



Environmental Monitoring
6-7 May 2009
Becici, Montenegro

Problem description and proposed activities

- ❑ Bajza Railway Station - Kastrati Commune.
 - ❑ Project: Cleaning up of chemicals stored at Bajza Railway Station- Part of Regional Project on Strengthening the capacities of Western Balkan Countries.....
 - ❑ **One of 35 national environmental hot spots (inherited industrial pollution).**
-

What we have done with regard to environmental monitoring

- Initially it was presumed to have a full EIA
 - PSI including sampling and analysis was considered as a tool to find out what really was stored in the storehouse (nature of chemicals)
 - PSI seemed in this case as cost effective
-

Montec

- German Company hired to conduct the PSI (PSI, Risk Assessment and Action Plan)
 - Montec also prepared the TORs for Repackaging, Transport and Final Disposal
-

Scope and objectives of PSI- Bajza Hot-Spot of the activities - Montec Report

It was assumed that beside the contamination within the storage buildings on-site a contamination of the surrounding soil and groundwater is likely too.

That poses a variety of health risks to human and various impacts to the environment, e.g.:

- ❑ Risks to human beings from toxic and carcinogenic substances, such as mercury, dioxins¹ and organic contaminants,
 - ❑ Damages to the soil, due to leaking and emptying of the old drums and containers,
 - ❑ Damages to groundwater resources, due to diffuse contamination,
 - ❑ Damages to surface water resources, especially lakes and rivers, by contaminants from the groundwater ,
 - ❑ Risks entailed by the clean-up activities themselves, e.g. additional release of contaminants
-

SITE INVESTIGATION

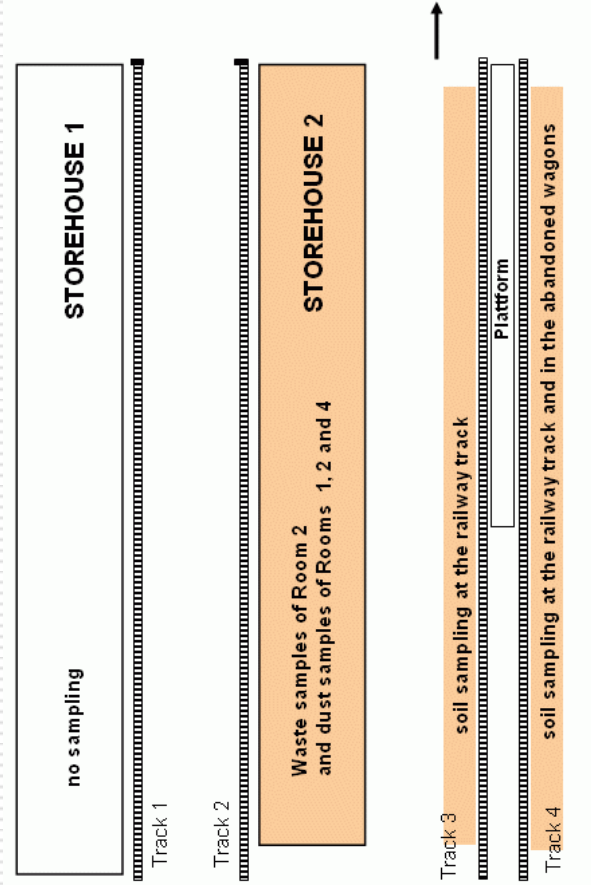
- the supposed hazardous chemical material/waste is stored in only one room at the storehouses, since the beginning of the 1990th
 - the German train with the pesticides has already been removed and it is assumed that no pesticides of the train are stored in the storehouses,
 - the old train wagons, deposited east of the storehouses are assumed to be not part of the German train with the pesticides,
 - the station itself and the storehouses are secured and restricted areas with no public access,
 - the train station is in operation for commercial transport of goods, there are no passenger transportation trains,
 - the storehouses are not in operation,
 - the station of Bajza is looking forward to use the storehouses in the future.
-

Sampling

MonTec team carried out the site visit and the sampling to the major subjects of interest:

- ❑ Storehouse 2, Room 3 with the supposed hazardous chemical material/waste and leather rugs.
 - ❑ Storehouse 2, Room 2 with dust and assumed remnants of the chemical materials in the adjacent Room 3 to which it has an open access at the southern wall. This material was focused at as a further storeroom for the hazardous materials in Room 3 after repacking.
 - ❑ Storehouse 2, Room 1 and 4 with dust and unknown further composition.
 - ❑ Abandoned railway wagons at track 3 and 4 were searched for leftovers of pesticides.
 - ❑ Topsoil was sampled in the direct vicinity of the railway tracks 3 and 4 in order to follow up spilled pesticides.
-

Overview of the sampling locations

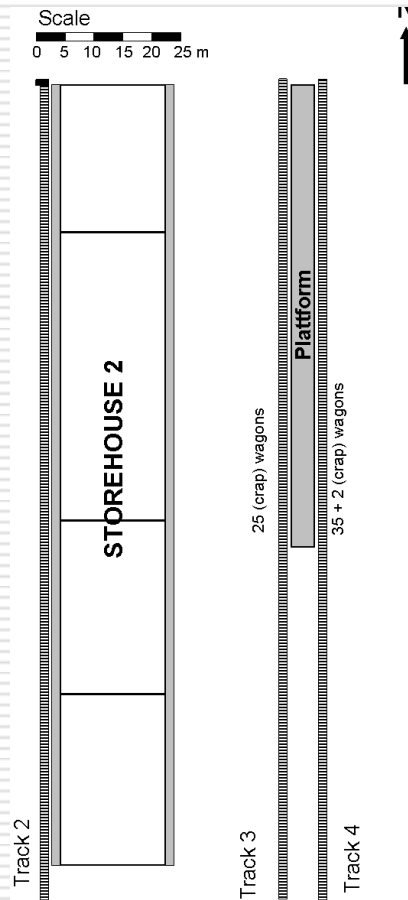


Samples from storehouse 2

- ❑ Main parts of the stored materials are leather rags (shoes production) without and within plastic bags (80 % of the stored material).
 - ❑ White and a grey **powder** were found in hall 3 consisting of small acicular crystals (size < 0.1 mm) and were often cemented due to infiltrated and evaporated humidity.
 - ❑ **Sampling of dust/debris** in the other rooms consisted of rubbed plastering and trickled roof material, remnants of stored chemical substances and some organic material
 - ❑ The material of both samples contained probably carbonate which had been proven by a test with diluted hydrochloric acid.
-

Solid samples from outside the Storehouses

Sampling of solids outside the Storehouse concentrated on peculiar remnants of chemicals in or around the abandoned railway wagons or the topsoil in the direct vicinity of the railway tracks 3 and 4.



Soil sampling at the railway tracks 3 and 4

- ❑ For soil sampling 3 small pits were dug in order to collect material from topsoil west of track 3. Each pit was approximately 30 cm deep.
 - ❑ In no case a top sealing by a confining clay layer or any other cohesive soil material was found.
 - ❑ The humid top soil consisted of a sandy silt layer with a large amount of well rounded gravel.
 - ❑ The silt was rich in carbonates proven by a test with hydrochloric acid.
 - ❑ It can be assumed that the topsoil will provide only a moderate sorption capacity to organic chemicals like pesticides.
-

Water sampling

- Water sampling was already performed on 01.09.2008 at the Syri i Sheganit karstic well.

Parameter	Dimension	Concentration
sodium	mg/L	2
potassium	mg/L	< 1
calcium	mg/L	44
magnesium	mg/L	7.2
ammonium	mg/L	0.07
aluminium	µg/L	50
cadmium	µg/L	< 0.3
chromium	µg/L	< 2
lead	µg/L	< 1
mercury	µg/L	< 0.1
nickel	µg/L	< 2
chloride	mg/L	3
sulphate	mg/L	5
nitrate	mg/L	3.2
DOC	mg/L	0.8
AOX	µg/L	10

Estimation of quantities

The estimation of the quantities gives the following results:

- ❑ Storehouse 2 - Room 1: Dust and debris on the floor < 50 kg
 - ❑ Room 2: Dust and debris on the floor ~ 100 kg
 - ❑ Room 3: Leather waste ~ 200 t
Chemical Waste ~ 80 t
 - ❑ Room 4: Dust and debris on the floor < 50 kg.
-

Overview of sampled material and subsequent chemical analysis

Nr.	short name	description	material	colour	analytical procedure
1	M1	material 1	powder	white	XRF, TOC, EOX, GC-MS, density analysis
2	M2	material 2	powder	grey	XRF, TOC, EOX, GC-MS
3	L	leather	leather	brown	microbiology, HM after water extraction, GC-MS
4	S1	dust 1	solid	grey	XRF, TOC, EOX, asbestos, GC-MS
5	S2	dust 2	solid	grey	XRF, TOC, EOX, GC-MS
6	B1	railway-wagon 1	powder	greywhite	XRF, TOC, EOX, GC-MS
7	B2	railway-wagon 2	mudstone?	red	XRF, TOC, EOX, GC-MS
8	B3	railway 3, soil	soil	greybrown	TOC, EOX, GC-MS
9	B4	railway 4, soil	soil	greybrown	TOC, EOX, GC-MS
10	SiS	water	water		chloroorganic pesticides, GC-MS, Ca, Mg, Na, K, Cl, SO ₄ , (NO ₃ , NH ₄ , DOC), HM, AOX,

Analysis of samples

- One of the possible hazards in leather remnants is the contamination with anthrax spores. This can only be identified by a specific microbiological and molecular-biological analytic procedure
 - The composite samples of the white and grey powder (M1 and M2) are investigated by X-ray fluorescence (XRF) which may prove the most likely inorganic composition of the material.
 - Material was also tested for total organic carbon (TOC) and extractable organic halogens (EOX).
 - Finally, extracts with 2 organic solvents (methanol and hexane) are analyzed by GC-MS in order to identify potential organic compounds.
 - Asbestos fiber identification was performed by raster electron microscopy (REM) and further confirmation by fourier-transformed infrared spectroscopy (FT-IR) by CRB Analysis Service , D- 37818 Hardegsen, FRG.
-

Analysis of samples

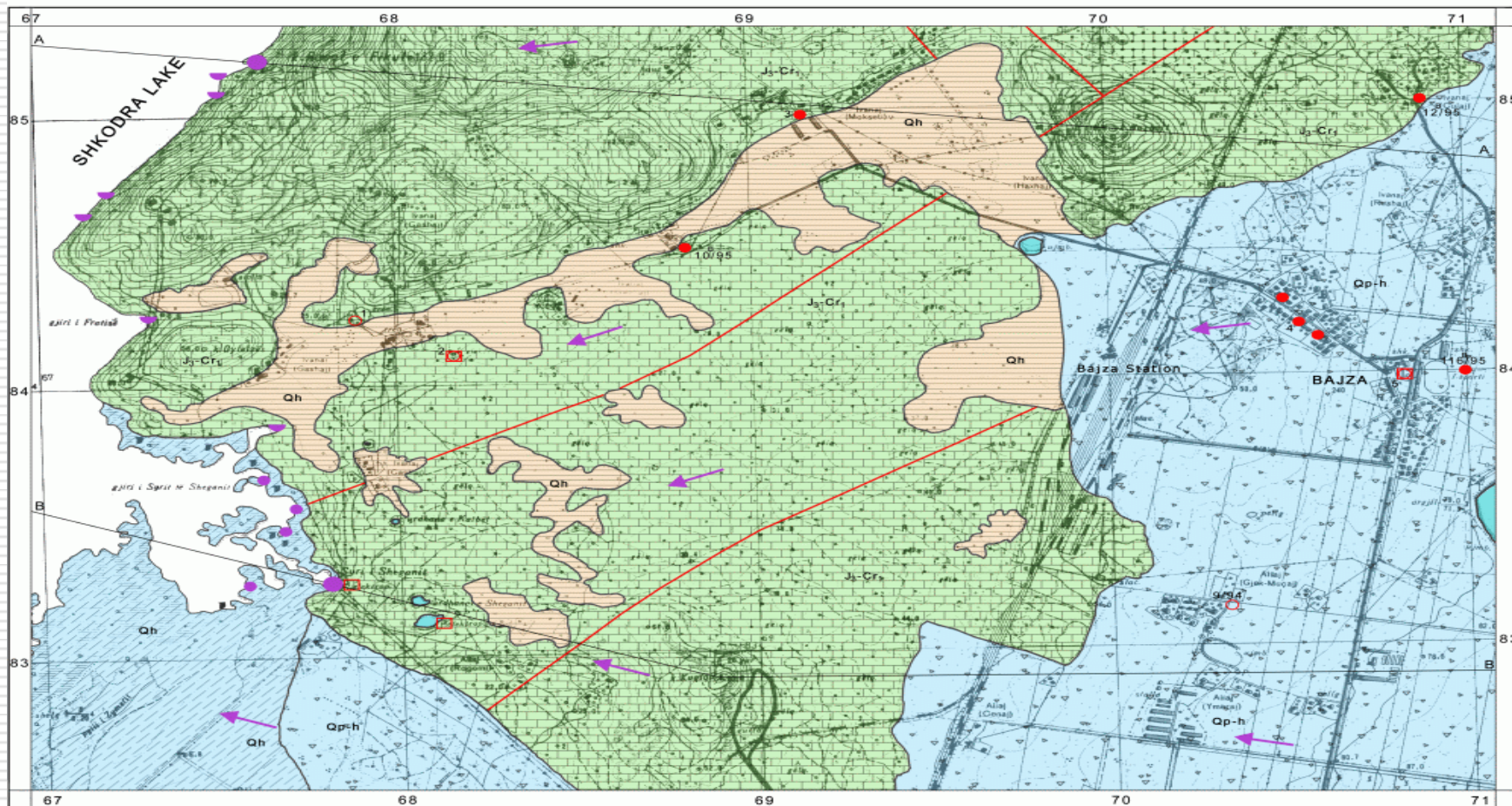
- **Analysis of the dust samples S1 and S2** - analyzed for asbestos fibres which may be included to the dust from trickling roof material
- **Analysis of the samples B1 and B2 from the abandoned railway tracks** - B2 sample has to be crushed by a hammer as a preparation for further analysis.

The GC-MS screening proves whether these materials contain organic pollutants like pesticides.

- **Analysis of the soil samples B3 and B4** - with respect to the parameters TOC, EOX and after extraction with methanol and hexane by GC-MS in order to identify residues of any spilled pesticide or other organic pollutants.
 - **Analysis of water** - Due to the transport condition water analysis focuses on conservative inorganic ions (Ca^{2+} , Mg^{2+} , Na^+ , K^+ , Cl^- , SO_4^{2-} and heavy metals).
-

HYDROGEOLOGICAL MAP of BAJZA AREA - SHKODRA, ALBANIA

Scale 1:10 000



1 Groundwater and rocks

Porous and abundant aquifers

- Qh Holocene. Highly permeable gravel and sand aquifer superficially covered by relatively impermeable silty-clayey deposits.
- Qp-h Pleistocene - Holocene. Highly permeable gravel, pebble, sand and conglomerate aquifer usually covered of a thin cultivated sandy-silt layer.

Karst - fissured abundant aquifers

- J₃-Cr₁ Upper Jurassic - Low Cretaceous. Limestone, dolomite limestone and dolomite; Generally high but very heterogeneous permeability.

Practically without water

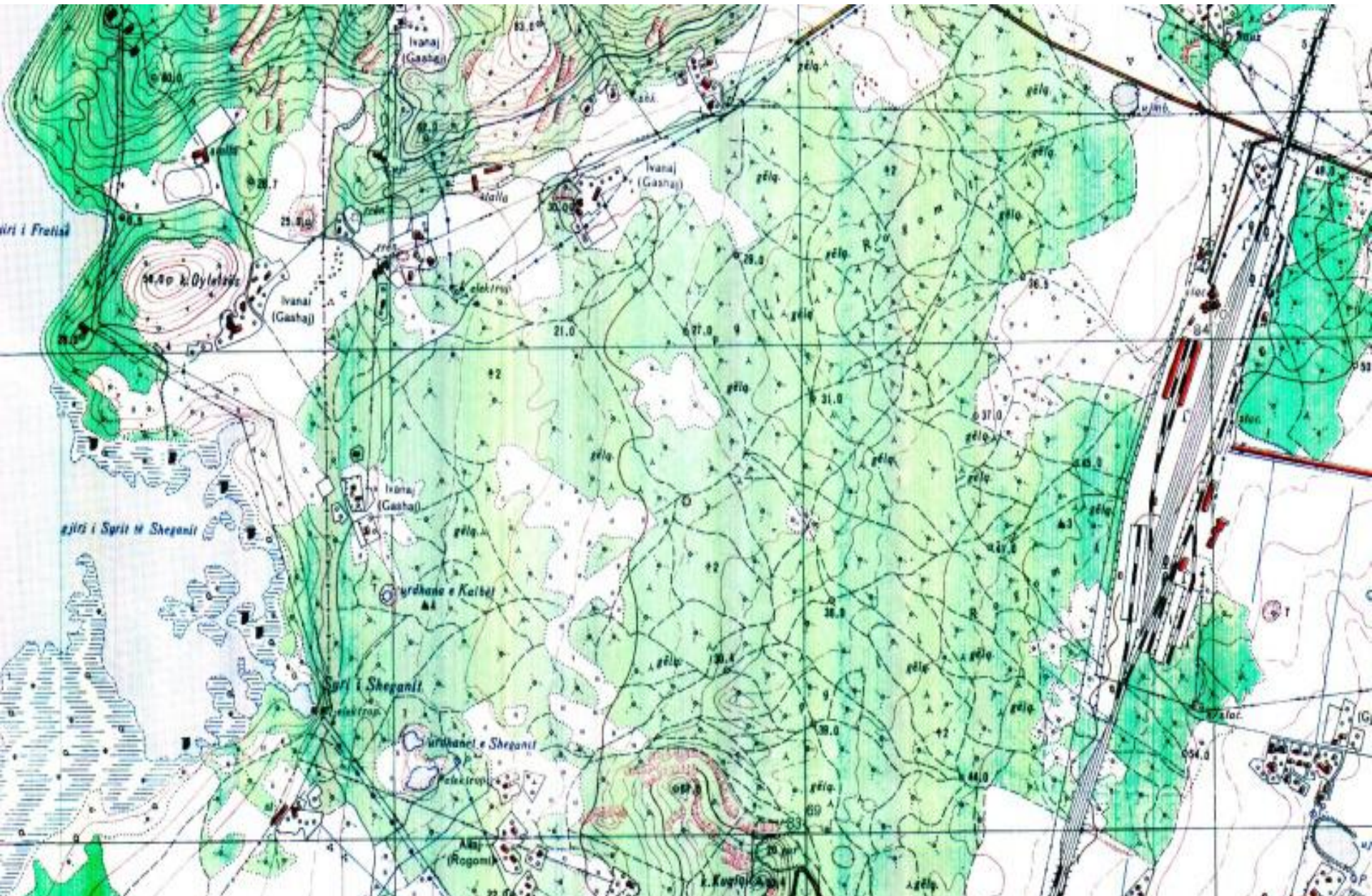
- Qh Holocene. Silt and clay (terra rossa); covering layer of surface caverns and other karstic forms.

LEGEND

2 Special signs

- Karstic spring, average discharge more than 1m³/s.
- Karstic spring, average discharge less than 1m³/s.
- Temporary spring, biggest discharge more than 1m³/s.
- Groundwater flow direction.
- Borehole and the number.
- Dug well.
- Groundwater pumping station.
- Hydrogeological boundary.
- Tectonic fault.

Underground Waters scheme



Equipment used

- ❑ Electronic radiation dosimeter to record possible radioactive impact on humans with a detection limit of 50 nSv/h.
 - ❑ Over a period of 6 h no radioactivity was recorded (0 μ Sv).
 - ❑ It can be concluded that no radioactive material or any remnants of this are stored in storehouse 2 and in the surrounding of that building.
-

Findings of the Preliminary Site Investigation

CONCLUSIONS AND RISKS

There are two major storehouses at the Bajza Station. Both storehouses are empty, besides the stored chemicals and waste.

- Storehouse 1 with loading ramps left and right, the storehouse is empty and not in use.
 - Railway Track 1 in operation
 - Railway Track 2 in operation
 - Storehouse 2 with loading ramps left and right, the storehouse is empty and not used.
 - Room 1: empty
 - Room 2: empty, dust and debris on the floor. There is a direct access to Room 3.
 - Room 3: loaded with chemical material/waste, leather rags
 - Room 4: empty.
-

Findings cntd

- ❑ Radioactive material or any remnants of this has not been detected in Storehouse 2 and in the surrounding of that building.
 - ❑ Inside the Storehouse 2 pesticides are not detected. The only compound with biocide properties found was sodium hexafluorosilicate.
 - ❑ The detected waste inside the storehouse is hazardous for human beings when it is inhaled, ingested or in contact with the bare skin. The contact with water should be prevented because of the acid producing reaction. Therefore the waste should be repacked immediately. Any unauthorized access to the waste should be inhibiting.
-

Constraints to be faced

The main constraints for the occupational protection during the cleaning and the repackaging procedure are given by the following results:

- The occurrence of sodium hexafluoro silicate (M1 and M2) in Room 3 of Storehouse 2 which is a hazardous chemical substance and classified as toxic particularly when it is inhaled, ingested or in contact with the bare skin.
 - The occurrence of asbestos fibers in the dust/debris (S1) of Room 2 in Storehouse 2 indicates that an inhalation is dangerous.
 - Particular constraints for the repackaging material are posed by the classification of sodium hexafluoro silicate (M1 and M2) to UN hazard class 6.1 (UN No. 2674) which has to be complied by the used material.
-

Constraints to be faced

- Although the occurrence of anthrax spores in the leather rags (L) was excluded by a specific microbiological examination, the repacking of the leather rags should be done under appropriate protection of the handling personnel for precautionary reasons however.

The microbiological tests of leather aiming at the exclusion of the occurrence of *Bacillus anthracis* were performed by a specialized laboratory at the University Stuttgart-Hohenheim, Institut für Umwelt- und Tierhygiene, 70593 Stuttgart, Germany (Prof. Dr. R. Böhm).

Analysis was done as microbiological cultivating on a semi-selective nutrient medium and as a molecular- biological procedure like polymerase-chain-reaction (PCR).

Outside the Storehouse

- ❑ Close to the Bajza Station storehouses and at the 2 railway tracks east of the storehouses hazardous material has not been detected so far except the grey-white powder in one railway wagon (B1) which contains at least remnants of the pesticide tetradifon (UN hazard class 6.1, UN No 2761).
 - ❑ Neither the soil sampling nor the investigations of other conspicuous material (e.g. B2) give any indication to an unacceptable pollution of the environment.
 - ❑ Particularly pesticides are not found apart from the grey-white powder B1. The B1 material however should be recollected and disposed in a safe way.
 - ❑ As the hydrogeological conditions of the area are determined by the karstic and the coarse grained porous aquifer wells - natural karstic or artificial drilled ones - do not exist in the immediate vicinity of the Bajza Station - investigation of groundwater in the near field of the Station is excluded unless new boreholes and wells are constructed.
 - ❑ At the moment the investigation of groundwater quality relies on the karstic wells at the Shkodar Lake shore line (e.g. Syri i Sheganit). Until now the water sampling and analysis has not revealed any conspicuous result or any adverse impact of the Bajza site on the local groundwater in a greater distance.
 - ❑ Further monitoring of water quality can affirm this finding and is recommended.
-

General conclusions

Apart from the storehouses and the operation of the Bajza freight station several other activities in the immediate vicinity or in the wider surroundings may pose a hazard to environment.

Following practices have to be mentioned:

- the supposed diesel fuel storage southwest of the Bajza station (Kuquqi Hill)
 - disperse waste disposal and waste burning in Bajza village and single homesteads in the Bajza karst plain infiltration of untreated waste water to the underground at the same places abandoned petrol stations in the surroundings of Bajza village.
 - For achieving a concluding regional environmental impact assessment the further investigation of the referred activities and an evaluation of their potential impact on the environment will be necessary and can not be ignored even for further environmental assessment of the Bajza station.
-

General conclusions 2

Further investigations on the above mentioned topics will contribute to several goals in a sustainable development of the Shkodar Lake region, which among others are :

- Support for the preservation of the wildlife habitat at a Ramsar site.
- Module to the protection of the regional water resources and the development of an integrated water resources management.
- Enhancement for initiatives which try to mitigate potential environmental hazards by solid and liquid waste as well as waste water impact on the water resources of Lake Shkodar.

The achievement of these goals can be assumed as middle- to long-term tasks.

- A further strategic environmental planning has to be seen beside the immediate rehabilitation of hazards by waste storage at the Bajza Station.
-

Short term action

- The storehouses are situated in the restricted station area but there is an open access to all rooms. As consequence children can play in the dust and loose goats can enter the Storehouses. It can be assumed that the asbestos fibers can be found in Storehouse 1, too.
 - The open gates to **the storehouses must be closed immediately** in order to confine the access to authorized personnel only.
 - The repackaging and final disposal of the hazardous materials as well as the collecting of the loose residual pesticide material in the railway wagons out side the storehouse. **should be started as soon as possible.**
-

Long term action

- Before a rehabilitation of the storehouses there should be an **investigation for hazardous construction material**.
 - **Groundwater:** In order to evaluate the local groundwater quality at the Bajza site monitoring wells should be installed (1 in the groundwater upstream and two in the groundwater downstream of the railway tracks 3 and 4).
 - To affirm the results on groundwater quality a **groundwater monitoring program** can be recommended.
 - **Soil:** It can be assumed that 37 different active organic ingredients of pesticides were stored temporarily in rail wagons at the Bajza site. In the soil pesticides have not been found so far.
 - In case the groundwater monitoring does not affirm these findings an **extended soil sampling and investigation program for the railway tracks** can be recommended.
-

SCOPE OF WORK for repackaging

- ❑ Preparation of a clean and safe working place in the storehouse,
 - ❑ Safe repackaging of the hazardous chemicals and waste in the storehouse and some leftover pesticides in an abandoned wagon outside using packages which allow a
 - ❑ Safe transport of the waste material to a final disposal respecting all conditions as set in Basel Convention for export and import countries with regard to the transport of chemical waste.
-

Thank you

UNDP Albania Hot spot programme

Klodiana Marika, MSC, MBA

Programme Manager

E-mail: klodiana.marika@undp.org
