# PREPARATION OF LICENSING DOCUMENTATION FOR A RADIOACTIVE WASTE DISPOSAL FACILITY IN IRAQ

javys
jadrová
a vyraďovacia
spoločnosť, a.s.

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# INITIAL CONDITIONS

- **Iraq**
  - Significant nuclear program in the past
  - Bombing in 1991 – damage and also looting at the nuclear sites (10 in total), in particular at **Al-Tuwaita site**, (18 nuclear facilities)
  - **Iraq Decommissioning Project** (2004) support by US State Department, coordinated by IAEA – to assist in
    - ❖ planning for and decommissioning,
    - ❖ RAW management,
    - ❖ remediation of contaminated sites,
    - ❖ drafting the relevant legal and regulatory framework

# INITIAL CONDITIONS

- **Al-Tuwaitha site – overview of nuclear installations**
  - **Research reactors** (French Osiraq-2, IRT-5000 – Russian design)
  - **Radiochemistry laboratory** (extraction of radionuclides and reprocessing the irradiated fuel to extract plutonium for research purposes)
  - **Active Metallurgy Testing Laboratory** – decommissioned in 2010
  - **Italian isotope production facility**
  - **Fuel Fabrication** and **Uranium Purification** Facilities
  - **RAW treatment and storage facilities**

# INITIAL CONDITIONS

- **Al-Tuwaitha site – general**
  - **Largest** nuclear site in Iraq (1967), provided by France, Italy and the former USSR
  - Destroyed in 1991, some parts looted in 2003 – **documentation** of the facilities – **lost or destroyed**, many **orphan sources** could be recovered
  - Location – 14 km south of Baghdad center

# INITIAL CONDITIONS

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# PROJECT SCOPE

- Feasibility study, basic design and engineering design of an engineered radioactive waste disposal facility IQ4.01/11 (EuropeAid/135599/DH/SER/IQ)
- **Financed by European Commission (1 740 800 €**)
- **Beneficiary** – Ministry of Science and Technology of Iraq (MoST)
  - Operator of the nuclear facilities in Iraq
- **Duration of project** – from 27. 04. 2015 to 30. 06. 2019

# PROJECT SCOPE

- **Goals of the project**
  - Provide basic (conceptual) and enginnering design
  - Develop and demonstrate the repository safety (SAR)
  - Derivation of activity WAC
  - Construction licensing documentation additional to design and SAR

10 tasks

**Approval** by beneficiary (MoST) and Iraqi regulatory body

Base for the **next project** documentation

**Further executing design** for construction phase

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# INTRODUCTION OF CONSORTIUM

**NUKEM Technologies Engineering Services GmbH**

- Leader of the Consortium
- Predecessor company founded in 1960
- Globally active in RAW management, decommissioning of nuclear facilities and engineering
- Current and former members of project team: Enrique Biurrun, Hagen Jung, Anke Traichel, Uwe Freiberg, Sandra Völk

# INTRODUCTION OF CONSORTIUM

## BGE Technology GmbH

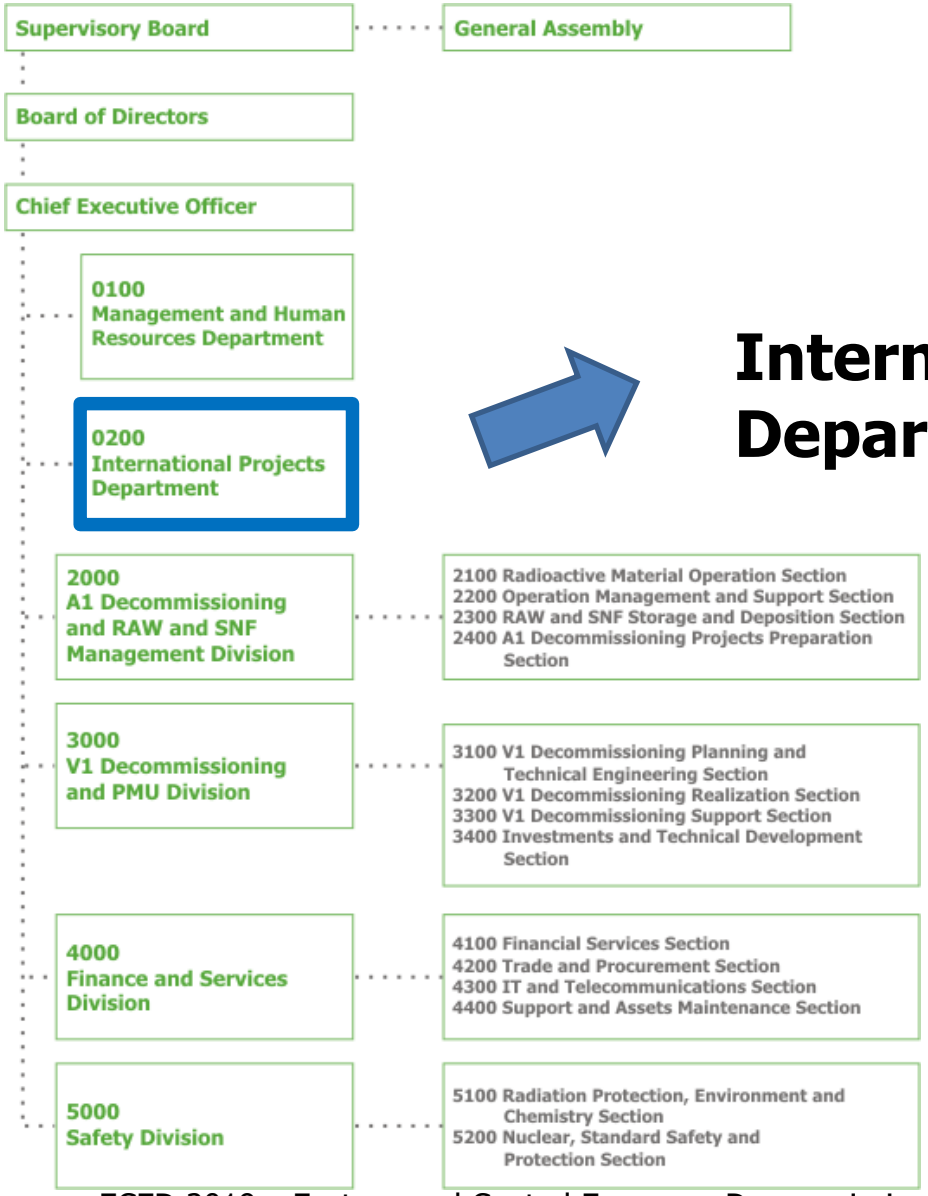
- Member of the Consortium
- More than 40 years experience in the final disposal
- Responsible for implementing the **site selection procedure** for repository sites, **operator** of German repositories, **development** of Bulgarian National Disposal Facility
- Members of project team: Bernt Haverkamp, G. Nieder-Westermann, R. Gasull, Thilo von Berlepsch

# INTRODUCTION OF CONSORTIUM

## Jadrova a vyradovacia spolocnost, a.s.

- Member of the Consortium
- More than 30 years experience
- Responsible for
  - Decommissioning of NPPs,
  - Treatment and conditioning of RAW,
  - Final disposal – NRWR in Mochovce
- **Members of project team**: Peter Salzer, Martin Hornacek, Jozef Smugala, Roman Strazovec, Peter Gerhart, Ondrej Uhrik

# INTRODUCTION OF CONSORTIUM




**International Projects Department**

javys jadrová a vyraďovacia spoločnosť, a.s.

## International Projects Department

- **Established in 2014**
- **Responsibilities**
  - Business development
  - Project implementation
- **Total staff – 10 employees**

**Since 2014** – 8 large scale international projects + others (studies, workshops)

**total 38 M€**

# INTRODUCTION OF CONSORTIUM

## MCM Environmental Services Ltd

- **Support** of the Consortium – sub-contractor of NUKEM
- **Portfolio**: Environmental Safety, Siting and Geoscience, Programme Management, Integrated Waste Management, Conceptual Design, Technical Feasibility Assessment
- **Members** of project team: Neil Chapman, Alastair Clark, Wolfgang Kickmayer

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# PROJECT TASKS

- 10 tasks
  - Task 1 Project preparation and management of project implementation
  - Task 2 Review and integration of the inventory of LILW
  - Task 3 Definition of design criteria and standards
  - Task 4 Site characterization
  - Task 5 Development of conceptual design
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# PROJECT TASKS

- **Task 1 Project preparation and management of project implementation**
  - Establishment of the Project team
  - Organization of meetings
- **Task 2 Review and integration of the inventory of LILW**
  - Collection and update of input data
  - Lack of sufficient information (probably lost documentation, ongoing investigations/determination)

**High uncertainty** – assumptions based on expert knowledge and international experience – **preliminary** estimate of RAW inventory

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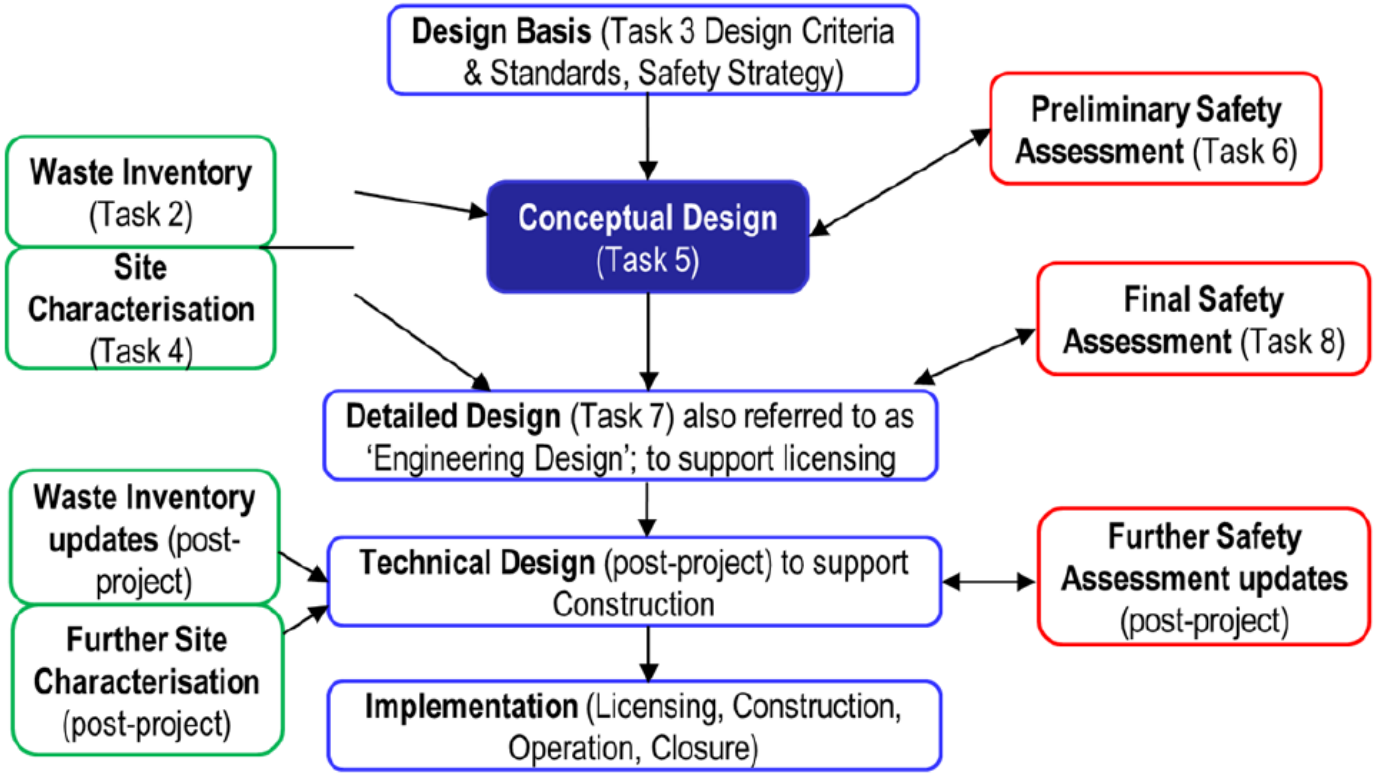
# PROJECT TASKS

- **Task 3 Definition of design criteria and standards**
  - **Cooperation JAVYS-BGE**
  - **Analysis** of the applicability of the Iraqi legislation – documents in various stages (drafts)
  - **Comparison** of national legislative and regulatory framework with applicable international standards (e.g. IAEA recommendations, outputs of PRISM Project)
  - **Specific boundary conditions** – on-site disposal as a part of remediation activitites

Aspects not covered by Iraqi legislation – international regulations and practice (EU, IAEA, WENRA, ICRP)

# PROJECT TASKS

- **Task 3 Definition of design criteria and standards**
  - Design process according to IAEA Technical Document 1256 „Technical considerations in the design of near-surface disposal facilities for radioactive waste“



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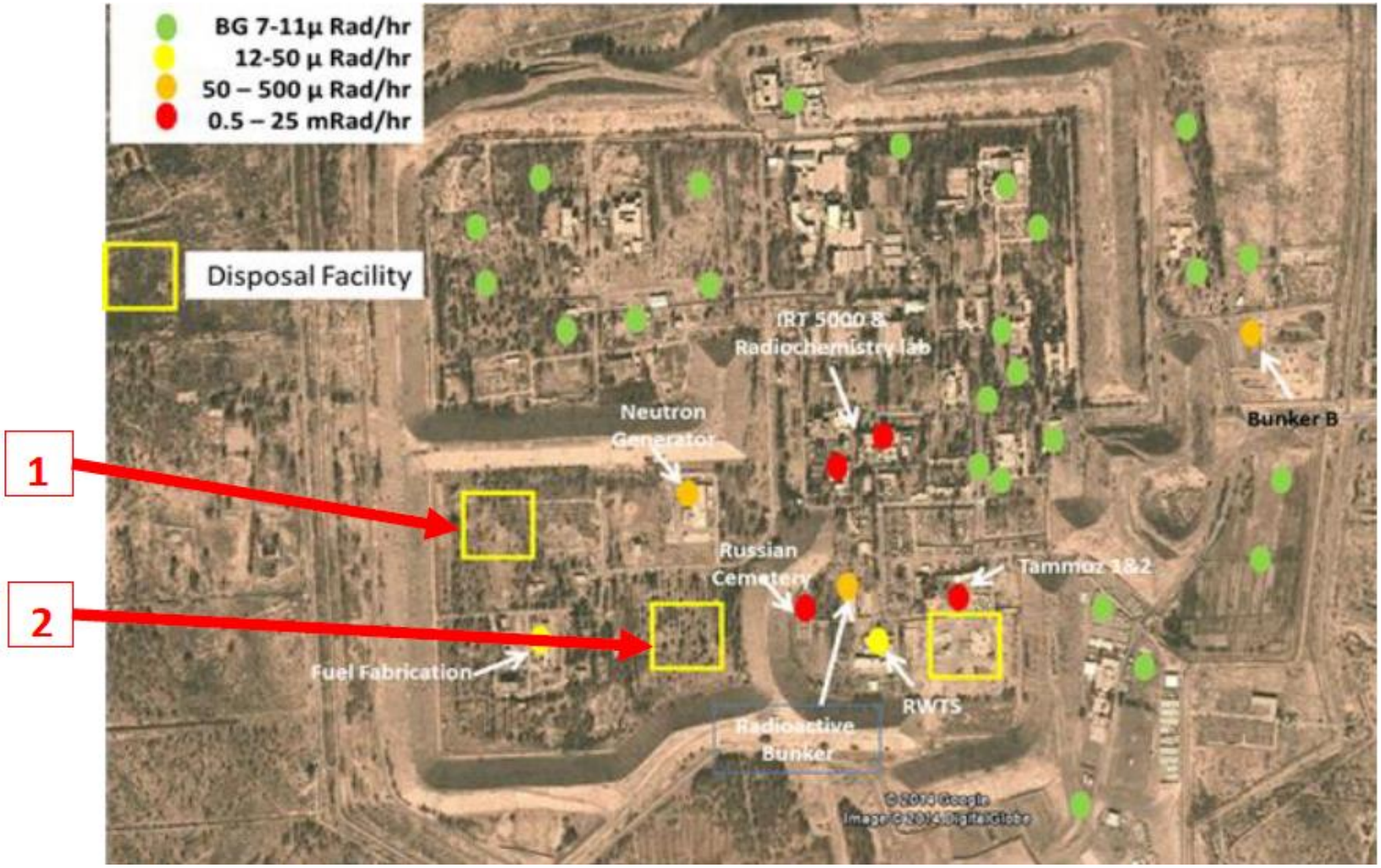
# PROJECT TASKS

- **Task 4 Site characterization – subsequent subtasks**
  - 4.1 Preliminary Assessment of site characteristics based on existing data
  - 4.2 Site characterization program requirements
  - 4.3 Field investigation options
  - 4.4 Data interpretation, site confirmation of the proposed site within a final report

  - **Extensive review** of available documents (e.g. hydrogeology, agriculture, earthquakes)
  - **Lack of input data** – further investigations from Iraqi side – to perform a comprehensive (regional etc.) investigation (and monitoring) program (in-situ non-invasive and invasive)

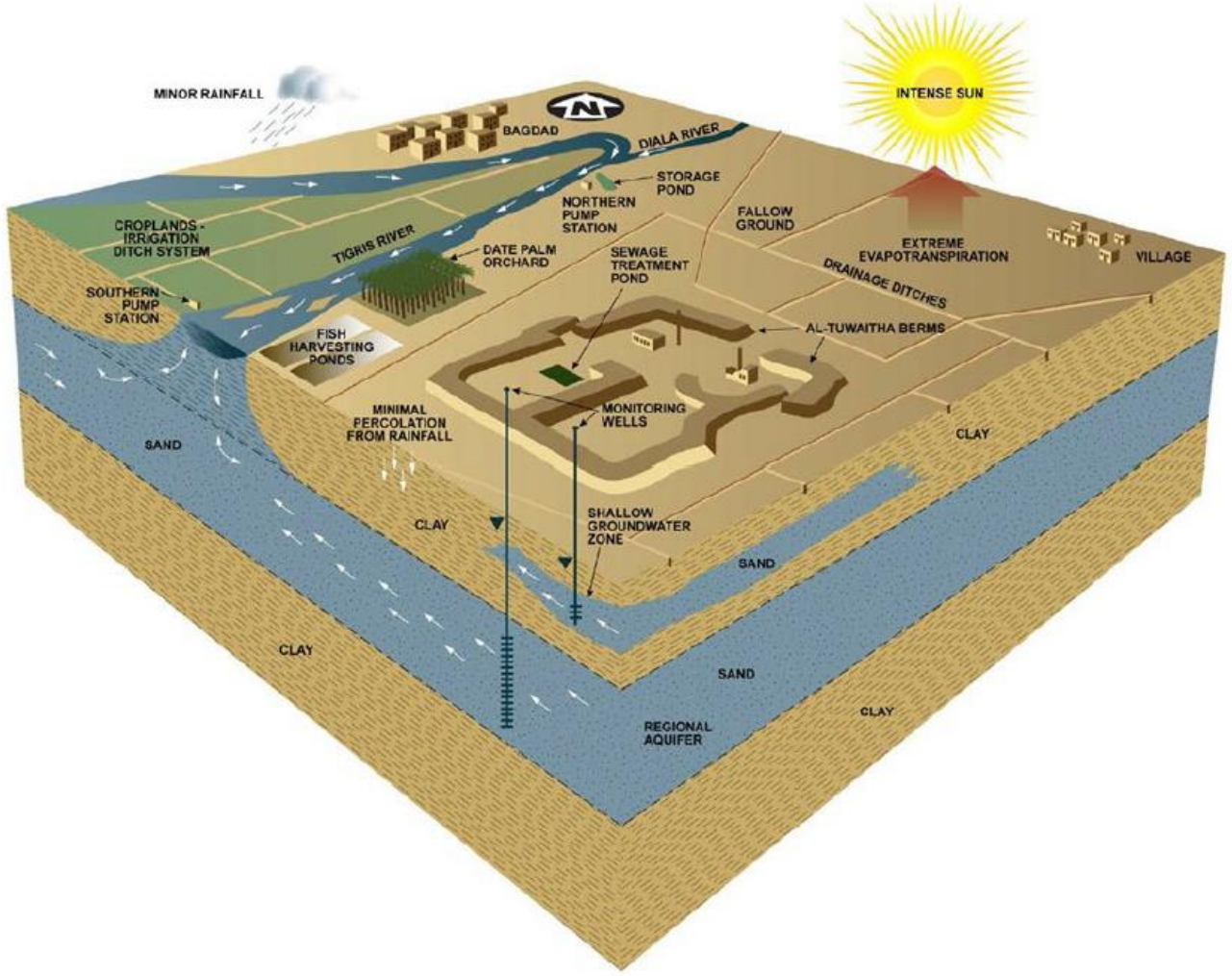
# PROJECT TASKS

- **Task 4 Site characterization – possible locations for disposal**



# PROJECT TASKS

- **Task 4 Idealized conceptual site model**



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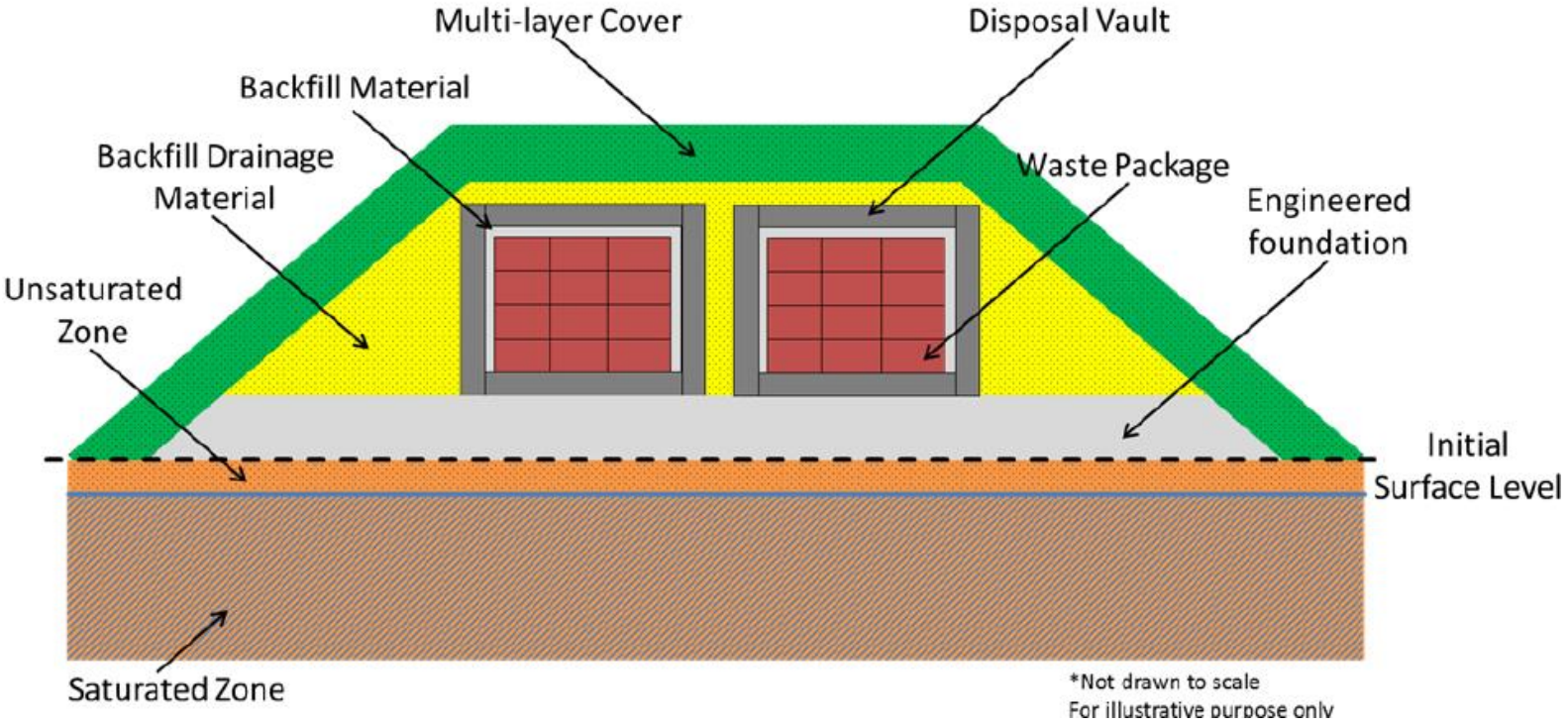
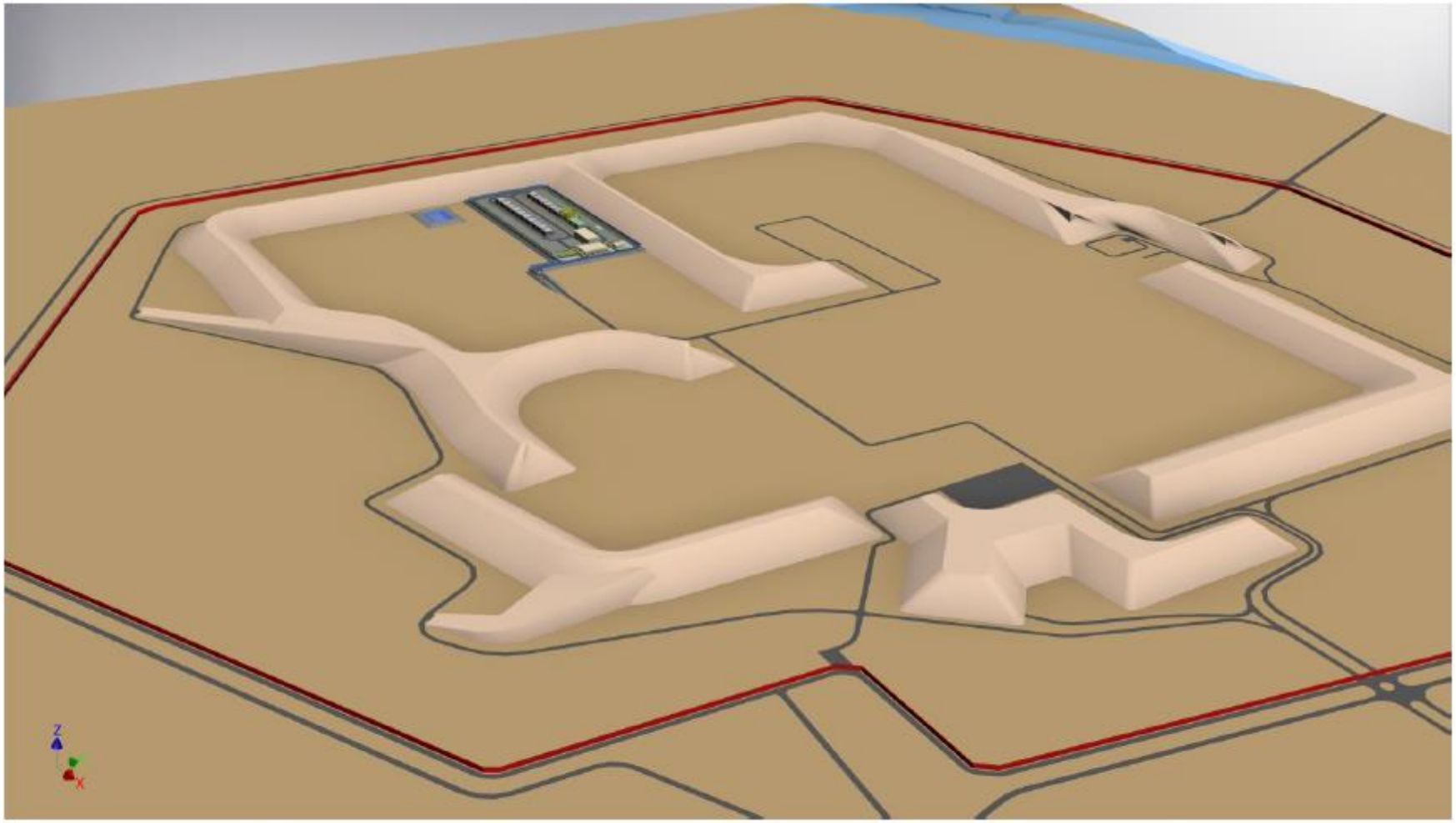
# PROJECT TASKS

- **Task 5 Development of conceptual design**
  - Preferred option for the LLW disposal facility – multi-attribute decision analysis method – 9 options were analyzed
  - **Variant 1** was proposed – similar as L'Aube (France) and El Cabril



# PROJECT TASKS

- **Task 5 Development of conceptual design – Variant 1, Option 1**



# PROJECT TASKS

- **Task 5 Development of conceptual design – Variant 1, Option 1**

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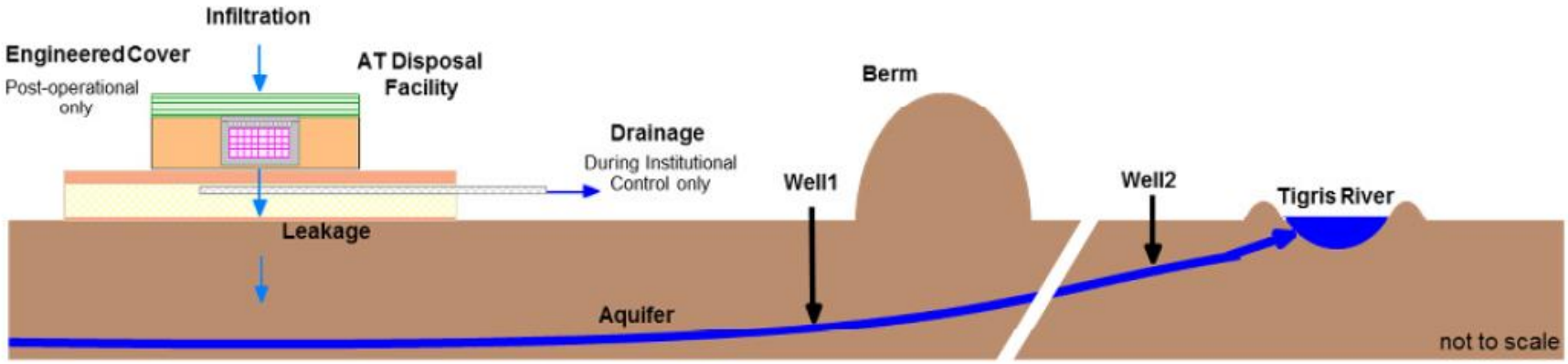
# PROJECT TASKS

- **Task 6 Development of Preliminary Safety Assessment**
  - Results of previous tasks, updated inventory and waste streams from MoST in 2018
  - Calculation models – GoldSim code
  - Structure – IAEA document „Safety Assessment Methodologies for Near Surface Disposal Facilities"
  - Differencies between Iraqi classification and IAEA recommendations

  - Meeting in Bratislava 10/2016 – Draft of new Iraqi classification of radioactive waste

# PROJECT TASKS

- **Task 6 Development of Preliminary Safety Assessment**
  - **Iteration** of results of previous tasks, updated inventory
  - **Development of scenarios** (Normal Evolution, Human Intrusion, Earthquake, Climate Changes, Accidents) and sensitivity analyses
  - **Results** – total activity inventory, specific activities of radionuclides



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# PROJECT TASKS

- **Task 7 Development of detailed design**
  - Information for the **near field**
    - ❖ Waste types (e.g. origin, nature, quantities and properties, radionuclide inventory)
    - ❖ System engineering (e.g. waste conditioning, packaging, disposal units)
    - ❖ Extent and properties of the zone disturbed by any excavation or construction
  - Overall safety concept and safety functions
  - Processes with possible influence of the disposal system (radiological, thermal, hydraulic, mechanical, chemical, biological)

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# PROJECT TASKS

- **Task 8 Development of Pre-Construction Safety Assessment**
  - Operational Safety Assessment
  - Defining Waste Acceptance Criteria
  - More detailed data and analyses (e.g. human intrusion, relative share of concrete, etc. )
  - Taking into account proposed Iraqi waste classification (20 kBq/g for β and γ nuclides) → **two sets of WAC – maximum specific activity:**
    - ❖ Based on the waste classification scheme **and** results of the safety assessment
    - ❖ Based **only** on the safety assessment results

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# PROJECT TASKS

- **Task 9 Development of additional licensing documentation**
  - Cooperation NUKEM-JAVYS
    - ❖ Operation of Facility
    - ❖ QA Measures
    - ❖ Technical Acceptance Criteria (including WAC)

    Approval documents

    - ❖ Operation of Facility (Personnel)
    - ❖ Management Systems
    - ❖ Inspection Guideline
    - ❖ Set of Radiation Protection Rules
    - ❖ Working and Process Instructions
    - ❖ Maintenance

    Operational regulations

# PROJECT TASKS

- **Task 9 Development of additional licensing documentation**
  - Based on the output of Task 2, Task 3, Task 6 and Task 8
  - Updated according to the last versions and Beneficiary's comments

- **Task 10 Final report and dissemination of results**
  - Final project meeting – April 2019
  - Preparation of Final report and press release

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**OVERVIEW OF JAVYS CONSULTANCY PROJECTS**

# OVERVIEW OF JAVYS CONSULTANCY PROJECTS

- **Project D48-1**: Technical Design and Update of SAR for modernization of „SD RAW-KOZLODUY" to receive and process decommissioning RAW
- **Scope:** Development and provision of documentation for procurement of technology – project D48-2
- **Members of Consortium**
  - IDOM (Spain) – leader
  - JAVYS (Slovakia)
  - Atomtoploproekt (Bulgaria) ATP ATOMTOPLOPROEKT

# OVERVIEW OF JAVYS CONSULTANCY PROJECTS

- **Project D48-1**: Technical Design and Update of SAR for modernization of „SD RAW-KOZLODUY" to receive and process decommissioning RAW
- **Project start:** January 2018
- **Project team:**
  - Roman Strazovec – **key expert**
  - Martin Hornacek – non-key expert
  - Tomas Hrncir – non-key expert
- **Contract price: 1 571 234 € (financing by EBRD)**

# OVERVIEW OF JAVYS CONSULTANCY PROJECTS

- **Project P 67**: Strengthening CBRN Waste Management Capabilities in South-East and Eastern European Countries
- **Scope:** Strengthen and harmonize regulatory frameworks of CBRN Waste Management capabilities in the SEEE region partner countries
- **Members of Consortium**

SCJS – leader
SUSTAINABLE CRIMINAL JUSTICE SOLUTIONS
Cranfield University
ISEM INSTITUTE
javys
Public Health England
VERTIC
WIChiR

- **Contract price: 3 M€ (Funded by European Union)**

# OVERVIEW OF JAVYS CONSULTANCY PROJECTS

- **Countries:** Albania  , Armenia  , Azerbaijan 

Bosnia and Herzegovina  , Northern Macedonia 

Georgia  , Moldova  , Montenegro 

Serbia  , Ukraine 

- **Project team approved by EC**
  - Peter Salzer – **key expert** from JAVYS
  - Non-key experts: Tomas Hrncir, Roman Strazovec, Martin Hornacek, Peter Gerhart, Ondrej Uhrik

# THANK YOU FOR YOUR ATTENTION

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