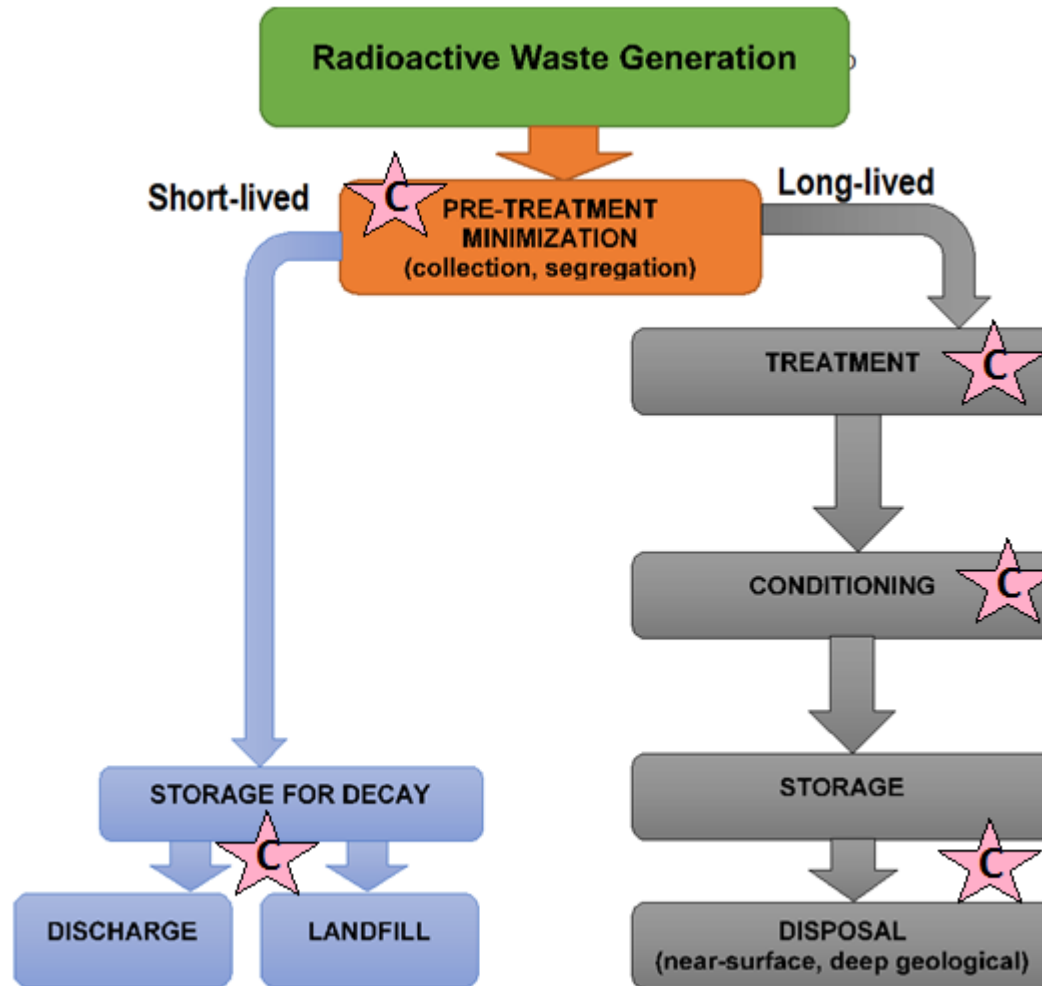ДСП «ЕКОЦЕНТР»

Waste Characterization
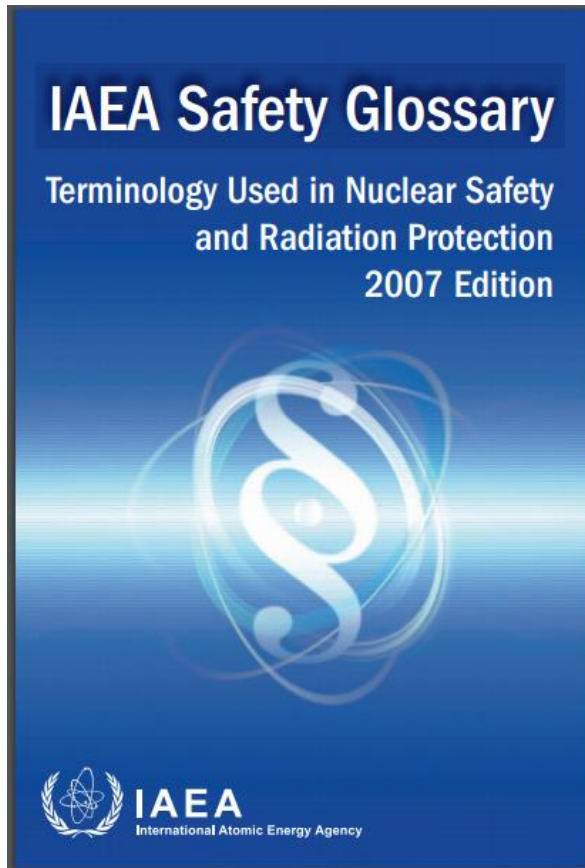
waste characterization

Determination of the physical, chemical and radiological properties of the waste

to establish the need for further adjustment, treatment or conditioning, or its suitability for further handling, processing, storage or disposal.

RAW: Cradle-to-Grave

Steps for **managing radioactive wastes** (IAEA, 2001).

Waste Characterization

Advantages

- Safety assurance
- Quality end product
- RAW Inventory and classification
- Conservatism reduction
- Decision making

Disadvantages

- Cost
- Difficulties obtaining a representative sample
- Lack of qualified personnel

ДСП «ЕКОЦЕНТР»

What happens when there is no proper characterization

Ukraine (before 2015)

I can't think about that right now. If I do, I'll go crazy. I'll think about that tomorrow.

— *Margaret Mitchell* —

Results of such policy:

- Accumulation of RAW at nuclear facilities;

- «historical» RAW;

- Difficulties in RAW treatment and conditioning

Ukraine (2013)				View: Expand All
Waste Class	**Storage Unprocessed (m3)**	**Storage Processed (m3)**	**Disposal Unprocessed (m3)**	**Disposal Processed (m3)**
▶ HLW*	870.0	0.0	3,960.0	0.0
▶ ILW*	11,216.5	56.9	6,918.9	0.0
▶ LLW*	1,110,430.4	5,637.4	684,969.6	2.0

ДСП «ЕКОЦЕНТР»

Ukraine (before 2015)

RAW Characteristic	Initial Information
Amount of RAW, cub. m	1100
Total activity, Bq	Approx. 0.02 TBq
Radionuclide composition	? Presumably, Cs-137, Co-60 and some other
Waste stream(s) (Origin)	? Presumably RAW from NPP operation RAW from Chernobyl accident - possible
Other characteristics	A mixture of radioactively contaminated pipes, termal insulators, construction materials, spent ion exchange resins; paper, sand, work clothes, electric motors, chip scrap etc. accumulated between 1978 and 2003

ДСП «ЕКОЦЕНТР»

Belgoprocess

http://www.belgoprocess.be/

- Treatment and conditioning of all types of radioactive waste
- Temporary storage of conditioned Belgian radioactive waste
- Dismantling of obsolete nuclear installations
- UF6 cylinder washing and recertification
- Plasma thermal technologies

Spring 2013:

- formation of gel in drums with conditioned radioactive waste related to alkali-silica reaction

- Corrosion and degradation of packages (thousands!)

- Problem unsolved as of November 2016

Waste Characterization Criteria

Radiological criteria (7)

Chemical criteria (14)

Physical and thermal criteria (7)

"All tests point to the same conclusion: it is indeed a big banana."

Waste Characterization Criteria

Variable

Complex & Variable

Simple & Variable

Characterization for decision making and safety assurance

Reseach & Characterization Laboratories

Waste from accidents and decommissioning; historical waste

Full-scale characterization for decision making

Simple

Complex

Simple & Stable

Complex & Stable

Characterization for safety and quality assurance

Waste from NPPs; Waste from conditioning facilities (end-product)

Waste from SNF reprocessing; Retrieved waste

Characterization for decision making; characterization as an expertize

Stable

ДСП «ЕКОЦЕНТР»
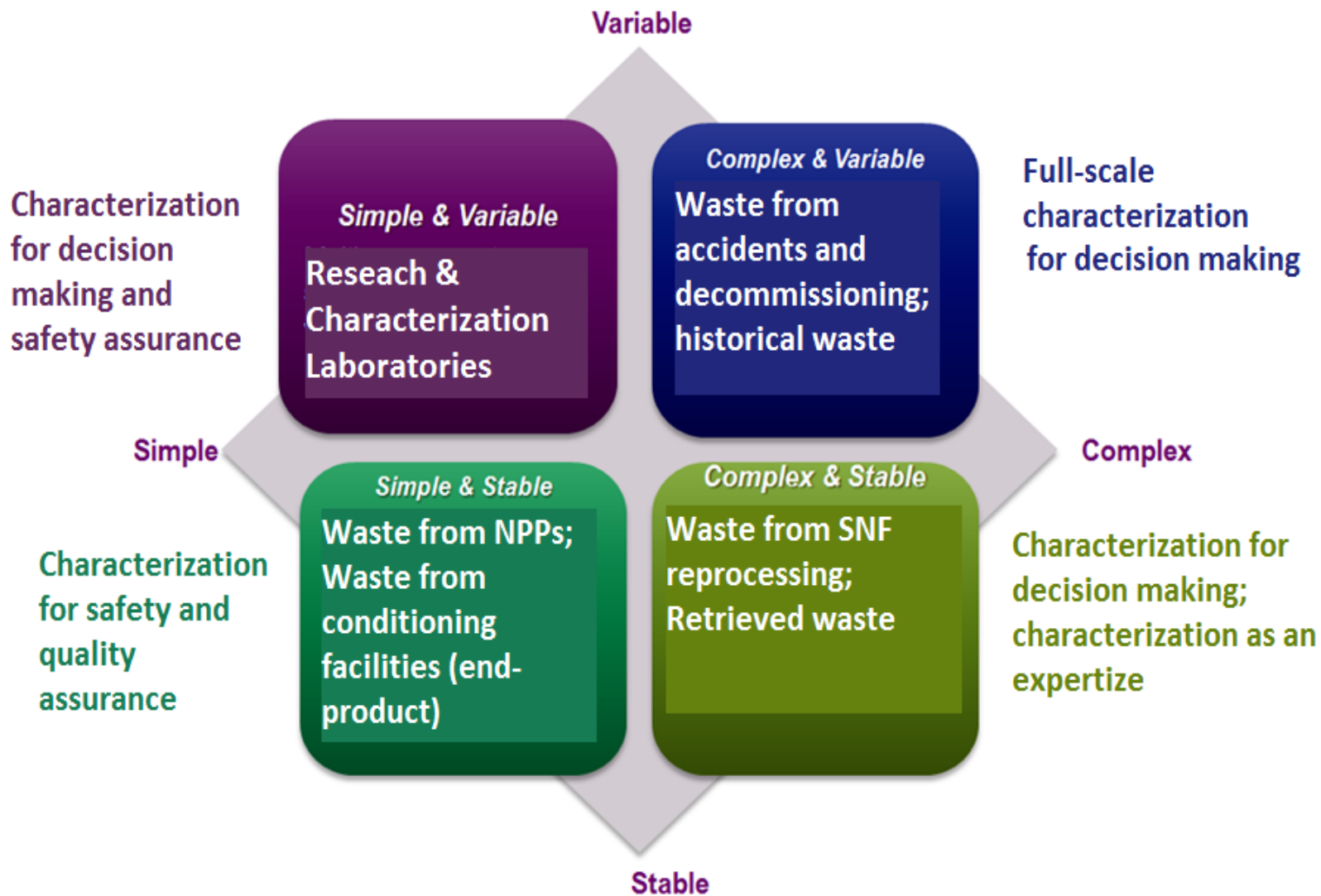
How we do waste characterization in Ukraine (since 2015)

Central Analytical Laboratory: An independent expert

- EuropeAid project "Improvement of the Infrastructure for the Radioactive Waste Management in the Chornobyl Exclusion Zone. Phase II" in 2015

- Initial purpose: characterization for the re-classification of RAW
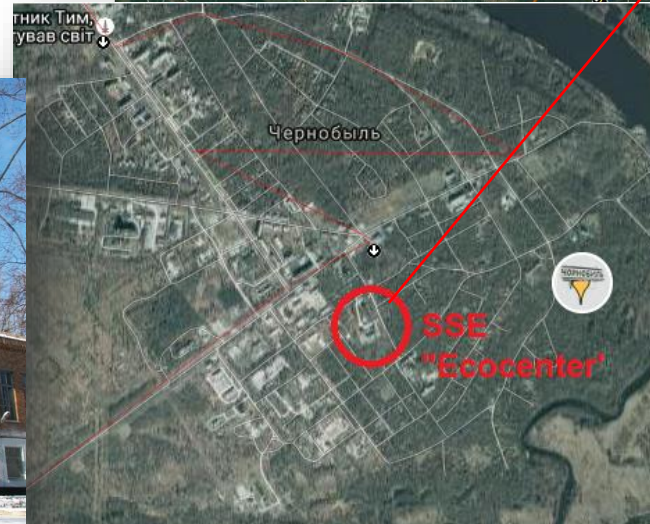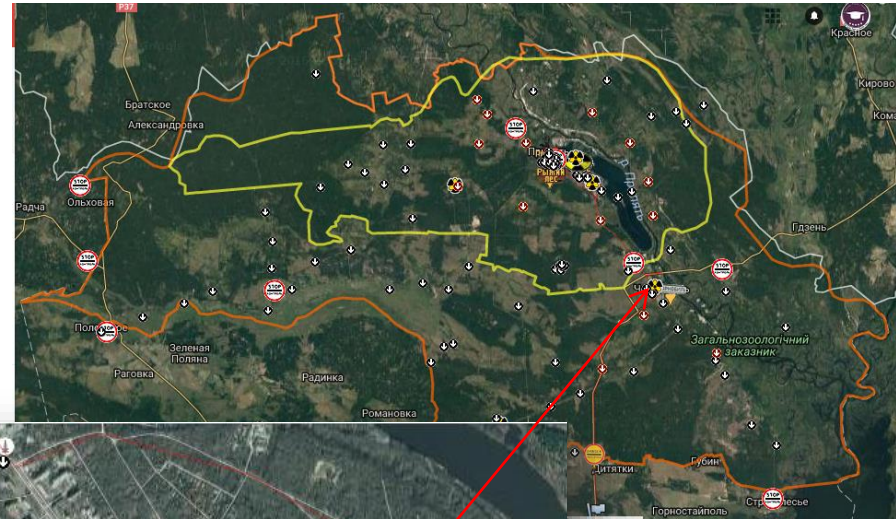
Central Analytical Laboratory: An independent expert

Functions of CAL:

- **Physical, chemical & radiological characterization of RAW;**

- **Measurements of environmental samples from EZ within the framework of the Schedule for Radiation Monitoring;**

- Verification of RAW packages prior to disposal;

- Development of methodologies for characterization;

- Training.

Central Analytical Laboratory:
An independent expert

Status of CAL:

Independent laboratory for RAW characterization, radiation measurements for environmental monitoring of EZ, and expert evaluation of radiological, physical and chemical properties of RAW and radioactively contaminated materials.

Major objective:

Protection of future generations.

Analytical capacities

Full capacity to perform physical, chemical and radiological characterization of RAW and environmental samples

- Radionuclide composition and activity;

- Surface contamination;

- Homogeneity of RN;

- Chemical composition and compatibility;

- RN leaching;

- Corrosion resistance;

- Free water content;

- Fire resistance;

- Mechanical strength;
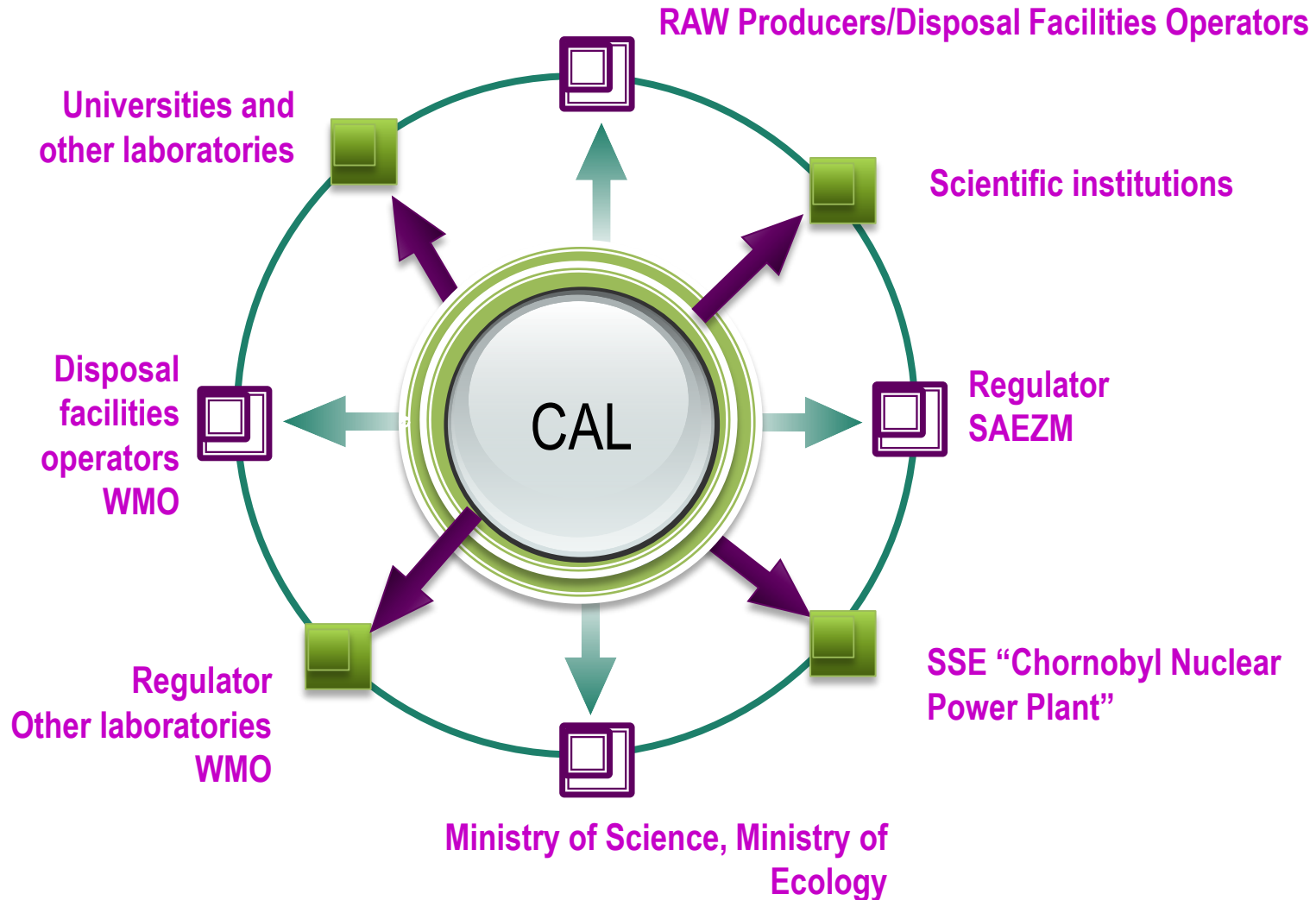
- thermal stability etc.

Analytical capacities

Pie chart values:
- 1890 (Air filters)
- 1000 (Fallouts)
- 400 (Vegetation)
- 3000 (Other including RAW)
- 2950 (Soil)
- 1100 (Groundwater)
- 1630 (Surface water)
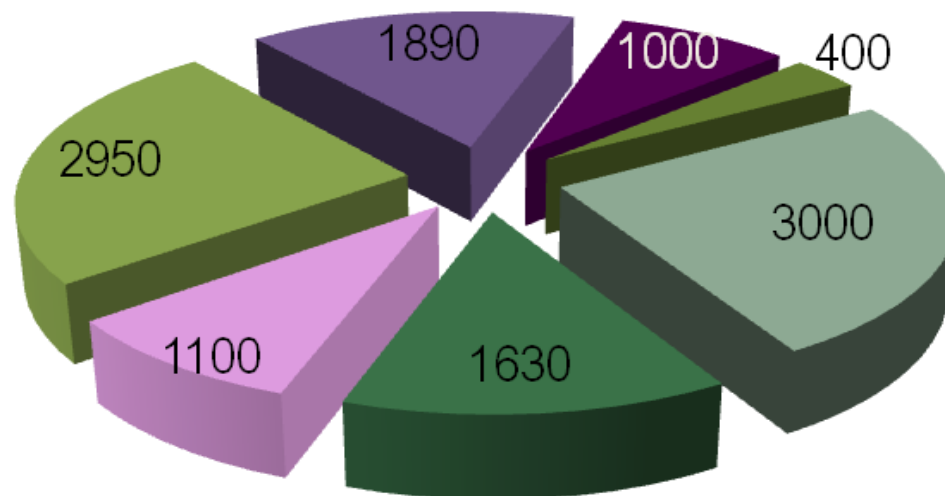
Legend:
- Surface water
- Groundwater
- Soil
- Air filters
- Fallouts
- Vegetation
- Other (including RAW)

Existing and potential stakeholders

RAW Producers/Disposal Facilities Operators

Universities and other laboratories

Scientific institutions

Disposal facilities operators WMO

CAL

Regulator SAEZM

Regulator Other laboratories WMO

SSE "Chornobyl Nuclear Power Plant"

Ministry of Science, Ministry of Ecology

ДСП «ЕКОЦЕНТР»

Waste characterization procedure

STEP 1

Preparation

- Requesting initial information from the waste supplier;

- Choosing/development of a program for characterization;

- Choosing methodology (including sampling);

- Modelling (if necessary);

- Preparation of tools, protective equipment, reagents etc.

ДСП «ЕКОЦЕНТР»

Waste characterization procedure

STEP 2

Sampling

- One of the most difficult stages;

- Done either by Ecocenter or by the waste owner;

- Specific requirements to samples;

- Sampling can change the course of characterization.

Representative sampling = 50% of successful characterization

Waste characterization procedure

STEP 3

Sample preparation

- Differs from the preparation of environmental samples for monitoring;

- Risk of cross-contamination
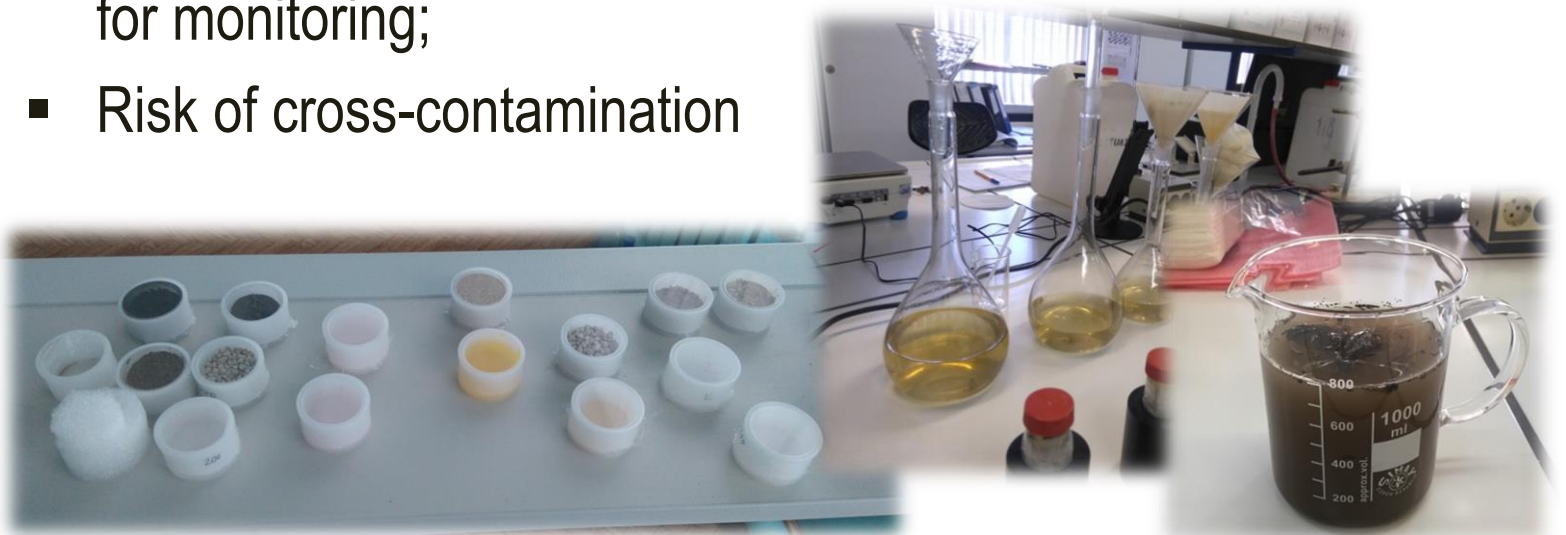
Accurate sample preparation = another 40% of successful characterization

ДСП «ЕКОЦЕНТР»

Waste characterization procedure

STEP 4

Measurements

- Radiation, physical, chemical properties;
- Always parallel measurements (vs single measurement for monitoring);
- Measurement on-site/during sampling – always preferable

Measurement =instrument + operator + consumables + procedure

Most expensive & least determiative stage

Wrong sampling/sample preparation – measurements don't make sense

ДСП «ЕКОЦЕНТР»

Waste characterization procedure

STEP 5

Data analysis and reporting

- Calculations taking into account sampling and sample preparation;

- Filling in the standard protocol (+detailed report on demand);

- Indicate permissible levels/concentrations, results obtained by other laboratories, reference data etc.

Be careful with providing recommentadions!!!

Waste characterization procedure

STEP 6

Handling the sample residue and secondary waste

- All the remains and leftovers are removed from the Lab ONLY after the report is accepted by the Customer;

- Decontaminate if possible;

- Disposal/Return if decontamination is impossible.
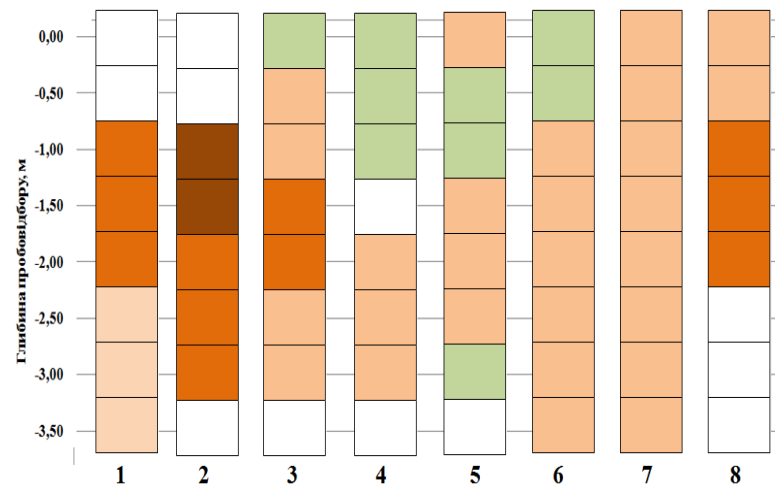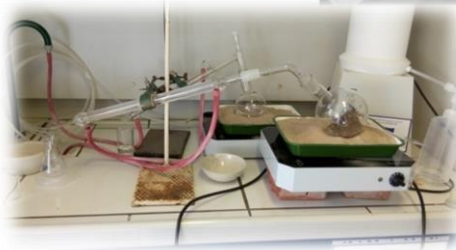
Examples of past work

Tritium measurements in soil moisture under radiation accident conditions

Radiological and physical measurements in borehole soil from RAW disposal facility

Measuring moisture content
CEM GmbH, Smart Turbo

Examples of past work

Independent radiological and chemical measurements of contaminated scrap metal – expert measurements

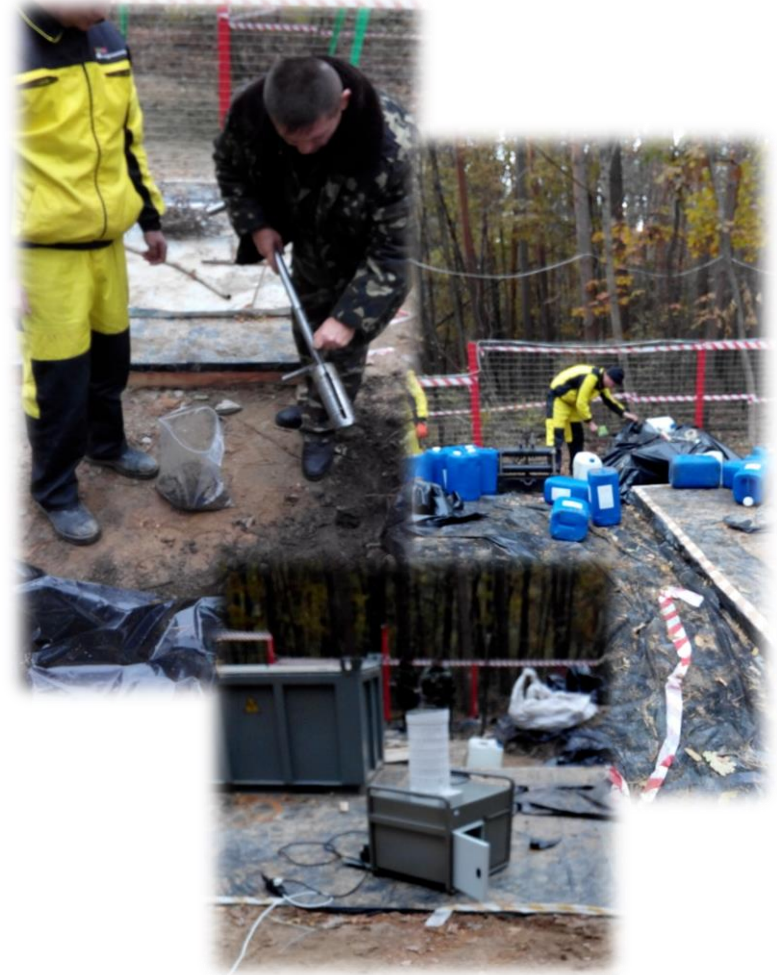Assistance to State Border Guard
Service of Ukraine

Examples of past work

Characterization of RAW from Soviet Army military activities

- Site characterization;

- 25 samples characterized;

- Over 10 reports made

ДСП «ЕКОЦЕНТР»

Expertise as a crucial resource

Summer School on Waste Characterization & REM

- ChEZ as a laboratory under the open sky;
- Opportunty to improve master thesis by consultations with experts;
- Working with real samples;
- Planning further research

ДСП «ЕКОЦЕНТР»

Conclusions

- Waste characterization fosters waste management culture, without which no National WM program will work.

- Every dollar invested in characterization saves hundreds of dollars at the later stages of RWM.

- Comprehensive training, sharing good practices and joint research make characterization possible even in the most difficult cases.

ДСП «ЕКОЦЕНТР»

Thank you for your attention! Questions?

ДСП «ЕКОЦЕНТР»