FACES OF URANIUM / TVÁŘE URANU

Would you agree that nuclear power is clean and cheap? But did you ever ask how uranium is mined – being the basic resource for the production of fuel for nuclear power plants? How many tons of dangerous waste is generated by extracting one kilogram of mined uranium? That the impacts of uranium mining belong to the worst environmental burdens from the past?

The large sized photos of the exhibition "Faces of Uranium" give an impression of uranium mining while documenting at the same time the impacts on the environment and landscape. Portraits of people whose lives were affected by uranium mining, create a fuller picture by adding the human dimension. This series of photographs also points to the fate of political prisoners who were sentenced to forced labour in the uranium mines. The communist regime sacrificed thousands of prisoners ' lives in its hunt for uranium to feed the Soviet nuclear bomb.

Based on a Czechoslovak – Soviet agreement on uranium deliveries almost 100 000 t of uranium concentrate ("yellowcake") had left Czechoslovakia already in 1945. A domestic natural resource disappeared thanks to the "generosity" exerted at that time without receiving adequate counter-value; a fact which caused not only economic losses. Hundreds of miners died as a consequence of having worked in the uranium mines, the impacts on the landscape are among the worst environmental disasters in the Czech Republic. After 1989 the state took over the responsibility for the clean-up after uranium extraction and devotes annually around 3 billion Czech crowns to this purpose. These funds are not only used for the clean-up itself, but also to cover welfare payment to the miners.

Nuclear power is often referred to as an energy source for the future and as a so called emission- free technology with a minimum impact on the environment. However, what needs to be taken into account are the indispensable parts of nuclear energy, which is uranium mining. To produce 1 kilogram of yellowcake it is necessary to process 1 ton of uranium ore, using a significant amount of chemicals to dissolve the uranium in the ore. After the chemical leaching over 99 % of the processed material is disposed of in tailings ponds.

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The safe disposal of enormous amounts of toxic waste stemming from uranium concentrate production is one of the most problematic issues of uranium ore processing. The argument used in favour of nuclear power plants – little amount of waste produced – is completely false. The permanent contamination, both chemical and radioactive of the uranium mill area as well as the tailings ponds area and its closest surroundings are the chronic consequences of uranium processing.

The dream of a nuclear power renaissance lures investors from abroad to the Czech Republic, who toy with the idea of re-introducing uranium mining. Requests for geological examination of radioactive deposits were already filed and discussed at several places of Vysočina (Jamná, Polná, Brzkov) and Podještědí (Ploužnice, Osečná-Kotel). In 2008 Czech government declared the site Osečná – Kotel a protected deposit area, which entails for the local inhabitants some limitations, like a construction stop and only limited options in the development of the village. In protest against this the Podještědí citizen association was founded, which campaigns against the mining, organizes lectures at schools and spreads information about the risks of uranium mining. Their main campaign slogan is VODA nad URAN – WATER over URANIUM!

In fall the decision on the new energy strategy for the Czech Republic will be taken. The current strategy prioritizes clean-up of uranium mining, mining itself however is being phased out. A possible renewal of uranium mining would be a political decision of the Czech government with far reaching environmental, economic and moral impacts for the whole of the Czech Republic.

Photographer Václav Vašků documented the most important locations of uranium mining in the Czech Republic. The first cycle of photographs was made for the organization WISE in June and July of 2006 at Dolní Rožínka, Mydlovary, Ralsko und in the surroundings of Příbram. In spring 2009, in cooperation with Calla, a new cycle of photographs was taken, which focuses on the fate of people who worked with uranium enrichment in the area of Jáchymovsko.

Václav Vašků is a professional photographer working in Prague. In 2005 he won the second prize in the Czech Press Photo contest for a documentary photographs on the Chernobyl catastrophe.

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We thank all those who made this exhibition possible: Association Naše Podještědí, Jan Beránek of WISE, the members of the Confederation of political prisoners František Zahrádka and Zdeňek Mandrholec, the mayor of Mydlovary Petr Ciglbauer, Aleš Roubíček, Břetislav Sedláček – Director o.z. GAEM s.p. Diamo, miners at the Rožná mine, our financial sponsors and all people who contributed to this exhibition....

Calla – Association for the Preservation of the Environment campaigns for the sustainable energy supply based on renewable energy sources. Calla is also looking into the problems of uranium mining and takes part in legal procedures concerning this topic.

This exhibition was made possible thanks to the cooperation with the organization WISE and the financial support of Partnership foundation.

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IN SITU LEACHING IN STRÁŽ POD RALSKEM

Czech Republic experienced also perhaps the most drastic method of uranium mining, referred to as "in situ leaching". Uranium ore is not mined out, but sulphuric acid is pumped directly to the ground through thousands of drills. During decades, this site in Stráž pod Ralskem was pumped with over 4 million tons of sulphuric acid, 320 000 tons of nitric acid and other chemicals which roughly corresponds to 270 millions cubic meters. Today they present a timing bomb threatening to enter water reservoirs.



TAILING POND REHABILITATION AT MAPE

One of the MAPE's tailing ponds is being covered by ash from fossil-fuel power plant. The former chemical processing plant of uranium ore MAPE at Mydlovary is situated in Southern Bohemia, a few kilometers from the Temelin Nuclear Power Plant. Processing of uranium ore took place from 1962 to 1991. The amount of uranium ore processed here adds up to 16 745 835 tons. With this, 28 525 tons of yellow cake were produced. The uranium was separated from the ore by acid leaching with sulphur acid (H_2SO_4) and by alkali leaching with Na2CO3. After leaching, most of the ore residue was allowed to settle as sludge and stored in tailing ponds close to the plant.



PILES OF URANIUM ROCK AT PŘÍBRAM

Large piles of ore and rock around uranium mines represent a massive source of radioactive gas radon. Uranium industry in the Czech Republic left behind over forty large piles of uranium rock, in total volume of 43 million cubic meters. Level of radiation in neighborhood of waste rock and ore piles exceeds several times natural background, and for citizens living in the region represent a risk of increased incidence of lung cancer.



CONTAMINATED CONTAINERS, **P**ŘÍBRAM

Labeled as "CONTAMINATED", these steel containers from Pribram's uranium mine lay in a freely accessible area. Uranium mining industry leaves behind even another category of radioactive waste. Contaminated machinery and mining tools. contaminated with uranium dust, they remain everlasting source of radiation. This is because half-life of U-238 is 4.5 billion years.



IN SITU LEACHING IN STRÁŽ POD RALSKEM

In Stráž deposit was the mine using chemical extraction occupies an area of 628 hectare. However, the surface of contamination including so-called affected water (where the water quality is affected by the leaching operations) reaches the size of 24 km2. The procedure of leaching means, that bore-holes to a depth of 250 to 350 m are filled by a leaching medium on the basis of sulphuric acid. After that, the solution is pumped to the surface and uranium is

chemically extracted. Responsibility for remediation of old ecological burdens caused by uranium mining after year 1989 was taken over by the state. State enterprise Diamo year by year requests funds for remediation about hundreds of millions CZK, which are released by the ability of the state budget. Year-by-year funding does not allow effective use of resources and the long term planning of implementation and clean-up operation.



DEEP URANIUM MINE "HAMR 1" NEAR TO STRÁŽ POD RALSKEM In the 60's began in the Stráž pod Ralskem to be developed parallel two methods for mining of uranium - a classic underground mine in Hamr deposit and the underground leaching by diluted sulfuric acid in the deposit Stráž. The coexistence of these two fundamentally different methods require perfect drying of deposit of the underground mining and maintaining underground water level as low as possible. On the other hand, the method of in-situ

underground leaching demanded the water level as high as possible because the pumping of the water to the surface is very expensive. Changing of the water regime increased burden on the environment by leakage of acidic solutions from digestion fields toward the mine Hamr I.



VILLAGE HAMR NA JEZEŘE NEAR STRÁŽ POD RALSKEM

Aerial view on deep uranium mine "Hamr 1" near to Straz pod Ralskem. The surroundings of this mine were seriously contaminated in the past. Radiation spread to about 7000 hectares of watershed of river Ploucnice, level of radiation is up to 30times higher than normal levels. Picture shows how close the whole industrial area is to the natural lake which used to be beautiful tourist resort with sand beach (right).



Tailing pond "K2" in Rožná (Dolní Rožínka)

Aerial view on the smaller tailing pond "K2" in Rožná - Dolní Rožínka. Besides seepage of waste into ground and water, a specific risk of tailing ponds is the failure of its wall. This may happen due to improper operation, heavy rainfall or an earthquake. A number of these accidents happened in the past, contaminating valleys and rivers. Operators of Czech uranium tailing dams are often trying to secure additional incomes by importing and dumping yet other hazardous wastes there.

Here poisonous galvanic wastes were dumped into tailing pond.



TAILING POND "K1" IN ROŽNÁ (DOLNÍ ROŽÍNKA)

Liquid and sludge waste from uranium ore processing is being dumped into artificial ponds, so called tailing ponds. Two tailing ponds in Dolní Rožínka contain 10 million m3 of radioactive sludge and occupy the space of 90 hectares. This is aerial view on the larger one, "K1," pond with chemical reprocessing plant for uranium ore (right), with former deep uranium mine "Jasan" behind.



MAPE – URANIUM REPROCESING PLANT

The former chemical processing plant of uranium ore MAPE at Mydlovary is situated in Southern Bohemia, a few kilometers from the Temelin Nuclear Power Plant. Processing of uranium ore took place from 1962 to 1991. The amount of uranium ore processed here adds up to 16 745 835 tons. With this, 28 525 tons of yellow cake were produced. The uranium was separated from the ore by acid leaching with sulphur acid (H_2SO_4) and by alcalic

leaching with Na2CO3. After leaching, most of the ore residue was allowed to settle as sludge and stored in tailing ponds close to the plant.



"Recultivation" with another toxic waste, MAPE Mydlovary

Operators of Czech uranium tailing dams are often trying to secure additional incomes by importing and dumping yet other hazardous wastes there. In Dolní Rožínka, DIAMO Company dumped poisonous galvanic wastes into tailing ponds. In Mydlovary, ashes from coal plants and old tires (imported from Germany) are stored in existing uranium tailing ponds. This results in accumulation of additional

dangerous materials in the uranium processing sites.



TAILING POND CLOSE TO THE MAPE

One of the tailing ponds close to the MAPE's uranium reprocessing plant MAPE at Mydlovary These tailing ponds contain a total of 36 million tons of sludge with an amount of uranium that could produce approximately 2 320 tons of pure uranium and emits 10^{14} Bq radiation from Ra-226. Today there is an approximately 26 meters thick layer of radioactive sediments in the tailing ponds. The soil of the neighboring communities as well as plants growing

close to the tailing ponds are known to have raised levels of radioactivity and heavy metals.



URANIUM ORE CRUSHER

Before the chemical processing the uranium ore must be first grinded. This happens in a multi-crushers and mills. The process itself produces waste mainly in the form of sludge, which are stored in separate tailings.



DEATH TOWER

So called Death tower near to the Jáchymov's uranium mines. Here uranium had killed dozens of political prisoners. During the communist regime in 50s political prisoners were sent to this tower to die. They had to knap pure uranium ore by hammer into smaller parts. After 48 hours working many of them had got high fever and radiation disease. Reportedly almost no one survive here more than half a year.



MINER ON HIS ENGINE

After descending 600 meters, the miners then step into small carts and travel another two kilometers beneath the ground before reaching the second elevator. The elevator takes the miners another 400 meters down. In the uranium mine, trains pull these small carts.



MINER IN SHAFT

Rozna is the site of the last deep uranium mine in operation in central Europe. Uranium is mined here since 1957.



MINER AT THE END OF HIS WORK SHIFT

After his work shift a miner gets on a lift to be pull out from 1000 meter depth of the deep uranium mine back to the surface.



MINERS GET INTO DEEP

The miners ride in a cage that descends at a rate of 8 meters per second, which is almost the speed of freefall. During the ride, some close their eyes, others continually swallow in order to deal with the pressure change in their ears.



CHEMICAL PROCESSING PLANT OF THE DEEP URANIUM MINE ROZNA Chemical processing plant of uranium ore Rozna near the city of Žďár nad Sázavou (Eastern part of the Czech Republic). Uranium ore usually contains only 0,1 to 0,3 % of uranium. Therefore, it needs to be processed to extract so called yellow cake, which is final and tradable product. Ore is milled into fine sand and then gets dissolved in aggressive alkali chemicals.



DEEP URANIUM MINE ROŽNÁ

Deep uranium mine at Rožná (Dolni Rozinka) near the city of Zdar nad Sazavou (Eastern part of the Czech Republic). Rozna is the site of the last deep uranium mine in operation in central Europe. Uranium is mined here since 1957.



TAILING POND "K1" IN ROŽNÁ

Radioactive sludges and other liquid waste from process of uranium treatment is pumped into a man-made lakes called tailing ponds. Two such ponds in the area Rožná (Lower Rožínka) contain over 10 million cubic meters of radioactive sludge and occupy the area of 90 hectares.



PETR CIGLBAUER, MAYOR OF MYDLOVARY VILLAGE

Three villages Mydlovary, Olešník a Zahájí with 1420 inhabitants are situated at proximity of former chemical processing plant of uranium ore MAPE. They are threatened by radionuclide Radon (222RN), respectively its decay products. As processing plant itself is dismantling with support of European union money, problem with former tailing ponds remains. Surrounding of tailing ponds is contaminated by dry sediments. When drought and a wind blow, the dust is drifted to surroundings. The soil in vicinity villages has increased radioactivity and heavy metals up to ten times according to some scientific studies. The situation is complicated by fact that soil is cultivated at closes

vicinity of MAPE. Some fields are situated as close as 15 meters from the edge of tailing ponds. The extent of contamination is still matter of research.



Ales Roubíček (mine electrician), Shaft No. 4. Uranium mine Křižany

During the communist regime, Comrades transported groups touring and visits from the Soviet Union via this shaft. In this way it was an exemplary mine. Everything here was much cleaner than for example in nearby Hamr. The facilities of the mine were quite modern for their time and new procedures were tested here. At the beginning, Shaft no. 4 used prisoners as workers. After 1984, only civilian workers were found here. Mining here continued until 1990. Aleš Roubíček worked off a total of 2,100 shifts as a mine electrician here and in other uranium mines. Today, he recalls that health safety equipment

against radioactive radiation was either nonexistent or very minimal. For example, the use of personal dosimeters was not implemented until the fall of the Communist Regime in November of 1989.



FRANTIŠEK ZAHRÁDKA (POLITICAL PRISONER), CAMP VOJNA After the budding of communism in 1948, František Zahrádka began to participate as a scout in the rebellion movement transporting people across the border to Germany. The group was however revealed and Zahrádka was arrested. Originally, he received a sentence of death but due to his young age at the time his sentence was reduced to "only" 20 years in heavy prison. After two years of prison served "alone" and partially on a "sharp bed" (a wooden plank without a mattress), Zahrádka was admitted at a weight of 45 kg as being capable of work in uranium mines and was transported to Jáchymov. There he worked first in the Eduard mine and later was

moved to the feared "Tower of Death", where he worked as a uranium sorter. He did 9 years of heavy labor in the uranium mines in the Jáchymov and Příbram regions. During this time, his family died and after being granted amnesty in 1962 he had no where to return to. For this reason, he accepted an offer to stay in the mines as a employee and continued working there until his retirement. Educated as a radio mechanic, he invented a whole list of equipment, like safety signals for the elevator cage. This photograph was taken in the Vojna camp near Příbram, where Zahrádka shortly after his arrival received 40 days of correction – in a small concrete bunker, through which water flowed and where the prisoner received hot food only every third day.



PILE OF URANIUM ORE, PŘÍBRAMSKO

As long as uranium ore is located deep in the underground, most of radon gas gets decayed before it can effectively reach ground through rock fractures. But when mined out and milled, the situation is exactly opposite. Basically all radon released goes directly to air, and wind distributes it dozens of kilometers away.



risk of developing lung cancer.

URANIUM, ROŽNÁ

The main hazards of uranium result from the fact of its natural radioactive decay. During this decay, it not only releases radiation, but also creates a whole series of other radioactive elements and isotopes, before finally forming a stable atom of lead. Concerning health impacts, the most important component is radioactive isotope of radon, Rn-222. Unlike all other daughter products, radon is gaseous and gets concentrated on the particles of dust. Thus, it can be easily breathed and inside lungs decay into other elements. Four consequent radioactive decays occur in less than one hour, thus intensively irradiating lung tissue from the close proximity. The result is increased



Chemical processing plant of the deep uranium mine \mathbf{R} ozna

In the usual concentration 0.1% uranium in the ore. Other 99.9% is dangerous waste. Sludge still contains everything that originally contained the ore itself. They also have 85% of the radioactivity of the original rocks to the residual uranium, which can not be completely separated. They also contain heavy metals and other environmentally hazardous toxins, such as the arsenic. Including also all chemical agents, which are used for uranium processing. All of these hazardous sludge must be stored in tailings ponds near by uranium processing plants. In the Czech Republic there are 31 such those tailing ponds for a total area of

820 ha. It wasn't rare, the use of dry uranium sludge in construction of residential houses. High level of radiation and radon was measured, of course.



Břetislav Sedláček (CEO of deep uranium mine Rožná), Dolní Rožínka

Uranium mine at Rožná (Dolní Rožínka) near the city of Žďár nad Sázavou (Eastern part of the Czech Republic). Rozna is the site of the last deep uranium mine in operation in central Europe. Its future depends on prize of uranium and political situation.



Zdeněk Mandrholec (former political prisoner), deep uranium mine Eduard

Zdeněk Mandrholec was arrested in 1954 during his military service and sentenced to 10 years for high treason. As an enemy of the state and of the Communist Regime, he was sent to the uranium mines in Jáchymov, where he spent 6 years in inhumane conditions. In 1960, after the death of Stalin when the political atmosphere loosened up, he finally received amnesty. Before receiving amnesty he worked in several Jáchymov prison camps. He worked in the shafts of Nikolaj, Rovnost and Mariánská. The Nikolaj camp is famous for its inhumane torturing of prisoners. Today, Mandrholec recalls the degradation of human dignity. Prisoners were led to work tied together by

a steel wire. Frequently, the camps were built right next to the mine. However, the prisoners from Nikolaj had to "ride" in so-called Russian buses from the Nikolaj camp to the Eduard mine. One shift, around 70 to 150 men, was broken up into close and tight groups of five. Prison officers tied up this living package with steel wire and carefully locked the ends with a padlock. The men on the edges of these groupings had to hold the wire, which unmercifully cut into their bodies. In this manner, belted together by a steel wire, they marched one kilometer across civilian areas to each shift. In the front and back were two prison officers and in the middle were guard dogs... Today, Zdeněk Mandrholec is an active member of the Confederation of Political Prisoners.



DEEP URANIUM MINE SVORNOST, JÁCHYMOV

Deep uranium mine Svornost in Jáchymov is one of the oldest mine in the whole Europe. During the 16th Century Mine was used for mining silver. In 1898 the discovery of radium, managed by Marie Sklodowska Curie, happened just when examining Jáchymov uranium. Main boom in uranium mining in Bohemia occurred after 2 World War II. In the 50's were sent to work in mine political prisoners, who have often had to work in very hard conditions. Since 1967, the mine is closed and radon water is pumped via tunnel from mine Svornost to the local spa, because of beneficial treatment of rheumatism and other

diseases and injuries of the locomotor's system.



LANDSCAPE NEAR TO MOUNTAIN JEŠTĚD

Right here, in lovely countryside called Podještědí, the miners would like to open new uranium mines and make a profit from it. Australian company Uran Limited LTD. repeatedly investigates in several localities for uranium deposits in the Czech Republic. In 2008 locality Osečná-Kotel in North Bohemia was proclaimed as a "territory of protected deposit". For local residents this means a building closure and other restrictions. However, uranium deposits are located under the largest reservoirs of drinking water in Central Europe, and only four kilometers from the area of drinking water supplies for the town of Liberec. Any uranium mining could harm by contamination the

important supplies of drinking water. As a protest against mining was founded the Civic Association Naše Podještědí, which organizes public events and lectures at schools informing about the risks of uranium mining. The main motto of the campaign is WATER above URANIUM!

MORE PICTURES FROM THE EXHIBITION HTTP://WWW.FOTOMAT.CZ/URANIUM