

ANALYSIS OF LOCATION FOR BUILDING OBJECT

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Abstract

In the center of Novi Sad according to town planning it is planned to build garage with several levels for private automobiles. The garage is projected for more than 300 vehicles. The building of this object is planned in first place because of the chaos city traffic, substantial lack of parking places. Considering the consequences that engine with internal combustion released in atmosphere CO, NO_x, Pb, HC etc... it is obvious that this location is inadequate for the object of this purposes regarding the environmental standards. Considering the planned location of the garage one can presume that it will be used by people employed in this part of town, which means that in rush hours multiple engine starting will be expected in short interval of time. It is well known that engine during the starting the emission of polluted gases is few times greater than during actual driving, so the logical conclusion is that in rush hours the emission of the polluted materials will be enormous.

Introduction

There is a few reasons for building object on this location:

- Parking garage in this part of city is necessary because huge lack of parking spaces and everyday heavy traffic which is made because plenty of vehicles are parked at the streets
- This location is one of few that are large enough for object like that
- There are no feature plans for significant increasing parking spaces in this part of city

According to latest register from year 1991. in township of Novi Sad lived 265.464 citizens. Population density in Novi Sad is higher than average density in Serbia and it is 380 citizens per square kilometer, but in some places it is 500 citizens per square kilometer.

In Buildings that are places around place for parking garage living about 1000 people. The biggest concentration of people is in streets around the location where are multistory buildings. This building are not rounded with enough green area per resident. The most endanger objects are 10 to 20 meter distanced from location.

According to plan parking garage is projected for 350 vehicles. It would be build on five levels (basement + ground floor + three floors), 14 meters high measured from the basement. The roof of the garage would be on 92 meters above sea level. Surface by floor would be 2600 m² with 2.8 meters height between floors and with 7300 m³ by floor. Also plan predict that each floor have 70 spaces for vehicles. As

cars coming and going, they are living behind plenty of gases from internal combustion, engine oil, antifreeze liquid, petrol, diesel, dust, iron, glass and plastic parts. The most significant pollutants are produced by exhaust emission from engine with internal combustion. Those gases are: NO_x , SO_x , CO, Pb, HC, particulate matter etc. Those gases can be identified in some amount always when engine works, but in time of starting engine there are few times raised emission. The biggest problem could be emission of NO_x . The NO_x is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Nitrogen oxides form when fuel is burned at high temperatures, as in a combustion process, such as in motors vehicles engines which are also the biggest producers of NO_x . Nitrogen oxides can travel long distances, causing a variety of health and environmental problems in locations far from their emissions source. These problems include ozone and smog, which are created in the atmosphere from nitrogen oxides, hydrocarbons, and sunlight. On smoggy days, you might notice difficulty breathing or trouble seeing objects in the distance. Nitrogen oxide emissions also contribute to the formation of particulate matter through chemical reactions in the atmosphere. At high levels, nitrogen oxides are known to cause lung damage and other respiratory illness, particularly in children and people suffering from asthma.

Illustration 1. Picture of a street near location.



Illustration 2. Location - view from north east



Illustration 3. Location - view from the north.



Illustration 4. Location - view from south west.



Methods

This project is based in environment impact assessment. All calculations, about exhaust emission, are simulated in Tscreen program.

For calculating as parameters are used : area of the emitting source (in second case it is 2700 m²), land qualification as urban and receptor height above ground is 2 m.

Motor vehicles - polluters

Exhaust emission from motor vehicles at first sight look like quite small pollution, but it is probable the biggest pollution activity...

Polluted gases from cars reach in air from three sources:

1. Gases of incomplete combustion of fossil fuels (**Exhaust Emission**)
2. Evaporation from engines and fuel tank (**Evaporative Emission**)
3. Evaporation during refueling (**Refueling Losses**)

Combustion Processes

Petrol and diesel are fuels get from petroleum and they consist mostly of hydrocarbons. In ideal engine which doesn't exist process of combustion would be like this:



Real combustion looks more like this:



Second formula also isn't completely correct because today petrol and diesel contain many additives and other chemical compounds which give to fuel better performance.

Quantity of pollution from exhaust emission depends of many factors such as old age of vehicles, technical order, quality of fuel and many other things. There are also climate factors, in winter there are more production of gases because low air temperature and incomplete burning processes.

Production of pollutants is higher when engine is cold and biggest is when cold engine starting - Cold Starting, also the lower production is when vehicles with hot engine is driving with small effort.

Many cold starting, driving vehicles with cold engine and driving vehicles on track that goes uphill - to next story(big effort), could be expect in parking garage. Also could be expect many starts of engines in short period of time because this garage would be used by people who work in this part of city. That means in rush hour could be great production of polluted gases.

There is a simulation in program Tscreen which give answers to question: What would be with NO_x emission when start one engine, and what would be when starts few engines in same time?

Results

Starting the engine of one, old and technical not so good vehicle, concentration of NO_x in the air can be so high and in some occasion it can exceed the maximal permitted value of imission for 24 hours. This is not a rule but it could happen. The much bigger problem is with multiple engine starting.

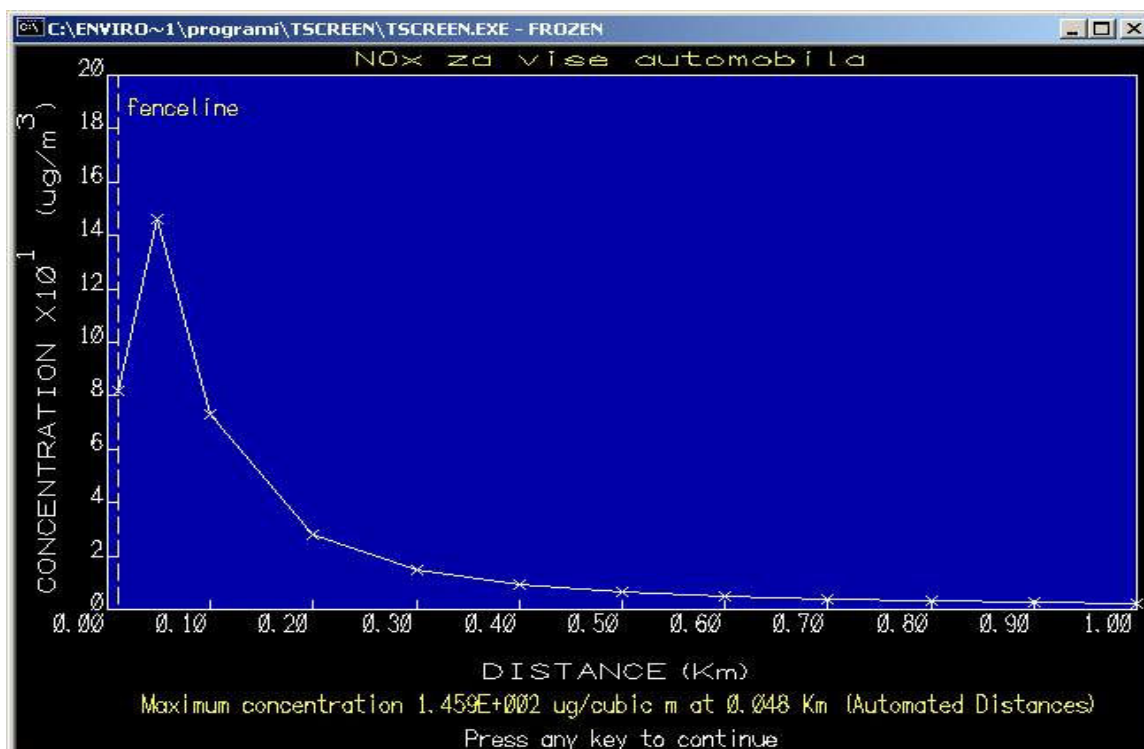
Gaseous Emissions from Multiple Fugitive Sources - Scenario 2.7							
DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	MAX DIR (DEG)
10.	81.85	6	1.0	1.0	10000.0	.00	45.
50.	145.2	6	1.0	1.0	10000.0	.00	45.
75.	103.1	6	1.0	1.0	10000.0	.00	45.
100.	73.15	6	1.0	1.0	10000.0	.00	45.
150.	42.80	6	1.0	1.0	10000.0	.00	45.
200.	28.15	6	1.0	1.0	10000.0	.00	45.
300.	14.92	6	1.0	1.0	10000.0	.00	44.
400.	9.354	6	1.0	1.0	10000.0	.00	40.
500.	6.501	6	1.0	1.0	10000.0	.00	36.

DIST = DISTANCE FROM CENTER OF THE AREA SOURCE
 CONC = MAXIMUM GROUND LEVEL CONCENTRATION
 STAB = ATMOSPHERIC STABILITY CLASS (1=A, 2=B, 3=C, 4=D, 5=E, 6=F)
 U10M = WIND SPEED AT THE 10-M LEVEL
 USTK = WIND SPEED AT STACK HEIGHT

<↑>, <↓>, <←>, <→>, Alt<↑>, Alt<↓>, <PgUp>, <PgDn>, <Home>, <End>
 <G> Graph <P> Print <F> Save to File <Esc> Exit

Table 1. Concentrations of NO_x at various distance from the source.

When five engines starts in short period of time, maximal concentration of NO_x can achieve to $145 \mu\text{g}/\text{m}^3$ without background concentration.



Graph 1. Concentrations of NO_x at various distance from the source.

In calculating, program didn't include climate factors as temperature and humidity of the air.

Discussions

Maximal NO_x concentration from second case (5 engines), together with background concentration, which is $8 \mu\text{g}/\text{m}^3$, already exceed maximal permitted value of imission four one hour. By national regulation for maximal permitted NO_x concentration is used a value of $150 \mu\text{g}/\text{m}^3$ for one hour in urban area.

There is a ring of residential multistory buildings around location for garage and all of that buildings are closer than 50 meters from the location. That means, huge number of residents could be victims.

Besides exhaust emission there are evaporative emission which are not calculated.

The value of background concentration is low and it doesn't give a real picture of situation because big part of industries does not working. Also everyday there is more and more vehicles on the streets, which are old 12 years in average.

Situation will be much changed if there would be some accident, like huge leaking from the reservoir.

Conclusions

Chosen location in encircled with multistory buildings that means air exchange is slower. Because of slow air exchange increased concentration of NO_x remain much longer. That could have bad influence, on first place, on people who live around parking garage.

Besides air pollution by NO_x there is noise pollution. So many vehicles which are pretty old have to make a great noise. Victim of that noise would be residents whose windows are located few meters from streets.

After all those assumption there is a question: "Is it the best location for building object like this?"

