The International Journal of
TRANSPORT & LOGISTICS
Međunarodni časopis
TRANSPORT I LOGISTIKA

UDC: 622.063.8

IMPACT OF EXTERNAL COAL CONVEYANCE ON URBAN AND NATURAL ENVIRONMENTS

UTICAJ SPOLJAŠNJEG TRANSPORTA UGLJA NA URBANE I PRIRODNE SREDINE

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Abstract: *Coal conveyance from a mine to consumers is made by various means of transportation, the most frequently by railway, trucks, conveyor belts etc. Each of these methods has more or less impact on the environment, and the causes of the harms arisen may be the following:*

- *Construction of haulage roads,*
- *Operation of haulage means, and*
- *Contact between the transported coal and the environment.*

The construction of haulage roads leads to the terrain degradation, intersection of natural flows and lanes and to the degradation of the environmental appearance. Harms resulted from the operation of haulage means may be the following: noise and vibrations, air pollution, fuel and lubricant leakage, etc. Air pollution resulted from the operation of haulage means may have two main causes: pollution caused by exhaust gases from vehicles and the pollution caused by dust rise due to the movement of haulage means. This paper gives the analysis of the harms resulted from the external coal conveyance for different types of haulage means.

Key words: *Coal Conveyance, Harms, Pollution*

Apstrakt: *Transport uglja od rudnika do potrošača se vrši različitim transportnim sredstvima, a najčešće železnicom, kamionima, transporterima sa trakom, i sl. Svaki od ovih načina više ili manje utiče na životnu sredinu, a uzroci štetnosti koje pri tome nastaju mogu biti:*

- *izgradnja transportnih trasa,*
- *rad transportniih sredstava i*
- *kontakt uglja koji se transportuje i okoline.*

Izgradnjom transportnih trasa dolazi do degradacije terena, presecanja prirodnih tokova i staza i narušavanja izgleda okoline. Štetnosti koje nastaju usled rada transportnih sredstava mogu biti buka i vibracije, zagađenje atmosfere, ispuštanje goriva i maziva i dr. Zagađenje atmosfere usled rada transportnih sredstva može imati dva osnovna uzroka: zagađenje usled izduvnih gasova vozila i zagađenje usled podizanja prašine kod kretanja transportnih sredtsava. U ovom radu je data analiza štetnosti koje nastaju pri spoljašnjem transportu uglja za različite vrste transportnih sredstava.

Ključne reči: *transport uglja, štetnosti, zagađenje*

1 INTRODUCTION

For the coal conveyance from the mine entrance to a separation unit or railway station, aerial ropeways were used in five of eight actual mines with underground exploitation. Currently, this conveyance method is operating only in Ibar mines. The other mines, in the early eighties, moved to truck or railway coal conveyance from a mine to primary consumers. In the beginning all mines used their own motor pool, but later, the use of external coal conveyance gradually decreased and there are, for now, mostly three forms of truck transport:

- Transportation by own trucks about 20%,
- By engaging third parties and companies on behalf of the mine 25%
- Transportation organized by customers 55%

1 UVOD

Od osam sadašnjih rudnika uglja sa podzemnom eksploatacijom, za transport uglja od ulaza rudnika do separacije ili železničke stanice, u pet rudnika su korišćene vazdušne žičare. U ovom trenutku samo je u Ibarskim rudnicima aktivan ovaj način transporta. Ostali rudnici su početkom osamdesetih uglavnom prešli na kamionski ili železnički transport uglja od rudnika do primarnih potrošača. U početku su svi rudnici koristili sopstveni vozni park, ali kasnije se postepeno učešće u spoljašnjem transportu uglja smanjivalo i za sada egzistiraju uglavnom tri vida kamionskog transporta:

- transport sopstvenim kamionima oko 20%,
- angažovanjem trećih lica i preduzeća za račun rudnika 25%
- transport u organizaciji kupaca 55%

2 EXTERNAL COAL CONVEYANCE IN SERBIAN MINES WITH UNDERGROUND EXPLOITATION

The current external conveyance system in coal mines with underground exploitation is developed and operates as follows:

BCM Rembas – Resavica. For coal transportation from mine shafts of BCM Rembas the combined transport system is used for the external conveyance (locomotive-belt-locomotive) through the Jelovački potkop and the Severni potkop for the purposes of the coal conveyance from the mine shafts Strmosten and Jelovac, and the locomotive system through the Južni potkop for the coal conveyance from the Senjski Mine. Although this conveyance is made through underground workings, it has the status of an external conveyance, because it conveys coal from mine shafts to the separation plant in Resavica. The coal is delivered to end consumers by truck or railway transport system.

BCM Jasenovac- Krepoljin. For the transport of coal from the Jasenovac mine shaft, a conveyor belt delivering the coal to a coal grading plant located in the area of the mine is used for the external conveyance . The end-user transportat is made by trucks.

2 SPOLJAŠNJI TRANSPORT UGLJA U RUDNICIMA SA PODZEMNOM EKSPLOATACIJOM U SRBIJI

Sadašnji sistem spoljašnjeg transporta u rudnicima sa podzemnom eksploatacijom uglja, rešen je i funkcioniše na sledeći način:

RMU Rembas – Resavica. Za otpremanje uglja iz jama RMU Rembas se za spoljašnji transport koristi kombinovani transportni sistem (lokomotivski-trakasti-lokomotivski) i to kroz Jelovački potkop i Severni potkop za potrebe otpreme uglja iz jame Strmosten i jame Jelovac i lokomotivski kroz Južni potkop za otpremu uglja iz jame Senjski Rudnik. Iako je ovaj transport vrši kroz podzemne prostorije, on ima status spoljašnjeg transporta, jer otprema ugalj iz jama do separacije u Resavici. Krajnjim potrošačima, ugalj se isporučuje kamionskim ili železničkim transportom.

RMU Jasenovac- Krepoljin. Za otpremanje uglja iz jame Jasenovac se za spoljašnji transport koristi transportna traka koja vrši dopremu uglja do klasirnice uglja locirane u krugu rudnika. Krajnji transport se obavlja kamionskim putem.

BCM Bogovina – Bogovina. From the Eastern field mine shaft (Istočno polje), where the exploitation is being carried out, the coal is delivered to the GIP and bunkers externally. From the bunkers the coal is then delivered, by trucks, to a separation plant for further processing.

Lignite Mine Lubnica – Lubnica. From the Osojno–South mine shaft where the exploitation is being carried out, the coal is delivered to bunkers of an aerial ropeway by a conveyor belt system. From the bunkers the coal is being "poured" into trucks and by truck transportation system (the cable railway has been inoperative for some time) it is delivered to a separation plant in the locality Grljan where the coal is further processed.

Anthracite Mine Vrška Čuka – Avramica. From the Vrška Čuka mine shaft the coal is delivered to bunkers by locomotive conveyance system, and then by conveyor belt it is transported to separation bunkers for further coal processing.

BCM Soko – Sokobanja. From the shaft of the Soko Mine the coal "tumbles" in wagons from the hoisting shaft to a reception bunker. Then, via a conveyor belt, it is transferred to the reception bunker „Parnaby" and after that for further processing. The conveyance of consumer coal is made by trucks, haulage roads go through the tourist place and special spa Soko Banja.

Ibar collieries – Baljevac. From the Tadenje mine shaft, coal is conveyed by a reception bunker system and a ropeway, to the ropeway reception bunker located on the plateau of the Jarando Mine. From the Jarando mine the coal is fed by a conveyor belt into a reception bunker of the ropeway Jarando. From this bunker, the coal is then conveyed by an arm of the aerial ropeway Jarando – Piskanja to a separation bunker located in Piskanja. From the separation plant, the processed coal is delivered by truck or rail transport to end consumers.

Lignite Mine Štavalj – Sjenica. From the Štavalj mine shaft, coal is fed, via the main belt, into a coal grading plant. Coal grading is partially made there. The residual unprocessed coal, of certain granulation, by a conveyor belt system is conveyed to the "Paranby" plant for further processing. Consumer coal is conveyed by truck transport through the protected natural zone of Pešter plateau.

RMU Bogovina – Bogovina. Iz jame Istočno polje gde se sada vrši eksploatacija ugalj se iz jame doprema preko transportne trake locirane u GIP i bunkere spolja. Iz bunkera se ugalj dalje kamionskim transportom doprema do separacije na dalju preradu.

Rudnik lignita Lubnica – Lubnica. Iz jame Osojno – jug gde se sada vrši eksploatacija ugalj se sistemom transportnih traka doprema do bunkera vazdušne žičare. Iz bunkera se ugalj „toči" u kamione i kamionskim transportom (žičara je već duže vremena u kvaru) doprema do separacije u mestu Grljan gde se vrši dalja prerada uglja.

Rudnik antracita Vrška Čuka – Avramica. Iz jame Vrška Čuka se ugalj doprema lokomotivskim transportom do bunkera, a odatle se transportnom trakom otprema do bunkera separacije na preradu uglja.

RMU Soko – Sokobanja. Iz jame rudnika Soko ugalj se vagonatima iz izvoznog okna „tumba" u prihvatni bunker. Dalje se putem transportne trake prebacuje u prihvatni bunker postrojenja „Parnaby" a odatle na dalju preradu. Otprema uglja za široku potrošnju obavlja se kamionskim transportom, transportni putevi vode kroz turističko mesto i specijalno lečilište Soko Banju.

Ibarski rudnici kamenog uglja – Baljevac. Iz jame Tadenje ugalj se preko sistema prihvatnog bunkera i vazdušne žičare doprema do prihvatnog bunkera žičare lociranog na platou rudnika Jarando. Iz jame Jarando ugalj se transportnom trakom doprema do prihvatnog bunkera žičare Jarando. Iz ovog bunkera krakom vazdušne žičare Jarando–Piskanja vrši se dalja otprema uglja do bunkera separacije locirane u Piskanji. Iz separacije, prerađeni ugalj se dalje transportuje kamionskim ili železničkim saobraćajem do krajnjih potrošača.

Rudnik lignita Štavalj – Sjenica. Iz jame Štavalj ugalj se preko glavne trake doprema do klasirnice rudnika. Tu se vrši deo klasiranja uglja. Ostatak neprerađenog uglja određene granulacije se sistemom transportnih traka doprema do „Paranby" postrojenja na dalju preradu. Ugalj se za široku potrošnju transportuje kamionskim transportom kroz zaštićenu prirodnu zonu Pešterska visoravan.

3 TRUCK CONVEYANCE OF COAL

Truck conveyance of coal is use to a great extent, moreover, in some mines it is the only type of conveyance. It is one of the most utilised type of coal conveying. That is the reason why the impact on environmental pollution of this type of transportation is a very considerable one.

Utilisation of these haulage means may endanger the environment, from the following aspects:

Air pollution:

- Air pollution by suspended particles caused by loading, reloading and unloading the coal into trucks,
- Air pollution by suspended particles caused by conveyance of coal, by the effect of eolian erosion and spillage of the coal from the box of the haulage means, as well as spilling out the material from the box, crushing, while working, and trampling the material, which additionally increases the total emission fund of dust,
- Air pollution by exhaust fumes from engines is reflected in the emission of carbon-monoxide CO, carbon-dioxide CO_2, nitric-oxides NO_x, sulfur-dioxide SO_2, acroleine, etc; and the contents of these noxious gases depend on operating conditions, load and truck motor power.
- Air pollution by dust emission from the surface of truck roads, which, in a warm and dry period of the year reaches enormous values.

Noise and vibrations:

- Bad influence of excessive noise result from the operation of truck engine, and it depends on operating conditions, load and truck motor power,
- A danger of baneful influence of vibrations is very present, especially because of the conveyance by large dump trucks, and it is related solely to the working environment.

3 KAMIONSKI TRANSPORT UGLJA

Kamionski transport uglja ima veliku primenu, često je u mnogim rudnicima to i jedini vid transporta. Jedan je od najzastupljenijih vidova transporta uglja. Iz tog razloga, značajan je i veliki uticaj ove vrste transporta na zagađenje životne sredine.

Primenom ovih transportnih sredstava životna sredina je ugrožena sa više aspekata:

Zagađivanje vazduha:

- zagađivanje vazduha suspendovanim česticama usled utovara, pretovara i istovara uglja u kamionska transporta sredstva,
- zagađivanje vazduha suspendovanim česticama usled transporta uglja, delovanjem eolske erozije i raznošenjem uglja iz sanduka transportnog sredstva, kao i prosipanje materijala iz sanduka, njegovo drobljenje pri radu i gaženje, što dodatno uvećava ukupni emisioni fond prašine,
- zagađivanje vazduha izduvnim gasovima iz motora ogleda se ukroz emisiju ugljenmonoksida CO, ugljendioksida CO_2, azotnih oksida NOx, sumpordioksida SO_2, akroleina i dr., a sadržaj ovih štetnih gasova zavisi od režima rada, opterećenja i snage motora kamiona,
- zagađivanje vazduha emisijom prašine sa površine kamionskih puteva, koja u toplom i suvom periodu godine dostiže enormne vrednosti.

Buka i vibracije:

- pojava nepovoljnog uticaja prekomerne buke kao posledica rada motora kamiona, a zavisi od režima rada, opterećenja i snage motora kamiona,
- opasnost od štetnih uticaja vibracija objektivno postoji i to posebno zbog transporta velikim kamionima – damperima i vezana je isključivo za radnu okolinu.

Pollution of surface and underground watercourses:

- Pollution level of surface and unerground watercourses is negligeable with this haulage system and is reflected in atmospheric influences on the transported mineral raw material as well as
- Leak of truck fuel, lubricants and cooling engines liquids.

Soil degradation:

- Is reflected in building haulage roads, which significantly degrades and disrupt natural and ecological systems. This problem is present especially in transporting mineral raw materials to the processing plant. Transportation length from a mine to a processing plant for coal may be from few hundreds of meters to tens of thousands of kilometers, whereas these roads may pass through protected areas.

Impact on flora, fauna and ecosystems:

- The most intense impact is reflected in the effect of taking up plots (land) for building truck haulage roads, intersection of natural habitats of some vegetable and animal species, intersection and dislocation of watercourses etc.
- Influence of noise and dust, as well as spillage of coal while transporting by truck, have an adverse impact on flora and fauna in close vicinity of haulage roads, and it influence on the migration of most of animal species, except some birds, small rodents and reptiles which may easily adapt to newly changed conditions in the habitats.

Figure 1 shows some of the impacts of truck conveyance on the environmental pollution.

Zagađenje površinskih i podzemnih voda:

- zagađenja površinskih i podzemnih voda neznatni su kod ovog načina transporta i ogledaju se u atmosferskim uticajima na transportovanu mineralnu sirovinu kao i
- curenje goriva za kamione, sredstava za podmazivanje i tečnosti za rashlađivanje motora.

Degradacija zemljišta:

- ogleda se kroz izgradnju transportnih puteva, čime se znatno degradiraju i remete prirodni i ekološki sistemi. Ovaj problem je posebno aktuelan pri transportu mineralnih sirovina do postrojenja za preradu. Dužine transporta od rudnika do postrojenja za preradu uglja se kreću od nekoliko stotina metara do više desetina kilometara. Pri tome ovi putemi mogu prolaziti kroz zaštićene sredine.

Uticaj na floru, faunu i ekosisteme:

- najveći uticaj izražen je kroz efekat zauzimanja površina za izgradnju transportnih puteva za kamione, presecanje prirodnih staništa nekih biljnih i životinjskih vrsta, presecanje i izmeštanje vodotokova itd.
- uticaj buke i prašine, i rasipanja uglja koji se transportuje kamionskim transportom, nepovoljno utiče na biljni i životinjski svet u neposrednoj okolini transportnih puteva, i utiče na migraciju većine životinjskih vrsta, osim nekih ptičjih vrsta, malih glodara i reptila koji se mogu prilagoditi novim promenjenim staništima,

Na slici 1 prikazani su neki uticaji transporta kamionima na zagađenje životne sredine.

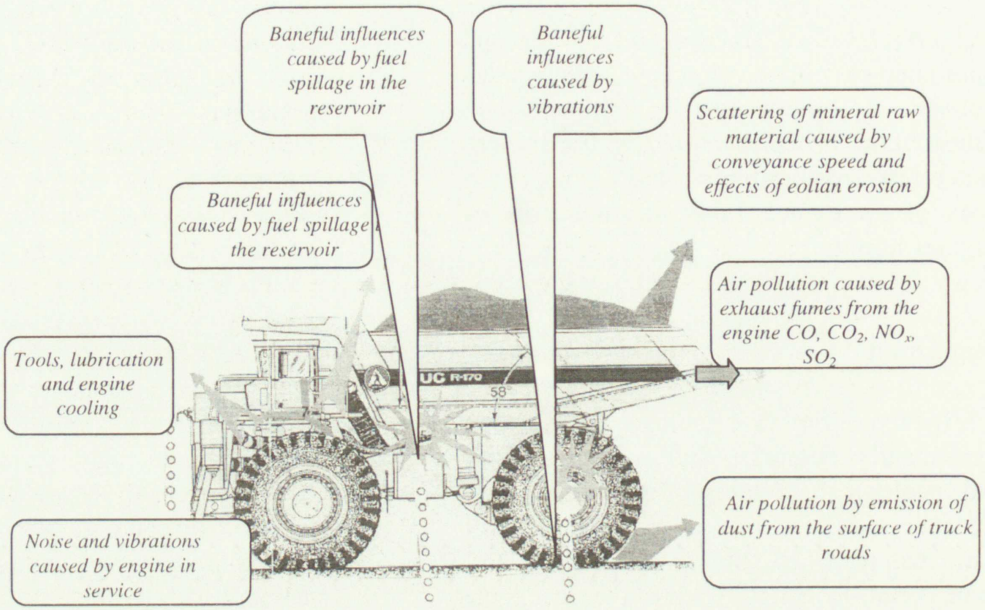

Figure 1 Possible impact of truck conveyance on the environmental pollution
slika 2 Mogući uticaji na zagađenje životne sredine kamionskim transportom

4 RAILROAD CONVEYANCE OF COAL

The railroad conveyance is used in transporting energetic mineral raw materials – coal. This conveyance system, also influences on the pollution of the environment through which the conveyance is performed. Basic elements the railroad conveyance consists of are tracks, railroad stations and trains. Each of these elements has its impact on the environmental pollution and disturbance.

In conveying coal, from loading stations, through intermediate stations to unloading stations, tracks pass trhough inhabitated places, forests, farms, protected natureal resources, etc, and thereby they cause certain environmental damages.

Air pollution:

- Air pollution by suspended particles is the most intense at loading and unloading stations. Depending on the applied technology of loading and unloading into/from wagons, the scope and the intensity of environmental and working environment at these stations will increase or decrease,

4 ŽELEZNIČKI TRANSPORT UGLJA

Železnički transport se koristi za transport energetskih mineralnih sirovina - uglja. Ovaj vid transporta takođe utiče na zagađenje životne sredine kroz koju se transport obavlja. Osnovni elementi koji sačinjavaju transport železnicom su pruge, stanice na prugama i železničke kompozicije. Svaki od ovih elemenata na svoj načine deluje na zagađenje i narušavanje životne sredine.

Pri transportu uglja od utovarnih, preko međustanica pa sve do istovarnih stanica, trase pruga prolaze kroz naseljena mesta, šume, poljoprivredna zemljišta, zaštićena prirodna dobra, itd., i samim tim izazivaju određene štetnosti.

Zagađivanje vazduha:

- zagađivanje vazduha suspendovanim česticama, najizraženije je na utovarnim i istovarnim stanicama. U zavisnosti od primenjene tehnologije utovara i istovara u vagone, zavisi i veličina i intenzitet zagađenja životne i radne sredine na ovim stanicama,

- Air pollution by suspended particles caused by conveyance of coal, by the effect of eolian erosion and spillage of the coal from rail wagons, is also significant with this conveyance system. However, this type of pollution is less significant than in truck conveyance, because of the possibility of making special wagons for transporting coal. Wagons for transporting coal, are specially designed and are made with minimal size of open contact surface or, in some cases, as closed wagons. Closed wagons do not cause environmental pollution while transporting,
- Air pollution by exhaust fumes appears only if there are diesel mine locomotives. However, nowadays are used more and more electric mine locomotives, while diesel mine locomotives are used very rarely, for example as an auxiliary shunt (manoeuvre) locomotive at loading and unloading stations.

Noise and vibrations:

- Influence of noise and vibrations may arise at loading and unloading stations, because of loading and unloading means as well as because of locomotives in service and of motion of wagons at the stations,
- Noise and vibrations are especially intensive while trains are moving along the railroad and the danger of baneful influences depends on the kind of environment the path was marked through, as well as on the intensity and scope of the railroad conveyance.

Pollution of surface and underground watercourses:

- Pollution level of surface and unerground watercourses is as negligeable as with truck conveyance, except in case of the influence of atmospheric conditions – flooding of the transported raw materials from wagons (rain and snow), while, with closed wagons, this influence is not taken into the consideration,
- Leak of diesel fuel, as well as of lubricants and cooling engines liquids, from diesel mine locomotives, occures only in case of using diesel mines locomotives for conveyance. As already mentioned above, this is very rare nowadays.

- zagađivanje vazduha suspendovanim česticama usled transporta uglja, delovanjem eolske erozije i raznošenjem uglja iz železničkih vagona, takođe je izraženo kod ove vrste transporta. Međutim, ova vrsta zagađenja je mnogo manje izražena nego kod transporta kamionima, zbog mogućnosti izrade specijalnih vagona za prevoz ovih materijala. Vagoni za transport uglja se izrađuju u specijalnim izradama, sa minimalnim veličinama otvorenih kontaktnih površina ili u nekim slučajevima kao zatvoreni vagoni. Zatvoreni vagoni ne zagađuju zivotnu sredinu ovim putem,
- zagađivanje vazduha izduvnim gasovima javlja se samo kod lokomotiva sa dizel gorivom. Međutim, danas se sve više koriste lokomotive sa elektro-vučom, dok se dizel lokomotive retko koriste i to samo kao pomoćne lokomotive za manevrisanje u utovarnim i istovarnim stanicama.

Buka i vibracije:

- uticaj buke i vibracije se javlja na utovarnim i istovarnim stanicama kako zbog utovarnih i istovarnih sredstava tako i zbog rada lokomotiva i kretanja vagona u stanicama,
- buka i vibracije su posebno izražene kod kretanja železničkih kompozicija duž pruge i opasnost od štetnih uticaja zavisi od toga kroz kakvu sredinu je trasa projektovana, kao i od intenziteta i obima transporta železnicom.

Zagađenje površinskih i podzemnih voda:

- zagađenja površinskih i podzemnih voda kao i kod transporta kamionima nije posebno izražen osim kod uticaja atmosferalijama – spiranje transportovane sirovina iz vagona (kiša i sneg), dok se kod transporta zatvorenim vagonima ni ovaj uticaj ne može uzimati u obzir,
- curenje dizel goriva iz dizel lokomotiva kao i sredstava za podmazivanje i tečnosti za rashlađivanje motora, javlja se samo u slučajevima gde se za transport koriste lokomotive na dizel pogon. Kako je već rečeno ovo je danas veoma retko.

Soil degradation:

- Is reflected in building haulage roads, especially while building railtracks through protected natural areas as well as through inhabited places. Since the existing tracks are mostly used for railroad conveyance, whereby it is also performed the conventional – civilian transportation (except at short sections from a mine to a processing plant), the pollution level is very significant, because these lines usually pass through inhabited places.

Impact on flora, fauna and ecosystems:

- The same as with truck conveyance, the impact of this conveyance system is reflected in taking up large plots for building stations, railroad tracks which occupy or intersect natural habitats of some vegetable and animal species, intersect and dislocate watercourses etc.
- Noise, dust and intersection of some natural habitats have an impact on migration of a large number of animal species, as well as on the extinction of some vegetable species.

The Figure 2 shows some impacts of railroad conveyance on the environmental pollution.

Degradacija zemljišta:

- ogleda se kroz izgradnju transportnih puteva, posebno kod izrade pruga kroz zaštićene prirodne ambijente kao i kroz naseljena mesta. Pošto se za železnički transport uglavnom koriste već postojeće pruge gde se obavlja i konvencionalni – civilni transport (osim kraćih deonica od rudnika do postrojenja za preradu) onda su zagađenja posebno izražena jer ove trase uglavnom prolaze kroz naseljena mesta.

Uticaj na floru, faunu i ekosisteme:

- kao i kod kamionskog transporta i ovde se uticaj ovog vrsta transporta ogleda u zauzimanju velikih površina za izgradnju stanica i pruga čime se zauzimaju ili presecaju prirodna staništa pojedinih biljnih i životinjskih vrsta, presecaju se i izmeštaju vodotokovi itd.
- uticaj buke i prašine, i presecanje pojedinih prirodnih staništa utiče na migraciju velikog broja životinjskih vrsta, kao i izumiranje pojedinih biljnih vrsta.

Na slici 2 prikazani su neki uticaji transporta železnicom na zagađenje životne sredine.

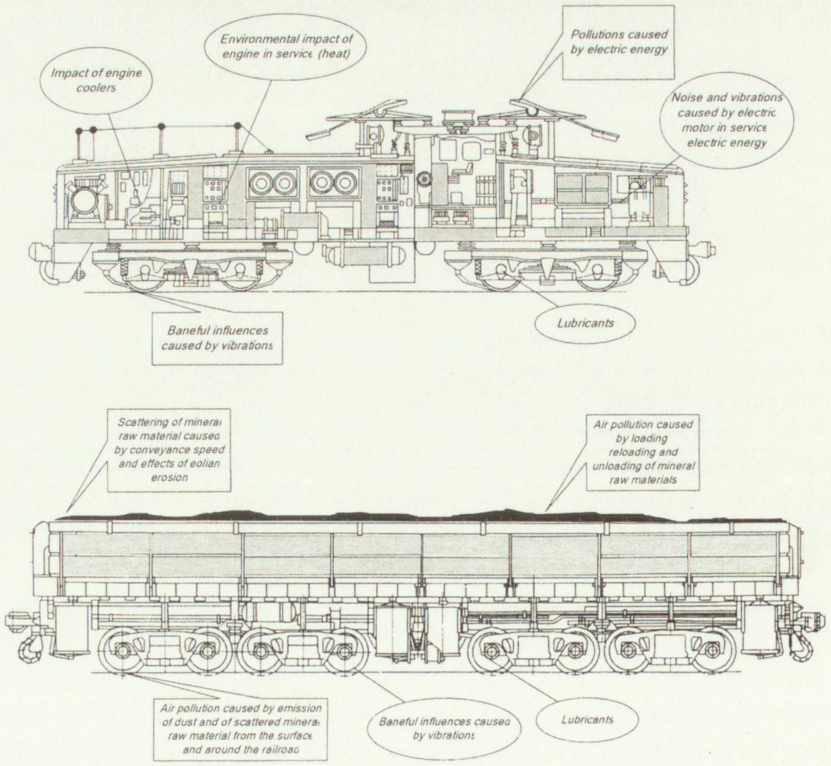

Figure 2 Possible impacts of railroad conveyance on the environmental pollution
slika 2 Mogući uticaji na zagađenje životne sredine železničkim transportom

5 COAL CONVEYANCE BY BELT CONVEYORS

Because of its important advantages, belt conveyors are more and more used for transportation of coal. It is obvious that the utilisation of this conveyance system increased in the whole world as well as in our region. In addition to the enhancement of the conveyors' operating capacity, the enhancement of their length is also significant, so that the conveyors utilised nowadays may reach even over 100 km.

These belt conveyors, very large in length and with a high efficiency of transmission, pass through the environment, endager, degrade and pollute it. By utilisation of belt conveyors, there is no such a pollution caused by truck and railroad conveyance (discharge of fuel, oil, lubricants, exhaust fumes etc.); however, it must be noted that there is a pollution whidh result from spilling out the goods transported as well as from a permanent contact between the material transported and the environment.

The Figure 3 shows some impacts of coal conveying by belt conveyors on the environmental pollution.

5 TRANSPORT UGLJA TRANSPORTERIMA SA GUMENOM TRAKOM

Zbog velikih i značajnih prednosti, za transport uglja, sve više se koriste transporteri sa gumenom trakom. Evidentna je sve veća primena ove vrste transporta mineralnih sirovina kako u svetu tako i kod nas. Pored povećanja propusnih sposobnosti transportnih sistema, zavidno je i povećanje njihovih dužina, tako da danas primenjeni sistemi transporta trakama dostižu dužine i preko 100 km.

Ovako velike dužine transportera sa trakom sa velikim propusnim moćima, prolaze kroz životnu sredinu, ugrožavaju je, degradiraju i zagađuju. Primenom transportera sa trakom nema zagađenja one vrste koje izazivaju kamionski i železnički način transporta (ispuštanje ulja, goriva, maziva, izduvnih gova i sl.), međutim, konstantno je zagađenje koje nastaje prosipanjem tranportovanog tereta kao i stalni dodir između materijala koji se transportuje i okoline.

Na slici 3 prikazani su neki uticaji transporta uglja transporterima sa trakom, na zagađenje životne sredine.

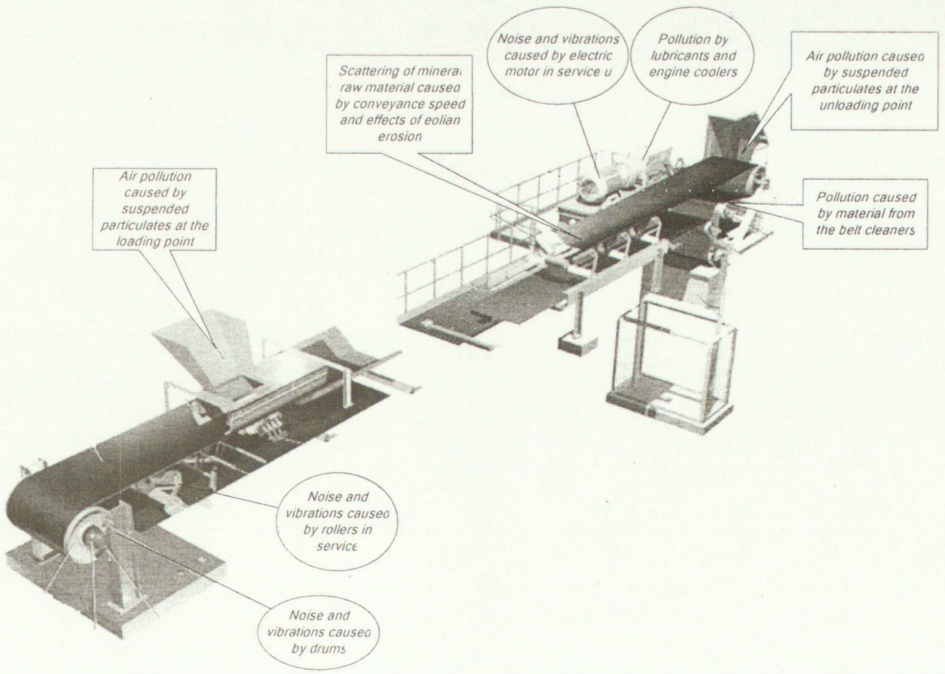

Figure 3 Possible impacts of belt conveyance on the environmental pollution
slika 3 Mogući uticaji na zagađenje životne sredine transportom transporterima sa trakom

Utilisation of this type of conveyance the environment may be endangered from different aspects:

Air pollution:

- Air pollution by suspended particles appear at the loading, reloading and unloading points of belt conveyors,
- Air pollution by suspended particles caused by the effect of eolian erosion and spilling out the coal from the conveyors, as well as the spillage the coal from the bearing belt because of the bad centering or the belt's slipping from the direction of conveyance,

Noise and vibrations:

- Bad influence of excessive noise and vibrations result from the operation of belt conveyors, especially at the conveyor's working unit, but also at full length of the belt because of the rotation of belt conveyor rollers,
- Noise at loading, reloading and unloading points
- Baneful influences of vibrations arise at the working unit of belt conveyors, as well as at full length of the belt conveyor.

Pollution of surface and underground watercourses:

- Pollution level of surface and unerground watercourses is negligeable with this type of conveyance and its impact on the environment is related to the atmospheric conditions (sluicing the coal on the conveyors by rain, snow etc.).

Soil degradation:

- As with previous types of coal conveyance, the soil degradation is reflected in building belt conveyor lines, but to a much lesser extent comparing with other types of conveyance.

Impact on flora, fauna and ecosystems:

- The largest effect of endangering the environment through this type of conveyance is reflected in building belt conveyor lines, whereby natural habitats of some animal and vegetable species are intersected. The conveyors lines have a negative impact on flora and fauna as well as on migration of some animal species.

Primenom ovih transportnih sredstava životna sredina je ugrožena sa više aspekata:

Zagađivanje vazduha:

- zagađivanje vazduha suspendovanim česticama javlja se na utovarnim, presipnim i istovarnim mestima na transporterima,
- zagađivanje vazduha suspendovanim česticama delovanjem eolske erozije i raznošenjem uglja sa transportera, kao i prosipanje uglja sa noseće trake usled lošeg centriranja ili bežanja trake iz pravca transporta,

Buka i vibracije:

- pojava nepovoljnog uticaja prekomerne buke kao posledica rada transportera sa trakom, posebno na mestu pogona transportera, ali i celim tokom transporta usled okretanja valjaka transportera,
- pojava buke na utovarnim presipnim i istovarnim mestima,
- štetni uticaja vibracija javlja se kako na pogonskim stanicama transportera, tako i celom dužinom trase transportera sa trakom.

Zagađenje površinskih i podzemnih voda:

- zagađenja površinskih i podzemnih voda neznatni su kod transporta transporterima sa trakom i njihov uticaj na životnu sredinu vezan je za atmosferske prilike (spiranje uglja sa transportera usled kiše snega i dr.).

Degradacija zemljišta:

- kao i kod prethodnih načina transporta uglja, i ovde se zemljište degradira izgradnjom trase transportera sa trakom, ali u mnogo manjoj meri od ostala dva pomenuta načina transporta.

Uticaj na floru, faunu i ekosisteme:

- najveći efekat ugrožavanja ovim načinom transporta ogleda se u izgradnju trasa transportera čime se presecaju prirodnih staništa biljnih i životinjskih vrsta. Trase transportera negativno utiču na biljni i životinjski svet kao i na migracije pojedinih životinjskih vrsta.

6 CONCLUSION

Inspite of the fact that there is a tendency of constructing thermal power units in the vicinity of big coal mines, large haulage lengths for coal conveyance from deposits to first consumers are still evident. Identifying and analyzing harms caused by coal conveyance through urban and natural environments, represent the first steps to the categorization of environments from the aspect of ore conveyance, with a view to identifying the most suitable methodology for selecting the best transportation system with the least harmful effect on the environment.

6 ZAKLJUČAK

Uprkos činjenici da se teži izgradnji termoenergetskih objekata u blizini velikih rudnika uglja, još uvek su evidentne velike transportne dužine za transport uglja od ležišta do prvih potrošača. Definisanjem i analizom štetnosti koje nastaju transportom uglja kroz urbane i prirodne sredine, vrši se prvi korak ka kategorizaciji životnih sredina sa aspekta transporta mineralnih sirovina, u cilju utvrđivanja najpogodnije metodologije za izbor najpovoljnije varijante transporta koja najmanje zagadjuje životnu sredinu.

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Ovaj rad je deo i jedan od rezultata projekta 17021 „ISTRAŽIVANJE TEHNOLOGIJA TRANSPORTA UGLJA IZ RUDNIKA KROZ PRIRODNE I URBANE SREDINE" koji finansira Ministarstvo za nauku Republike Srbije.

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