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Reflections Of Motor Vehicle Transportation On The Pollution Of Iraqi Environment

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ABSTRACT

The paper shows that the number of vehicles in the country amounts to 3.14 millions, a two- folds compared to the vehicle numbers in the last decade. This huge number emits as much as 17.2 tons of exhaust gasses such as COx, NOx, SOx, lead, and other pollutants. This is equivalent to 40 gm/sq. kilometer of Iraq area. This paper also addresses the adverse consequences of this fast-becoming major problem for physical and mental health. It appears that this sector may lead to 40-100 deaths/10000 vehicle, a value that exceeds the global rate. Vehicles are gluttony consumers of fuel. It is estimated that 71 million liters of fuel are daily burnt in vehicles. This may create odor, thermal pollution, as well as other pollutants. More than 3 million used batteries and 6 million tires are yearly discarded. The fate of these materials is either burnt causing more air pollution or left on land and creating solid waste problems. This sector has other detrimental effects on environment. Noise pollution, tourist activities consequences, and military actions using such vehicles could bring about a detrimental bad impact on the environment. The paper concludes with some steps to be adopted so as to reduce the burden caused by motor vehicle sector on the Iraqi environment.

Keywords: Transportation pollution, Environmental pollution, Pollution.

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hυDŽgqsDŽIIE

Σδ! 2δŠzk!f fRNj LJD þδhυ .DδδŰl Dźl η Ŏ5 DźδŰl ýlZ LJdž LJĂ‡kk LJĆlLjŰf ŁơŢ LJD ýĆlδ Ćdž ĺŠδλ‡ ŠNjþzk LJ!Ă .Ćnjδ5 ţ δzk Ŏk!f KĆzdžknđž!f ŁơŢ ĬŰZ Ćnjkdžŭl Ŏ5 DźĆlηŰfĂ ýĂlz!f þdžkzk Rą .ĺδ5Ć‡ .ŁšδŰljĂ Łδơ Ţ ŁFδhυ ĆŎT ý‡ ýhp ykdžkk Dź! Ćdž ĆnjhυÅzT ĂD KĆzdžknđž!f

ŁŰơŠdž Ĭ!ą ýÅơk!f ŁδŰdžZ Ŏ5 YSĆlk!f Łηδkłj ŁδljþdŽ!f lĆδơ KhơĆŢ Ŏk!f ý‡ĆTdž!f LJdž ŁĂŰk!f þzδ ŭ!f Ɣ!ĆŎdž!f KfR lþlzdž!f ŁšŠŢz!f lĆδơ!f Ĭ!ą ŁŎĆlh!f lĆδơ LJdž ýĆlkljŰfĂ Ł ưnjŰ!f ýĂdŽTh ŠĆkdžk lþδþη Ćdž! ĺŠUlj LJĆlLjŰĆh ŁŎδơdž!f ŁFδh!f ĬŰZ ŁδhŰl!f ŠĆhŰf LJdž Šδλ‡!f ŝŰP Ĭ!ą ýÅơk!f fRNj ăþD þpĂ .lþÅþơdž ŁdžĆl KfŠĆƐ ĂD ŁhŰŢ Kŭưŏ5 ý‡T ĬŰZ LJĂ‡k þp ŁšZĆljŢĂ ŁšZfŠŠĂ ŁŠTh KĆŝŰPdž LJdž Ćnjδ5 Ĭ lδ ă Š PD KĆhÅŰdžĂ ŎŝljĂ ŁŠFĆδdžδ‡ þfĂdž LJdž ĆnjNjĆδdž Ĭ!ą Ɣ Šlkδ ĆdžZ ßưŏ ĆnjFfĂNj Ŏ5 þZĆŢkk lŠδŎPĂ lŠλ‡ Ɣhυlu .ŁFδh!f ŁÅŰk HŰ‡Tdž Ŏ5 ßδlĆlD ĺŠÅþ ƔzŰδ ýlLj!f YĆŎp LJ35 ŝŰŎLjdž!f fRNj LJdž þĆ‡kÅ .ŁšδŠ!fÅ ŁδLj‡l!fÅ ŁŠZĆljŢ!fÅ ŁŠĆηk!f ŝŎĆLjdž!f ý‡ Ŏ5 ĆNjŠĆTkljfÅ ŝŠŎ!f ĬŰZ ŁŰdžĆz!f KĆh‡Šdž!f 2ŭz!f Ŏ5 Ł ŝljk ljRNj ŁŠh!f ýlLj!f ŎFĆlÅÅ .ĆnjδŰZ KĆh‡Šdž!f ŠÅŠdž LJdž Ư ŠŰf LJdž Łzpŝ ĭD ÅŰPk Ů ýÅþ LJδh ‖!R Ŏ5 ŝ5 Ů CfÅnj!f Ł ÅŰk Ĭ!ą ‖!Rh ŁδpŒdž KĆhÅŰdž!fÅ KfšĆz!f LJdž ŁŰFĆNj ŠδpĆldž ĭ Ån!f .ŁδdžĆLj ýÅþ ÅD Łdžþlkdž

Dźþlk ăþdž! Łδ lĆlD lšδdžÅ ŎηÅ!Ălj‡k!fÅ Ŏdžŭz!f ŠÅŎkŰ! Łδdžkơ Łηδkłj LJĆ‡ ýlLj!f ŎFĆlÅ ŠÅŎk LJą ŁŝŰkPdž!f ýlLj!f ŎFĆlÅ Š5Åk! KfŠkdžÅŰδ‡!Ch Σδ!Å KĆzĆl!Ch KĆ5Ćldž!f LJÅlδlδ ΣĆLj!f OhŢD þl5 .LJfþŰh!f ĭ ŠĆươ!f Dźơŭk!fÅ ĭ Š‡ŝ!f R5ĆLjk!f Łzδ Ţ ýlLj!f ŝlơ þl!Å . Ư zhυ Dź!Ćz!f CfšηD ŎhŠ ĬŰZ Łδhυĉl!f Ćnj! Ŏk!f ‖ Špδ RPDÅ Dźþlk!f LJdž YÅLj!f fRNj Ŏ5 ŠULj!f lþĆZEhu Dþh lšδPŰf ŁLjÅŰf Ŏ5 LJĆlLjŰf LJą Ůą. Ư ŠŰf DdžD LJδh Ł!Ånjlh NhυĆlơ ĂD ljŠδþlk LJ‡džδ Ů LJdžλ!f fRNjÅ .LJdžλ LJdž N! þh Ů ŠPć ĆŎT ý‡ LJdT NLjdT DźþlK!f fRNj LJD ŎĆTLj ĭD LJdžλ LJD ĭD .[1]ŎZĆdžknŰf LJdžλ!f OŰŎŢdžh þĆŢkpŰf CĆdžŰZ NLjZ Šhzδ Ćdž NδŰZ ŝŰŎδ LJD LJ‡džδÅ CƳZ ŠPDh ĂD ý‡Th ýdžơkδl ydžknđž!f LJD ĬLjzdžh Ü Ćdž Ł lδŠŎh f ĆPTŰf LJdž ŁZÅdžηdž ĬŰZ Šλđδ LJD þhŰ .ŁŎTljŰf ljRNj

Łfδh!f ĬŰZ ĭ Šh!f ýlLj!f YĆŎp Ćnjλþơδ Ŏk!f ý‡ĆTdž!f ĬŰZ CĂư!f ŎδŰl k ł oh!f fRNj ýÅĆơδ .Šδl!f ŁδhυĆδljfÅ Łzδŝl!f ŝŠŎ!f Š5Åkh ŁljŠĆldž KĆh‡Šdž!f þfþZD Ŏ5 lŠdžkldž!f lþĆδs!f ł δơ LJdž ŁδpfŠz!f ŁljŠĆldž ĆnjljZ ŁηkĆlj!f KĆhÅŰdž!f Łδdž‡ lþĆδsÅ Łdžδþl!f KĆh‡Šdž!f KĆ‡Šơdž Ŏ5 ýŢĆơ!f ŠĆλþljŰf LJZ ŭưŏ5 .Ćnj! Ełj‡dždž!f ýÅŰơ!f Ư zhυ þĆηδą Ł!ÅĆơdžÅ .yĆlŢ!f Łλδþơ!f KĆh‡Šdž!Ch

þσJFTDŽIIE huyŲŲEþDŽ

Łh‡Šdž!f YÅlj Ɣlơ Å .(ýsδþ!DÅD LJδsljh!f) þÅpÅ!f LJdž lŠδh‡ KĆδdž‡ ĭ Šh!f ýlLj!f YĆŎp ‖Űnjklδ ŝŠT!f ýÅþÅ Łδh ŠÅŰf ýÅþ!f Ŏ5 %30 Ĭ!ą ýŢδ þÅpÅ!f LJdž YĆŎl!f fRNj ‖ŭnjklf Ó!Ćdžηą LJĆ5 Ćnjdžηơ Šδh‡!f ‖ŭnjklŰf Ɣhυlhλ .[2]Łδ‡δŠdžŰf lþơkdž!f KĆδŰÅ!f Ŏ5 þÅpÅ!f LJdž %50 Ĭ!ąÅ ĬLjþŰfĂ ŎlÅŰf NLjZ Nkljδ ‖!R! Ü $C_x H_y$ ŁδljÅŰh Š‡ÅŠþδnj!D Łδljδ5fŠĆh!D KĆh‡Šdž!f LJdž ŁZÅdžηdž ĂNj þÅpÅ!f LJŰÅ ŁpĆŎŰ! þδlĆ‡DÅ CO_x LJÅŰh Š‡!f þδl‡ÅD ÓljĆλÅ ýÅD KfšĆƐ ĆnjdžNjD LJdžÅ Ł5ŰkPdž!f KĆλÅŰdž!f LJdž lŠδh‡ KĆδdž‡ þδlĆ‡ŰfĂ KĆdžδlη!f Ĭ!ą Ł5Ćưą HC KĆljÅh Š Ć‡ÅŠþδnj!fÅ SO_x KδŠh‡!f þδlĆ‡DÅ NO_x LJδηÅŠkδlj!f ΣδfS!f Ɣhldž!f ýlLj!f ŎFĆlÅ Šhkzk5 ŠĆŎdžŰf ljĆδdžÅ CfÅnj!f Ŏ5 lþÅηÅdž!f f ĆŢS!f KĆh‡Šdž Ćdž D .ŁδFÅư!f .ŁδZĆljŢ!f ŠδƐ LJþdž!f Ŏ5 ĆŢÅŢPĆnj!

Ćnjhυl ýŢÅdž!f ŁljδþdžCfÅηD Ŏ5 lþÅηÅdž!f f ĆŢS!f KĆh‡Šdž LJdž %70 ù 60 LJdž Šλ‡D LJD Ł ÅŰk LJZ ŁηkĆlj Łh Šk!f ŎSÅ ŠĆŎdžŰf ljĆδdž Ŏ5 f ĆŢS!f KĆh‡Šdž! ΣδfS!f Šþŝdž!f LJfÅ þÅpÅ!f ŝfŠkδf ýhp KδŠηf Ók!f NLkl fŠþ Ŏ5 [4] (1989 LJÅSPfÅ ýδŰP) Khλf Ćdž‡ .[3] KĆh‡Šdž!f Ł‡Šơ Ɣhυlu CfÅnj!f Ŏ5 Ŏlδ fS!f Ɣhυl!f ŎNj KĆh‡Šdž!f LJfÅ f ĆŢS!Ch NλÅŰdž ýŢÅdž!f ŁljδþdžCfÅηf LJf KĆh‡Šdž!f þfþZf lþĆδs KδŠh‡!f KĆh‡Šdžh CfÅnj!f Ł ÅŰk! Ćhυl LJÅ‡δ KδŠh‡!f ĬŰZ ĭ ÅkơdŽ!f þÅpÅ!f LJf ýh Ɣlơ5 fRNj Σδ! . ‖!R þÅpÅ!f ŝfŠkơf LJZ NkĆlj ýŢÅdž!f ŁljδþdžCfÅNj Ŏ5 lþÅηÅdž!f KδŠh‡!f þδlĆ‡D ŎλŰk LJdž Šλ‡D LJfÅ KfþD þl5 Dź!Ćz!f ăÅklδ ĬŰZÅ .[5]ýsδþ!f þÅpÅ ĆŢÅŢPÅ KδŠh‡!f ĬŰZ ĭ ÅkơdŽ!f ŎLjÅhŠĆ‡ÅŠþδnj!f ŠTkljδ ăŠPŰf KĆλÅŰdž!fÅ KfšĆz!fÅ ŠĆhz!f LJdž LJŎ LJÅδŰdž (150) Ó!fÅơ LJD Ĭ!ą lþơkdž!f DdžŰf KĆδjFĆŢơą

Ǒ!Ġdžŋǧ LJdž %40 ýlĮ!ƒ LJƵ JNkĠĮ!ƒ ł Ăl̈k!ƒ ѕĂѕöĂ .Ǒ ư ƧŰ̄ƒ Ɣ‡Ă‡!ƒ ǑƱƹǒ ĭ Ʀ!ƒ CƒĂnj!ƒ Ǒ5 ƱöĂĮ].[6] ăƧPŰ̄ƒ ƘĠ̀ĂĂl̈dž!ƒ

ƘĠ̀ĂĂl̈dž ǑNj ǑlP̈fþ!ƒ ѕƒƧkơŰƒ ƘĠ‡Ƨơdž LJdž Ł̀ƶzhŮjdž!ƒ ƘĠ̀ĂĂl̈dž!ƒ DiUzdž LJD LJdž Dižƨ!ƒ Ĭ l̈ƵĂ ĠNjƧöƙĂk LJDĂ ýh .ljĠödž!ƒĂ Ɨhƨk!ƒ ýƙdž LJĠ̀ĮŮ̀Ġh ƬƱöơdž!ƒ ƗfÖh!ƒ ƧŢĠ̀ljƵ Ɨólh Ĭ!ǧ ýŢǒ ĠNjƧöƙĂk LJD Ůǧ ÜƗöƨĠ̀ƹ Ǒk!ƒĂ ƧTĠhdž ý‡Th LJĠ̀ĮŮ̀ƒ Dižɳ Ǒ5 ƘĠ̀ĂĂl̈dž!ƒ ƨöƈƒƧk lpĠöƨ Ĭ l̈Ƶ ýdžƶöĂ LJĠ̀ĮŮ̀ƒ Ɨơ Ţ ýĠƱǒ ƧTĠhdž!ƒ ƥpĂ .ƘĂdž!Ġh Ǒnjƙljk ƥp Ǒk!ƒĂ Dižɳ!ƒ Ǒ5 Ɨl̈ólƚ!ƒ ƧŢĠ̀ljƵ! Ư ƶh Di‡ƒƧk ƥơ Ĭ!ǧ ýŢkĂ Yƒþ Ţ!ƒĂ ƧƒĂþ!Gh Dƥhuk ƘĠ̀ĂĂl̈dž!! Ġư Ƨƶk Σ Ġlj!ƒ Ƨƚ‡Ð LJdž DiNj ƧĂƧdž!ƒ ƬƱST LJD [7] (1989 LJĂƧPćĂ yölƱǒ) Ɨlƒ Ƨþ ƘĠljƱh yđž Dižɳ!ƒ Ǒ5 ljƶǒ‡Ƨk lpĠöƨĂ Di‡ƒƧk!ƒ Ĭ l̈Ƶ Ɨöl̈hĠl!ƒ N! ĭ Ʀ!ƒ f Ġ Ţ Ƨ!ƒ ýƚdž Ɨl̈ólƚ!ƒ ƧŢĠ̀ljƶ!ƒ Ġ Ţ Ă Ţ PĂ .ƘĠ̀ĂĂl̈dž!! Dižɳ!ƒ Ư Ƨƶk lƧk5 lpĠöƨ

hư ɭ ƽFđDŽllƐNj ƛəƑƬđžllƐ

ƘĠ‡Ƨơdž!ƒ ljƦNjĂ .ƧPƀh ĂD ý‡Th ǑlPfþ!ƒ ѕƒƧkơŰƒ ƘĠ‡Ƨơdž CĠljƛkɭƒ LJĂƥh ýlĮ!ƒ ƱƑĠɭĂ DižPkɭk þǒɭĠ‡ƒĂ ƘǒƧh‡!ƒ þǒɭĠ‡ÐĂ LJĂhƨ‡!ƒ þǒɭ‡ĂD ýĂD ǑNj Ɨǒɭ Ġ ư D NŏƨĠƹ ƘĠ̀ĂĂl̈dž yhƧD ĭĂɳ!ƒ Ƨ ŭʒ!ƒ Ǒ5 ł sljk þǒɭĠ‡ƒ ydž ƘĠljĂhƨĠ‡ĂƧþönj!ƒ ýƵĠsk LJdž JNkljk5 ƗǒFĂ ư Ġödžö‡!ƒ þǒɭĠ‡Ū̄ƒ Ġdžf. ƘĠljĂhƨĠ‡ĂƧþönj!ƒĂ LJǒɳĂƨĠƙöl̈j!ƒ LJ‡džD fRǧĂ .(Smog) ǑlĮĠ̀Pƥ!ƒ Ɣ Ġh ư!Gh Ƨƨzǒ Ġdž JNkljk Ǒk!ƒĂ Ɨǒɭ džT!ƒ ŁƶTŰ̄ƒ lƥZĠɭ dždhĂ LJǒɳĂƨĠƙöl̈j!ƒ ĂD LJĠ̀Pƥ ý‡T Ĭ l̈Ƶ ƘĠ̀ĂĂl̈dž!ƒ ljƦNj þĂɳĂ LJD Ůǧ Ü ƘĠh‡Ƨdžl̈! ýöƶTk!ƒ Ƨ ĂƧU LJ ɭ ơD Ǒ5 ƘĠ̀ĂĂl̈dž!ƒ ljƦNj ƨĠ‡Ljǧ .ѕöƨƱ!ƒ ǑdžþPkɭdž ýhp LJdž ljƨĠ‡Ljǧ LJ‡džö Ů Dižöþɭ!ƒ Ɣ Ġh ư

ѕƒƧkơŰƒ ƘĠ‡Ƨơdž Ǒ5 ýdžĠ‡ Ƨöƶ!ƒ ѕƒƧkơŰƒ Ɨöl̈džZ LJdž CO LJĂhƨĠ‡!ƒ þǒɭ‡Ăf ýĂf ƨĠƐ ł zhljö Ɣhɭh NO_x LJǒɳĂƨĠƙöl̈j!ƒ þǒɭĠ‡ƒ LJĂ‡ƙkĂ . ѕƧkơdž Ƨöƹ þĂpĂ‡ ƘĠljĂhƨĠ‡ĂƧþönj!ƒ ł zhljk Ġdž‡Ū Ǒl̈Pfþ!ƒ ƘöƧh‡!ƒ þǒɭĠ‡ƒ Ġdžd .ѕƒƧkơŰƒ Ɨ5Ƨ Ǒ5 Ɨö!Ġz!ƒ lƧƒƨơ!ƒ ƘĠɳƧþ Ǒ5 LJǒɳĂƨĠƙöl̈j!ƒ yđž LJǒɳɭ‡ĂŰ̄ƒ ýZĠ5k Ɨɳǒƙlj ĂNj NO_x Ă CO ƨƨơk LJd5 yþƒĂ!ƒ ǑƵĂ .ƘöƧh‡!ƒ LJdž Ɨhɭlj Ĭ l̈Ƶ þĂpĂ!ƒ CƒĂkơƒ þljZ JNkljk5 ýĂŢơĂ ѕƒƧkơŰƒ Ɨöl̈džZ ýĠdžk‡ƒ Dižpzh Ɨl̈ólĂ Ɨpŭƶ Ġnj!Ă ѕƒƧkơŰƒ Ɨ5Ƨ Ǒ5 ł þơk lƥlzdž ƘŭƵĠ5k! .[8] LJƨƒĂk!ƒ ƒRNj ýƚdž ýĂŢơĂ ѕƒƧkơŭ! Ǒ5Ġ‡!ƒ ƘpĂ!ƒ ƧƵĂk Dižþƶ Ɣhɭh ǑƒĠödžö‡!ƒ LJƨƒĂk!ƒ

$$C\ C_x\ H_y + (O_2 + 3.76N_2) \rightarrow aCO_2 + bCO + dNO_x + y/2H_2O + eH$$

ѕƒƧkơŰƒ JNkƒĂLj þĂpĂ CƒĂNj

ǁ önjĠLj . f Ġ Ţ Ƨ!ƒ ƘĠh‡Ƨdž ýƚdž ƘĠ̀ĂĂl̈dž!ƒ LJdž þöþƶ!ƒ ƘĠ‡Ƨơdž!ƒ ljƦNj LJƶ Ƨþ Ţ ǒ ƒRNj Ĭ!ǧ Ɨ5Ġ ư ǧ .þĂpĂ!ƒ ѕƒƧkơƒ þljƶ ýŢơǒ ĭ Ʀ!ƒ ĭ Ƨƒƨơ!ƒ ł Ăl̈k!ƒĂ ƗljĂ‡kdž!ƒ ƘĠdžöɭɳ!ƒ LJƶ Ĭ!ǧ ƘĠh‡Ƨdž!ƒ þþƶ ƗhɭljĂ ýöl̈p ƘĠh‡Ƨdž!ƒ þþƶ LJĠ5 ѕƒƶ!ƒ Ġnjö5 Ġdžh ƱɭĂŰ̄ƒ ѕƧT!ƒ ýĂþ Ǒ5Ă ѕƧT!ƒ ýĂþ Ksljŀ þ15 .Ǒlljƥkdž!ƒ ǑŢĠƶdž!ƒ ăĂkɭdž!ƒ CƒƧɳ ƗölljƥkdžĂ Ɨl̈ólp ăƧPŰ̄ƒ ǑNj f ĠPTŰ̄ƒ þþƶ þþƶ Ƹ̈h þ15.[9]Ɨölljƥkdž!ƒ Ĭ kơĂ ƗƱɭĂkdž!ƒ ƗöƧ Th!ƒ Ɨödžljk!ƒ ǑkF5 LJdžư Ɨöh Ƨz!ƒ ƘĠƶdžknđž!ƒĂ ƱɭĂŰ̄ƒ Ĭ l̈Ƶ ýŢö! þþz!ƒ þfþƨfĂ lƧöƹŢ Ɨh‡Ƨdž (672205) Di1990 DiĠƶ! ѕƒƶ!ƒ Ǒ5 lƧöƹŢ!ƒ ƘĠh‡Ƨdž!ƒ LJdž lƧöh‡ þfþƵD ýĂPþ Ɣhɭh Di2003 DiĠƵ þƶh ĠdžD .Di2000 DiĠƵ Ǒ5 lƧöƹŢ Ɨh‡Ƨdž (806646) ĭ D Ɨh‡Ƨdž 1826000 LJdž Ƨł‡D ƧƱ!ƒ ýŢĂ þ15 Ġnj! ǑpfƧz!ƒ LJƱƒĂdž!ƒ Ɨɳĝơ!Ă ǑFƒĂTƵ ý‡Th Kfƨĝǒɭ!ƒ 2632646 Ĭ!ǧ LJǒƨljh!Gh Ɨl̈džĠƶ!ƒ Kfƨĝǒɭ!ƒ þþƵ Ǒ!Ġdžŋǧ ýŢö! Ü ĭ ŭŢD þĂɳĂdž!ƒ ƘĠh‡Ƨdž!ƒ þþƵ ƨ ư KfĂljɭ!ƒ ýŭP Kfƨdž lþƵ ƨƵĠ ư k þp ѕöƧƱ!ƒ Ĭ l̈Ƶ Ɨl̈džĠƶ!ƒ Kfƨĝǒɭ!ƒ þfþƵf LJf ĭD . [12,11] lƧĝǒɭ Kfƨĝǒɭ!ƒ ǴnjöƵĂljh ƘĠh‡Ƨdž!ƒ þfþƵD Ǒ5 lƧdžkɭdž!ƒ lþĠöƨ!ƒ LJƵ lƨ‡5 ǑƱƶǒ (1) Dipƨ ýĂþŋ!ƒĂ Ɨ ư Ġdž!ƒ .(ýƨöþ!ƒ Kfƨĝǒɭ) ƘĠljơĠT!ƒĂ Ƙ Ţ Ġh!ƒĂ (LJöƨljh!ƒ Kfƨĝǒɭ) lƧöƹŢ!ƒ LJdž ýpD ǴnjljD Ůǧ (Di2000 DiĠƵ Ɨöĝƹ!) ƘĠh‡Ƨdž!ƒ þfþƵD Ǒ5 ýFĠnj!ƒ þöfƨk!ƒ LJdž Dižƨ!ƒ Ĭ l̈Ƶ 38) Di1990 DiĠƵ Ǒ5 ѕƒƧz!ƒ Ǒ5 ƘĠh‡Ƨdž!ƒ ǁ ŭkdžf ƱɭĂkdž Ƹ̈h þ15 .Di!Ġz!ƒ Ǒ5 ƘĠh‡Ƨdž!ƒ ǁ ŭkdžf ƱɭĂkdž 1000 / Ɨh‡Ƨdž 75) Ɨljɭ!ƒ Σ sljɭ Di!Ġz!ƒ Ǒ5 ƘĠh‡Ƨdž!ƒ ǁ ŭkdžf ƱɭĂkdž LJĠ‡ ĠdžljöĥĂ (f PT 1000 / Ɨh‡Ƨdž (f PT 1000 / Ɨh‡Ƨdž 540) ƘĠh‡Ƨdž!ƒ ǁ ŭkdžf ýpƶdž LJĠ‡ Ɨöƨ‡ƧdžŰ̄ƒ lpơkdž!ƒ ƘĠöŮĂ!ƒ Ǒ5Ă .(f PT .[13]

ƨƱ!ƒ ýŢĂ þ15 ĠNjƧƶljD Ư Ġs Plj fĂ Kfƨĝǒɭ!ƒ þfƨǒkɭƒ Ǒ5 ΘĠksljf ýĂŢơ!Ă Di2003 DiĠƵ þƶhĂ ĭD . f ĠhĂ lƧöh‡ Ɨh‡Ƨdž (105000) Ă lƧöƹŢ lƧĝǒɭ (1826000) ĠnjljdžĂ Ü Ɨh‡Ƨdž (1931000) þĂpơh fRnjhĂ .ŭŢD lþĂɳĂdž!ƒ Kfƨĝǒɭ!ƒ þþƵ Ƨ ư ĂNj LJǒkö ư Ġdž!ƒ LJǒkljɭ!ƒ ýŭP ƨƱ!ƒ ýŢĂ Ġdž YĂdžŋdž LJD

/ [illegible] 10.1) [illegible] ([illegible] 1000/[illegible] 99) [illegible] [illegible] [illegible]

(1) [illegible]

[12,11] [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	275	83	192	**1978**
19.2	381	114	267	**1980**
21.9	548	153	395	**1982**
14.4	706	176	530	**1984**
9.2	836	209	627	**1986**
5.0	920	270	650	**1988**
6.5	1040	368	672	**1990**
2.1	1150	385	735	**1995**
2.4	1289	405	806	**2000**
28	3140	508	2632	**2005**

[illegible] (60) [illegible] (90) [illegible] .[14] [illegible] (120) [illegible] CO_2 [illegible] H_2O [illegible] (1) [illegible] .[15] (2) [illegible]

(2) [illegible]

[illegible]

[15]([illegible]) [illegible]

[illegible] % [illegible]	[illegible]	[illegible]	[illegible]
844	29.5	249.0	[illegible]
500	1.95	9.72	[illegible]
20	47.2	9.85	[illegible]
8.9	4.15	0.37	[illegible]
-	-	0.37	[illegible]
-	1.9	-	[illegible]

ŧǚdžĜƶ!ƒ ƘƒƧĜŏƪ!ƒ ǊþĜƵ Ǉdž þƵĜƮkŏ ǇĂhƧŧ!ƒ þŏƪŧĂǊ ýĂǊ ƨĜƹ ǇǊ ýĂþŋ!ƒ ƒŖǋ ýǚƤ Ǉdž Ʊơǚŏ
ǁ!ŖĂǛŧ5Ĝƪdž!ƒ Ʃ5lj! Ƨŏƪ!ƒ þljƵ ýƨŏþ!ƒ ƘĜŧƧơdž Ǉdž þƵĜƮkk Ŏk!ƒ ŧŏdžŧ!ƒ ƻĜƶưǊ (8) ƔƧĜlŏ Ĝdžh ǇŏƨljhĜh
ǇǊ ǁ ù!Ŗ ýĜùƛdžĂ . ǇŏƨùljhǊ ƘĜŧƧơdž Ǉdž ĬǚƵǊ (þĂpĂ Ĭ!ƒ ƇƒĂǋ) ŧhƪlj þljƵ ýdžƶk ýƨŏþ!Ǌ ƘĜŧƧơdž ǇǛ
.ýƨŏþù!ƒ þĂpĂ Ƨk!/Ǌƶǚdž 29.5 Ƨƒþldžh ŧljƧĜldž ǇŏƨljhǊ þĂpĂ Ƨk!/Ǌƶǚdž 249 þĂþơh ýdžƶk ǇŏƨljhǊ ƘƒƧĜŏƪ
ŧùǚdžĜƶ!ƒ ƘƒƧĜŏƪù!ƒ ǇùŏÐ lþƵĜƮùkdž!ƒ ǁǚk ƘƒƧdž (5) ƔƧĜlŏ ŧŏljĂhƧŧĂƧþŏǌ!ƒ ƘĜhŧƧdž!Ĝh ŧĂǚk!ƒ ǇǊ Ĝdžŧ
þƵĜƮùkk ĜùdžljŏƜ .ýƨŏþù!ƒ þĂpĂ Ƨk! 1.95 / ǇŏƨljhǊ þĂpĂ Ƨk!/Ǌƶǚdž 9.72 ŧdžƪp ǇƵ ǋkĜlj ĂǋĂ Ǜýƨŏþ!Ĝh
ƘĜùŧƧơdž ǇùŏÐ þƵĜƮùkk Ŏùk!ƒ ǁǚk ƻĜƶưǊ ŧƪdžƤ ýþĜƶk Ĝdžh ýƨŏþ!Ǌ ƘĜŧƧơdž Ǉdž ǇŏŋĂƧkŏlj!ƒ þŏƪĜŧƒ
Ĭ!ǫ ƻĜưdž!ƒ ƒĜƮƧ!ƒ ƽƒƧkơƒ Ĭ!ǫ þĂƶk5 ƘƒƧĜŏƪ!ƒ ǊþƒĂƵ Ǉdž ŧƛƶhljdž!ƒ ƒĜƮƧ!ƒ ƘĜhŧƧdž ĜdžǊ .ǇŏƨljhǊ
%25 ǇǊĂ. ǋùŏ!ĜƵ ƱĜƶưǊ ŧhƪlj þljƵ ýdžƶŏ ǁƧơdžǊ ýƶŋŏ Ĝdžŏ Ǜ þĂpĂǚ! ŎljĜkŧĂǛǊ þþƶ!Ǌ Ǉŏƪơk! ǇŏƨljhǊ
Ĭù!ǫ ŧùŏĂŋ!ƒ ýdžƒĂƶ!ƒ ŧƱƪƒĂh ýdžơk! Ăŋ!ƒ Ĭ!ǫ ŧŏdžŧ!ƒ ŧƶhljkĂ lƧĜŏƪ!ƒ Ŏ5 Ĭlhŏ Ŏ!ĂƧkh!ƒ ƒĜƮƧ!ƒ Ǉdž
.[16] ŧhƧk!ƒ ĂǊ ƇƒĂǋ!ƒ Ŏ5Ă ŧhŏƧl!ƒ ƽƱĜljdž!ƒ

ŧŏƪŏƒƧ!ƒ ƽƧƱ!ƒ ǇƵ lþŏƶh!ƒĂ ŧhŏƧl!ƒ ýƮĂdž!ƒ ŧljŏþdž ƔƧk Ǉdž ǛŖĜdžlj ýdžŋ ǊƜk ŧơh!ƒ ƒŖǋ Ŏ5
ƔƧk Ŏ5 ƒĜƮƧ!ƒ ƨŏŧƧk ǇĜŧ þl5 .ƔƧk!ƒ Ŏ5 þĂŋĂdž!ƒ ƒĜƮƧ!ƒ ƨŏŧƒƧk Ŏ5 ƠưƒĂ ƽƧ5 ǁ!Ĝljǋlj ƧǌǓĂ
ƽƱĜljdž!ƒ ƔƧk Ŏ5 þƒþƨŏĂ ŧhƧk Ǌƹ/ǊƒƧƹĂƧŧŏĜdž 200 þĂþơh ŧŏƪŏƒƧ!ƒ ƳƧƒĂƬ!ƒ ǇƵ lþŏƶh!ƒ ƽƱĜljdž!ƒ
ƘƒƧĜŏƪ!Ĝh ŧdžơþƨdž!ƒ ƽƱĜljdž!ƒ Ŏ5 ĜdžǊ .ŧhƧk Ǌƹ/ǊƒƧƹĂƧŧŏĜdž 400 Ĭ!ǫ ýƮŏ! ŧŏƪŏƒƧ!ƒ ƳƧƒĂƬ!ƒĂ ŧhŏƧl!ƒ
.ŧhƧk Ǌƹ/ǊƒƧƹĂƧŧŏĜdž 500 Ĭ!ǫ ýƮĂĂ ƧƛŧǊ ƒĜƮƧ!ƒ ƨŏŧƧk þƒþƨƒ þl5 ŧljŏþdž!ƒ ƨŧƧdž ýƛdž

ŧǚdžĜƶ!ƒ ƘĜhŧƧdž!ƒĂ lƧĜŏƪ (2632×10^3) ŧƶ!Ĝh!ƒĂ ǇŏƨljhĜh ŧǚdžĜƶ!ƒ ƘƒƧĜŏƪ!ƒ þƒþƵǊ ŧ5ƧƶdžŽ ǇdžĂ
ĜǌkhƪljŽ ŧƶ!Ĝh!ƒĂ ƽŏƧƱ!ƒ ĬǚƵ ŧǚdžĜƶ!ƒ ƘĜhŧƧdž!ƒ þƒþƵƒ ƔĜƪơĂ ŧhŧƧdž (508×10^3) ŧƶ!Ĝh!ƒĂ ýƨŏþ!Ĝh
ƔĜƪơ Ǌk Ĝdžŧ.ƞŏdžĂŏ ƽŏƧƱ!ƒ ĬǚƵ ŧǚdžĜƶ!ƒ ƘĜhŧƧdž!ƒ þƒþƵƒ ŧ5ƧƶdžŽ Ǌk [12] Ŏǚŧ!ƒ þþƶ!ƒ Ǉdž (%90-80)
(ýƨŏþ!Ĝh ŧǚdžĜƵ ŧhŧƧdž/Ƨk!26.2)Ă (ǇŏƨljhĜh ŧǚdžĜƵ lƧĜŏƪ/Ƨk! 23.9) ýþƶdžhĂ ƞŏdžĂŏ ǁǚǌkƪdž!ƒ þĂpĂ!ƒ ŧŏdžŧ
ŧŏdžŧĂ (ǊĂŏ/Ƨk! 60.88×10^6) Ƙƶǚh ƞŏdžĂŏ ǁǚǌkƪdž!ƒ ǇŏƨljhǊ ŧŏdžŧ Ǉƒ ĭǊ . (ŧhŧƧdž/Ƨk! 25) ýþƶdžhĂ
ƻǚƶ!ƒ Ĭ!ƒ ŧ5ĂŖldž!ƒ ƘĜƛĂǚdž!Ǌ Ǌŋơ ƔĜƪơ Ǌk . (ǊĂŏ/Ƨk!10.16×10^6) Ƙƶǚh ƞŏdžĂŏ ǁǚǌkƪdž!ƒ ýƨŏþ!ƒ
Ǜ ƞŏdžĂŏ ǁǚǌkƪdž!ƒ þĂpĂ!ƒ ŧŏdžŧĂ (2 ǊpƧ ýĂþŋ) ŧhŧƧdž ýŧ ĜǌƽŖlk Ŏk!ƒ ƘĜƛĂǚdž!ƒ ŧŏdžŧ ýǚƤ Ǉdž ĭĂŋ!ƒ
. ĭĂŋ!ƒ ƻǚƶ!ƒ Ĭ!ǫ ŧơĂƧƱdž!ƒ ŧŏƨĜƶ!ƒ ƘĜƛĂǚdž!ƒ ŧŏƵĂljĂ ŧŏdžŧ (3) ǊpƧ ýĂþŋ!ƒ ǇŏhŏĂ

(3) ǊpƧ ýĂþŋ
(ǊĂŏ ýŧ! ǇƱ) ŧ5ǚkƤdž!ƒ ýlj!ƒ ƱƒĜƪĂ Ǉdž ŧ5ĂŖldž!Ǌ ƘĜƛĂǚdž!Ǌ ŧŏdžŧ

ƱǋǊƵǇǊǁƐ	üŖĭǫǁƐ lƐþƒĭƨ	ǊĭŖdžĜǁƐ lƐþƒĭƨ	lƒkǋŧǊƵǁƐ hĭƳǋdž
15.46	0.3	15.16	ǇĂhƧŧ!ƒ þŏƪŧĂƒ ýĂǊ
0.62	0.02	0.60	ƘĜljĂhƧĜŧĂƧþŏǋ
1.08	0.48	0.60	ǇŏŋĂƧkŏlj!ƒ þŏƪĜŧƒ
0.064	0.042	0.022	ƘŏƧhŧ!ƒ þŏƪŧĂƒ ŎljĜƛ
0.022	-	0.022	ƒĜƮƧ!ƒ
0.02	0.02	-	ǁĜljŖƪ!ƒ
17.26	0.86	16.4	ǊĂŏ ýŧ! ǇƱ / ƳĂdžŋdž!ƒ

ǊǓkljdž ýŧƬh ƘƧƬkljƒ Ă! (ǊĂŏ/ǇƱ17.26) ŧƶ!Ĝh!ƒĂ ŧŏƨĜƶ!ƒ ƘĜƛĂǚdž!ƒ Ǉdž ŧǚƒĜǌ!ƒ ŧŏdžŧ!ƒ ljŖǋ Ǉǫ
ýŏƶƬk! ǋŏ!ĜƛdžƵ ƻĂƧǓ!ƒ ǇǊ ƧĜhkƵƒ ĬǚƵĂ (²Ǌǚŧ 440×10^3) ŧƶ!Ĝh!ƒ Ŏpƒƶƶ!ƒ ƧƱl!ƒ ŧơĜƪdž Ŏ!Ĝdžŋǫ ĬǚƵ
.ǊĂŏ ýŧ! ŧŏƨĜƶ!ƒ ƘĜƛĂǚdž!ƒ Ǉdž (Ǌƹ 40) ĭĂĜƪŏ þơƒĂ! ýhƧdž!ƒ ƧkdžĂǚŏŧ!ƒ ŧƮơ ǇĜŧ! ƘĜhŧƧdž!ƒ
ŧƵƧƪ ĬǚƵ þdžkƶŏ ƘĜhŧƧǚdž!ƒ Ǉdž ǇŏƵĂlj!ƒ ǇŏŖǋ Ǉdž ŧƛƶhljdž!ƒ ƘĜƛĂǚdž!ƒ ŧŏdžŧ ǇƵ5 ăƧƤǊ ŧǌŋ Ǉdž
ƘƒƧĜŏƪ!ƒ ýƨƪk ǇǊ Ʊơǚŏ ŧŏơ.(4 ǊpƧ ýĂþŋ!ƒ) ǁ!Ŗ Ǉŏhŏ Ĝdžŧ lþƒĜƪ!ƒ ŧŏƒŏh!ƒ ƻĂƧƱ!ƒĂ ƘĜhŧƧdž!ƒ
þŏƪĜŧƒ Ǉdž þŏƨŏĂ ƘĜljĂhƧĜŧĂƧþŏĜǌ!ƒĂ ǇĂhƧŧ!ƒ þŏƪŧĂƒ ýĂǊ ŧĜƶhljƒ Ǉdž ýǚlŏ ǇŏƨljhǊ ĬǚƵ ŧǚdžĜƶ!ƒ
ŧĜƶhljƒ Ǉdž ýǚpǛƒ Ĭ!ǫ ĜǌkƵƧƪ lþĜŏƨ ĭþƌk5 ýƨŏþ!Ĝh ýdžƶk Ŏk!ƒ ƘĜhŧƧǚdž!ƒ ĜdžǊ .ƠưƒĂ ýŧƬh ǇŏŋĂƧkŏlj!ƒ
ŧƶ!Ĝh!ƒĂ ŧhŧƧdžǚ! ŧŏ!Ĝƛdž!ƒ ŧƵƧƪ!ƒ Ĭlhk.ǇŏŋĂƧkŏlj!ƒ þŏƪĜŧƒ Ǉdž lþĜơ lƧĂƮh þŏƨŏĂ ƘĜljĂhƧĜŧĂƧþŏǌ!ƒ

ýpƒ Ŏ!Ǵk!ĠhĂ þĂpĂǜ! ýdžǴ+kdž ѕƒƨkơƒ ĬǜZ ýĂŢơǜ! ƘĠh+ƨdž!ƒ ƘŮǴơ ýư5ƒ ŎNj (ŦZǴ]/bžǜ+ 100-80) .[18] Ŧ5ĂĶ]dž!ƒ ƘǴĂǜdž!ƒ LJdž Ŧ0dž+ Ǵnjƶdž ýdžǴƶkk Ŏk!ƒ Ŧ0ǜ5]!ƒ Ŧ0Fƒ Ănj!ƒ Ŧ!hƟ!ƒ Ŏ5 Ƨ Ķ!k ǴnjĻD ƘƒƨǴ0]!ƒ DžþǴZ lƨĂƟP LJdž þ0ƨ0 ǴdždžĂ Ĭ!ϙ ƨTĠhdž ý+ThĂ ŦZƨ]h ƘǴĂǜdž!ƒ ý!kĻjk DžĂ LJdžĂ ƨTĠhdž ý+Th (ƘĠhĻ!ƒ Ü LJƒĂ0ơ!ƒ Ü LJǴ]ĻÚf) CǴ0ơŪƒ .Ŧ0ĻjƒĂ0ơ!ƒ lĂƨ!ƒĂ Ŧ0Zfƨ ƨ!ƒ ý0Ţǵơdž!ƒĂ LJǴ]ĻjÚf

(4) Džpƨ ýĂþη

[17]Ŧ5ǜĬkPdž!ƒ ý0ƶTk!ƒ Ƨ ĂƨU Ƙơk DžþƒĂz!ƒ Ƙƒ ƨǴƐ Ŏ5 ƘǴĂǜdž!ƒ ƨ0+ƒƨk

hYþ ƨ ll€				ƘNj+ĐŽll€ ƟNjdž	ƟNjdž hǴ!þĐŽll€
DUƒǴFll€	hYþ ƨ ll€ huĬllƒkĐŽll€	ƟþƒƨFll€	huəĬƯǴ		
2.00	1.8	2.5	7	% LJĂhƨ+!ƒ þ0]+Ăƒ ýĂD	]ƒǴ!þĐŽll€ üĐŽyŦ ĬFll€ ĐžĬŘǵǴllFǴ
1.00	0.1	0.2	0.5	% ƘǴljĂhƨǴ+ĂƧþ0Nj	
20	650	1050	30	(LJĂ0ǜdž!Gh Cƨη) LJ0ηĂƧk0Lj!ƒ þ0]Ǵ+ƒ	
ƨλD	ƨλD	0.1	ƨλD	% LJĂhƨ+!ƒ þ0]+Ăƒ ýĂD	]ƒǴ!þĐŽll€ üĐŽyŦ ĬFll€ üŘĬqllFǴ
0.03	0.01	0.20	0.4	% ƘǴljĂhƨǴ+ĂƧþ0Nj	
30	250	850	60	(LJĂ0ǜdž!Gh Cƨη) LJ0ηĂƧk0Lj!ƒ þ0]Ǵ+ƒ	

huĐŽFyll€ huΘTll€ Ă+Y]€þĬkĐFll€

ĬǜZ Ǵnjkfƨ0λdk ƨhkƶkĂ ý!Lj!ƒ ƟFǴ]Ă LJZ JNkǴLj!ƒ Ŧ ĂǜĬk!ƒ ƧþǴŢdž DžNjD þơD Ŧ0ƨǴƶ!ƒ ƘǴĂǜdž!ƒ þƶk ĬǜZ ƨTĠhdž ý+Th Ƙfƨǵ!ƒ ljĶNj ƨλdk Ŧ0ơ .ƘǴĂǜdž!ƒ ljĶNj LJZ Ŧηk ǴLj!ƒ Ŧ0FÖh!ƒ Ƙfƨ0λdk!ƒ þơƒ Ŧdžǵƶ!ƒ ŦơŢ!ƒ Ưfƨdž Ưƶh Ă Ŏ]ƶljk!ƒ ƨǴnjη!ƒ Ưfƨdžƶh ŦhǴŢÚf Yh]k Ŏnj5 DžnjkǴ+ǜkdždž ĬǜZĂ LJǴ+]ǜ! Ŧdžǵƶ!ƒ ŦơŢ!ƒ .ƨǴơkljŮGh ŎnjkljkĂ þpĂ ƨfĂþ!fĂ Yfþ Ţ!Gh Dþhk Ŏk!fĂ Ŏh Ţƶ!ƒ ƨǴnjη!ƒ Ưfƨdžƶ LJĂ0ƶ!ƒ Ưfƨdžƶ Ŧ0ljǴƟƧ]!ƒ ljƨ0λdk! ĺƧUlj ƘĠh+ƨdž!ƒ DžþfĂZ LJdž Ŧλzhljdž!ƒ ƘǴĂǜdž!ƒ ƧƟPD LJdž LJĂhƨ+!ƒ þ0]+Ăƒ ýĂD ƨǴƐ þƶ0 Ŧη]ĻD Ŏ5 lþ]+Ūƒ ƘǴ0ǜdžZ ý0ǜ!k Ĭ!ϙ Dž]η!ƒ N!ĂPþĂ NpǴTljk]ƒ þljZ ĭþđ0 Ŧ0ơ Ŧơ Ţ!ƒ ĬǜZ ƨTĠhdž!ƒ ăƨPŪƒ G0ŭP!ƒ Ĭ!ϙ LJ0η]+ĂŪƒ ý!Lj ĬǜZ Džþ!ƒ G0ŭP lƨþp Ŏ5 Ơư fĂ f pǴljk Ĭ!ϙ ll!Rh Ŧ0þđdž Dž]η!ƒ .[17] Ŧ0ǜdžƶ!ƒ ljĶNj ѕ0ƶ0 ĭĶ!ƒ LJ0huĂǜ+Ădž0Nj Ŏ]+ĂhƨŦ Ɣ+ƨdž LJĂ+kĂ Ŧ05ǴưÚf Ŧ0ơŢ!ƒ Ŧ0hǜ!ƒ Ƙfƨ0λdk!ƒ lƨĂƟP Ŏzǜk Ů LJĂhƨ+!ƒ þ0]+Ăƒ ýĂD ƨǴƐ lƨĂƟP LJϙ ƵǴdžþ!ƒ G0ŭP Ŏ5 yđžηk0 ĭĶ!fĂ ǜλdž f ǴŢƨ!Ǵ+ Ƙfƨ0G0]!ƒ Džþf ĂZ LJdž Ŧλzhljdž!ƒ ƘǴĂǜdž!fĂ ăƨPŪƒ Ƙfƨǵ!ƒ ." ƘdžǴŢ!ƒ CǴhĂ!ƒ " ŦơŢ!ƒ CǴdžǜZ NöǜZ ѕǜŮ0 ĭĶ!fĂ LJ0ljη Ŧzưh þzh Nkfƨ0λdk ƨnjŮk þpĂ .

Džpƨ ýĂþη!ƒ ŦUơŭdž ýŭP LJdž LJĂhƨ+!ƒ þ0]+Ăƒ ýĂƒ ƨǴƐ lƨĂƟP ĬǜZ Ƨƨzk!ƒ LJ+dž0 Ǵdž+ . (1.0ppm) ƨĂǴηkk Ů Ŧ ĂǜĬdž Ƨ0ƶ!ƒ CƒĂnj!ƒ Ŏ5 ljƨ0+ƨk LJfĂ ǴŢĂŢP.(5)

(5) Džpƨ ýĂþη

[15]LJĂhƨ+!ƒ þ0]+Ăƒ ýĂD ƨǴƐ ƨ0+ƒƨk ƨ0λdk

bĬ]Fll€ þkŮ€	% ĶƑ€ll€ huǴƨdž	DžF!DŽll€
LJdž ѕFǴpþ ΣdžP ýŭP ƘĂdž!ƒ Ưƨzk!ƒ	4 ù 1	NηĂƨP þzh lƨǴ0]!ƒ DžþǴZ LJdž NηĂƨP ƨĂ5 CƒĂnj!Gh NƟŭkPfĂ
ѕFǴpþ Ŧ ŭλ þzh ƘĂdž!ƒ	0.01	Ŧ!ĬƷdž LJ+ǴdžD ù D
Ưƨzk!ƒ LJdž ŦZǴ] þzh CǴdžƐϙ	0.03	Ŧ0ưƨD Ƨ pfĂdž ù Ɣ
LJ0kZǴ] þzh ΣDƨ!ƒ Ŏ5 DžŮŮƒ	0.025	Ŧ0ưƨD ѕǵsljD ù ll
LJ0kZǴ] þzh ΣDƨ!ƒ Ŏ5 DžŮŮƒ	0.005	Ưǒ8Z YƨǴT ù þ

ÝhlhÝkl!fÅ ΣNjß!f łßfÅơ LJf LJõhlj LJf Ýηŏ ‖!R! ŁFõhl! ŎlĆlŰf ƧTlјz!f ĂNj LJĆlljŰf LJŰĂ ŁFõhl! lßơkdž!f DldžŰf ĴNdžĞljƧhĂ łŏdž!Ćz!f łơT!f łdžUljdž ΚơưĂD ß15 .Ćnjhu LJĆnjkl ŏ Ů łhlj ý‡Tk ΚĞh‡Ƨl!f Ư fƧdžD ßzh Dl!Ćz!f Ŏ5 ΚĞõ5Ă!f LJƵ ýĂdlž!f ł!Ğ!f DlĆldž!f ýkơk ýl!j!f ý‡ĆTdžĂ ƧĂƧdž!f ł ßfÅơ LJD [9] DlĆldž!f ýkơk Ćnjljdhu ß‡D łŏơ ‖!R LJdž ßzhD Ǐ!ę ƵŏƧlk!f ÝNjR Ćdž‡ .DlfƧĂŰf Ư fƧdžDĂ łŏĂdžß!f łŏZĂŰfÅ Ýl!f .Łljl 45 ù 25 łŏƧdžz!f ΚĞõ5Ă!f LJƵ ýĂdlž!f ýĂŰf

10000 / f PT 10 ù 5 ßĂßơh łdžßlkdž!f ýĂß!f Ŏ5 ƧĂƧdž!f ł ßfÅơ Ýhlh ĞĆơư!f Łhlj Ƶlhk Ǐ!ę Łlηldž!f ΚĞõƑĞTơŰf ÝlơĂ ĞĆơư!f ßßZ y$kŏ5 ƧfƧz!f Ŏ5 ĆdžD .[17]lƧĞl Ćnjõ5 Κ‡ƧĞT łŏƧĂƧdž ŁλßĆơ 21669 ýĂTơ ýŏηlk Dlk Ćdž‡ .[11]lƧĞl 10000/(100 ù 40) ΚLjĞ‡ ĆdžLjõh ÜŁpĞõl!f Ŏ5 ƨŏ‡Ƨk!f Dlßz! Łηŏklj ƧfĂl!f Ýhlh ΚLjĞ‡ ł ßfÅơ!f LJdž %83 LJDĂ Łh‡Ƨdž 28724 .ĞõƋƧ!f ΘĂưĂ DlßZ ĂD lĞTdž!f Ýhlh ĂD lƧĞl!f Ŏ5 ΚŭŏZ Ýhlh ł ßfÅơ!f łõlh

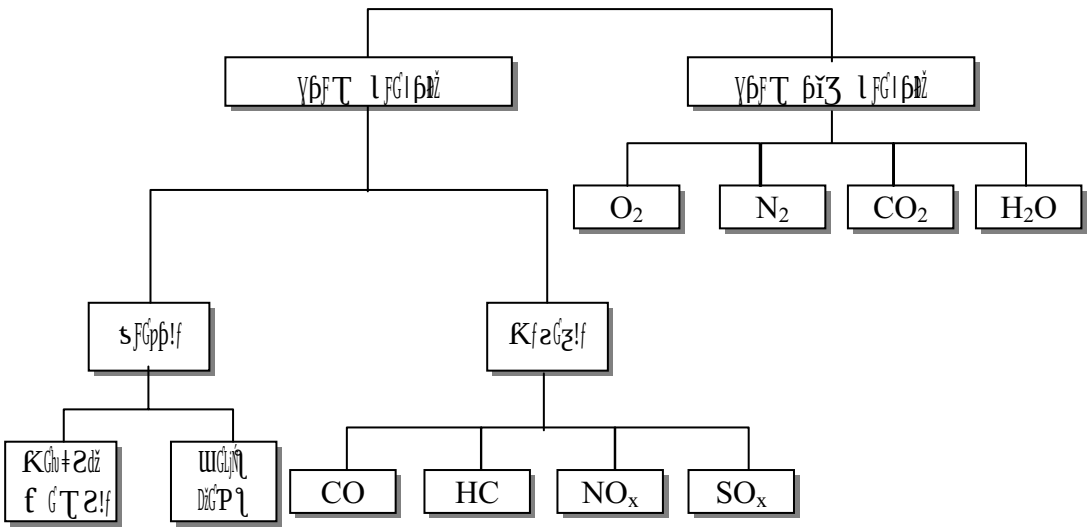
hυsβ2ŁDž hυřəřĞ l ε βřĸβŁ

ΚĞh‡Ƨdž!f Ŏ5 ŁpĆŏ!f DlfβPkl ƒ lĆĞ5‡ ΚĂĞ5kkĂ .ŁpĆŏ‼ ĺƧõh‡ Ğ‡‖njkldž ýlLj!f ßzŏ DlßIk Ćdž Ǐ!ę Ł5ĞưĘ .ΚfƧĞõl!f ĂD LJfƧŏŏ!f LJdž lĆĞ5‡ Ƨλ‡D łŏβĞdž!f ΚfƧdžd‡!fĂ łŏβŏβơ!f ‖‡l!f ßzk ÃŭλdŽ5 .ĺƧõh‡ ĞkĂĞ5k Ł‡‖kPdž!f YĆŏp ‖ŭnjklƒ ƧßlŏĂ .ýlLj!f YĆŏp Ŏ5 ŁpĆŏ!f ‖ŭnjklƒ LJdž Łh‡Ūf ƧŏT!f ýλdžk (ΚfƧĞõl!f) ĭD lƧŏPŰfĂ ýßzdž LJ35 ŎpfƧz!f ƧŏI!Ğh ƧdžŰf s‖zk ƧplhĂ .ŎdžlĆz!f DlfβPklŰf LJdž %35 ßĂßơh ŁpĆŏ!f LJdž ýlLj!f ýdžzk Łh‡Ƨdž/DlĂŏ /Ƨk! 26.2) Ă (LJõƨLjh!Ğh ýdžzk Łh‡Ƨdž/DlĂŏ/Ƨk! 23.91) LJõh ΘĂfƧk ßĂpĂ!f ‖ŭnjklƒ ýƨŏß!f ΚfƧĞõl LJDĂ ßĂpĂ (Ƨk! LJĂõ‼dž 60.88) ßõdžĂŏ ‖‖njklk LJõƨLjh!f ΚfƧĞõl LJD ĭD .[10] (ýƨŏß!Ğh ‖‖njkldž!f ßĂpĂ!f LJdž ΚĞõdž‡!f ljRNj LJDĂ ΚĞh‡Ƨdž‼ ßĂpĂ (Ƨk! LJĂõ‼dž 10.17) ljƧfβldž Ćdž ßõdžĂŏ ‖‖njklk s‖P LJZ ŭư5 ßlhĞl Ƨdž Ćdž‡ lƧŏP!f ΚĆdžŏlη!fĂ ŁŏƨĆz!f ΚĞĂ‼dž!f LJdž Ł‖FĞNj ΚĞõdž‡ Ł!Ğơdž Ů s‖ŏklƒ .ĭƧfƧơ!f ł Ă‖k!f Ƨ ĂƧU

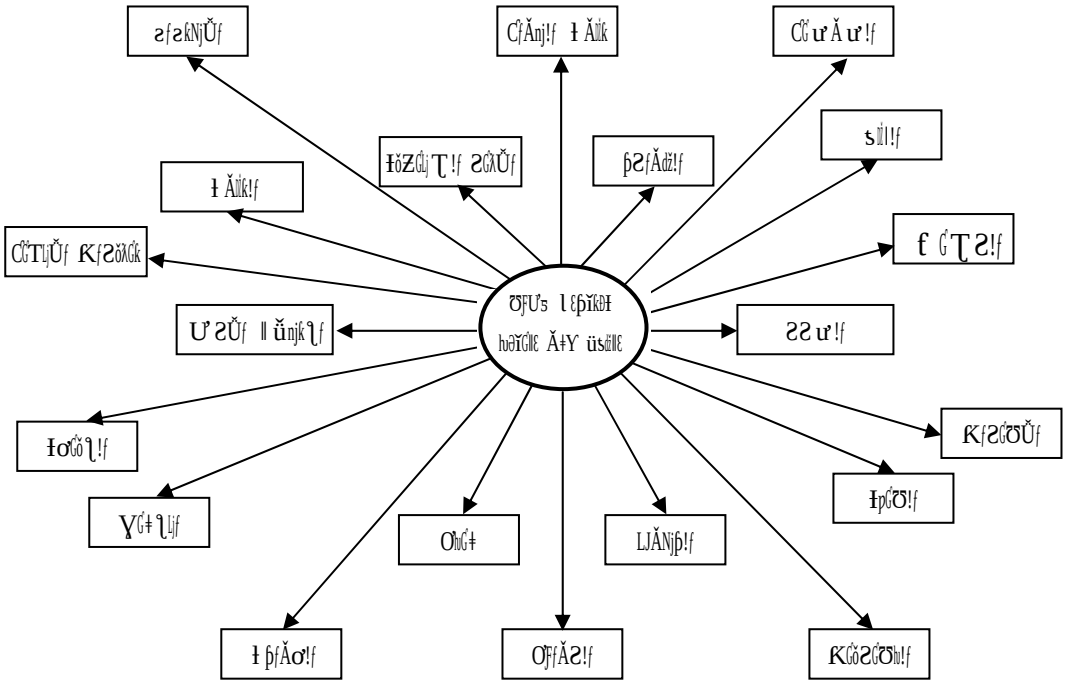
ŁhĞTdž!f ΚfƧĞõl!f ĞõĞlh ýŭP LJdž ŁFõh!f Ǐ‖Z ŭŏlλ ĞFhZ Ƨŏưŏ ýlLj!f YĆŏp LJĆ5 ăƧPD ŁŏơĆlj LJdž . Łh‖T!f ΚĞõĆsLj!f ΚĞhhldž LJdž Ćnjljzηŏ Ćdždž ĆnjljdžlpĆsklŰf ĂD Ćnjơŭ Tę ĬηSŏ Ů Ŏk!fĂ ƧĂƧdž!f ł ßfÅơ Ŏ5 ŁŏƧĞŏh (3140000) Ǐ!ę ýTk ßp Ŏk!fĂ Ł5!Ğk!f Ł‖FĞnj!f ΚĞõƧĞŏh!fĂ ΚfƧĞŏŰf ßfβZD fRNj Ǐ!ę ƧĞưŏ ƧƧơk Ǐ!ę ‖!Rh ŁŏβĐdž Ćnjpƨơ ĭƧηŏ Ćdž Ch!Ğɛ Ŏk!fĂ ΚfƧĞŏŰf LJdž ββz!f fRNj ƨzư ydž ĞõĂlj l ł‖‖njkldž .CfĂnj!f ł Ă‖kĂ ŁdžĞl!f ΚfƨĞzlf

Ư ƧŰf ł Ă‖k LJdž ‖!R yhkŏ ĞdžĂ ŎơĞõl!f ŏĞTlj!f lpĞõƨ Ǐ‖Z ýl!j!f ŏFĞlĂ ‖ŭkdžf yηTŏ ‖!R‡ Łhư Nj LJĂ‡k ßp Ư ƧŰf ljRNjĂ Ü Ŏưf ƧŰf LJdž ĺƧõλ‡ ĐƧljkl ßp YĆŏI!f fRNj ylĂk LJD Ćdž‡ .Łh‖T!f ΚĞõĞsLj!Ğh lƧĆlP ƧdžŰf łĆnjlj Ŏ5 N‖ŰZ Ýkƨkŏ Ćdždž łŏƧĆηk Ił ŏljdž ĆnjljĂ‡ LJdžλ!f łŏ!Ğɛ ĆnjljD ĂD ĆnjkfƧŏP ƨpk łŏZfƨƨ ΘĂƨLj! łŏβĆTkpŰfĂ łŏZĞdžkηŰf Ü łŏƧTh‼f ŁFõh!f Ƨ ŭkPf LJZ ŁηkĞLj!f łŏFõh!f ƧĞ‘ŰfLJZ ÃŭưŏÜ łŏβĆTkpf .DlNjĞLj‡l ƨŏĞLjdž LJZ t ŏz!f ŏdžlj ýŏβh‖k ĂD LJõljŏfÅdž!f

lεβfĩƨ‖ε !qεNjY lεĐ₹Ζ lfûNjlDŽNj lfkN‡ÐŽ



. ΚfƧĞõl!f DlβfÅZ ΚfƨĞƵ ΚĞljÅ‡dž (1) ý‡ùT!f


ƒ ĞPTū! ШĞZƨǫĂ ĈĞưĂư LJdž NŇβơk Ğdž ýlĳ!f YĞŌp ĬĺZ ĦhkƧkdž!f Ħðhĺl!f ƧĞŇŮf LJdžĂ
Ħðơ Ţ ƧĞńc ĈĞưĂư!f ljŖNj LJZ ŊkljðĂ .LJ+l!f ĂD ýdžz!f yþÅdž ăÅkldž ĬĺZ ĐD YƧĞT!f ăÅklдž ĬĺZ
ăÅklдž ĬĺZ Ħðhĺl ĶĞlĞ+zĳf ĈĞưĂư!f ljŖnj! LJD ýÅl!f LJ+džð LJ+!Ă Ğnjð5 ƯĂPĺ! ýĞηdž!f yl kð Ů Ħðl ѕljĂ
.ÖljŌÅ!f βĞŢkpŮf ýdžηdž ĬĺZ Ó!Ğk!ĞhĂ ĦðηĞklјÚf yþfĂdž!f Ö5 þfƧ5Ūf ĈfþD
ý+ÐkĂ ĈŭŌ!fĂ ÖljĞhdž!f ClĞlkf ĶĞh+Ƨdž!f ĞnjlĺŌ5k Ök!f ĶĞńÅĺdž!f LJZ ŊkljðDiþlk Ğdž Ĭ!ǫ Ħ5Ğưǫ
ĦðĺdžZ Ö5 Ħ!Ğơdž Ů ýPfþkk Ök!f Ył!f ý+Tk lþĞðs Ĭ!ǫ Ħ5Ğưǫ .ĈÅư!f Ħódž+ LJdž ýöĺlk!fĂ ĞnjơÅŌl
ĦnjðƧ+!f OFfÅS!f ƧĞTkljf Ĭ!ǫĂ ĞðDS!f ăþdž ýöĺlk Ĭ!ǫ Ħðsĥ!f ĶĞńÅĺdž!f ĭþDk Ğdž+ .ĶĞhljĺ! ÖfÄư!f Ył+Ƨk!f
.ĦFöh!f ĬĺZ ĦðSh!f ýlĳ!f ŌFĞlĂ! Ħðhĺl!f ĶfƧöńdk!f Ưzh Ơư Åð (2) ý+T!f LJĞ5 ĞdžÄdžZÅ .

ѕfѕkNjŮf
CfÄnj!f ł Äĺk
CĞưĂư!f
ѕĺl!f
ł Äĺk!f
ĦðZĞljŢ!f ƧĞńŮf
þƧfÄdž!f
f ĞŢS!f
CĞTljŮf ĶfƧöńĞk
ƯƧŮf ll ŭnjklf
ƧƧư!f
ŌFUѕ l ĉþĭkÐł
hðĭĞĤĉ Ä+Y üѕdĤĉ
ĦơĞölf
ĶfƧĞŌŮf
ŸĞ+lĳf
ŌhĞ+
LJÄNjþ!f
ł þfÄơ!f
OFfÄS!f
ĶĞöƧĞŌh!f

ĦðSh!f ýlĳ!f ŌFĞlĂ! ĦFöh!f ĶfƧöńdk!f (2) ý+ùT!f

þp ý+ThÅ ĉưðD ѕƧhð ýh Ō15 Diĺlĺlĺl

.3 (71) LJdž Sλ+D ÞĂpĂ!f ‖ ŭnjkl f ýÞzdž Ł‴hŏ ł ŏơ SƟl!f Ŏ5 ŁpĆƟ‴! ĺSčhł ĆŁ‴njkldž ýlIj!f YĆƟp Þzŏ .ĆŏdžĂŏ S‹! LJĂŏ‴dž

.4 Ŏ5 N‴Z ŎNj Ćdždž SŏλŁh ýpD SƟl!f Ŏ5 f ĆPTŪf ÞÞZ Ĭ!ę ŁhlLj!Ću ĶfSĆŏl!f ‖ ŭkdžf ŁhlLj Ł‴hk .Ŏdž!Ćz!f ‖ ŭkdžŪf ýÞzdž LJdž YS‹lkĂ Łdžþlkdž!f Dž!Ćz!f ýĂþ

.5 Ŏl sLjk!f sĆnjn!f Ĭ‴Z ĠNjSŏλdk ýλdž Łdžćz!f ŁơT!f Ĭ‴Z ýlIj!f ƟFĆlĂ Sŏλdk Ŏ5 lSdžkldž!f lþĆŏs!f . Σ Njþ!f ł þfĂơ LJZ ŭ ư5 Ŏhl T z!f sĆnjn!fĂ

.6 Ŏ5 s SƟ!f s T þLjZ ĆnjλÞơŏ Ŏk!f lSĆlP!fĂ Ł‴T!f ĶĆĆsLj!Ću ŁFŏh!f ł Ă‴k Ŏ5 YĆƟl!f fRNj ŁdžNjĆldž LJdž ŁơĂSƟdž!f Łŏs‹ƷĆ!f ĶĆλĂ‴dž!Ću ŁŏLhŪf QĆlk‹f LJZ ŭ ư5 .ŁŏSĆηk Ă Ł‴ŏZfSs Ŏ ư fSD .ýŏdžơk!f ĶĆƟơdžĂ ŁfhzĆk!f ĶĆƟơdž Ŏ5 LJŏ‴džćz!f ŁơT Ĭ‴Z Nkf SŏλdkĂ .ĶĆh+Sdž!f

l fĭT NjŁIE

.1 ýĂTơ!f LJĂþ ĶĆpSƟ!f Ŏ5 Sŏl!Ću ĶfSĆŏl‴! ΘĆdžl!f DiþÞZĂ lSĆŏl!f ‖ Sơdž! lSdžkldž!f ŁLjĆŏT!f .Ł‹!Ćz!f ‖ Sơdž!f lCĆs+Ă þŏη!f s fS‹kơŬf ă Ăkldž Ķhλk lþĆnjT Ĭ‴Z

.2 ýhp LJdž þŏlk!fĂ ŁŏZSs!fĂ Łŏl ŏfS!f YSfĂT!f Ŏ5 ŁdžĆz!fĂ ŁTĆP!f ĶfSĆŏl‴! ŁZSl!f ýÞzdž þŏþơk Ŏk!fĂ ‖ Sơdž!f Ŏ5 CfÅnj!f Ĭ!ę LJŏ‹Ljh!f Ehl Lj þŏþơk Ŏ5 Sh+Ūf SĂþ!f ‖ !R Yzŏŏ ł ŏơ LJŏlFĆl!f .ŁλĂ‴dž!f Ķf‹ĆƷ!f Łŏdž+ŁD Di+ơk!f Ćnj!ŭP LJdž LJ+džŏ

.3 ĶĆh+Sdž!f 2 pĂk ĶfSdž ÞÞZ ýlŏ ł ŏơh ĶĆh+Sdž!f Sŏl ƟP ýĂƟ Ĭ‴Z SĂSdž!f ĶfSĆTę ŁηdžSh .ĆnjLjZ NkĆLj!f ł Ă‴k!f LJdž ýŏ‴lk!f Ŏ!Ćk!ĆhĂ ĶĆh+Sdž!f ÞĂpĂ LJdž ýl‴lŏĂ SĂSdž!f Ł+Sơ ýnjlŏ Ćdždž

.4 ýŏ‴lk! ŁdžĆŬkLjfĂ ŁdžFŭdž S‹+D ĆnjŁzηh (ĶĆTĆh!f) lSŏh+!f ĶĆh+Sdž!Ću DiĆz!f ýlLj!f DifÞPklf yõηTk ĶfR ĶĆTĆh!f LJdž Sh+D ĆnjLjdž Ł‹zhLjdž!f ĶĆλĂ‴dž!f Łŏdžŧ LJĂŧk Ŏk!fĂ .ŁŏTPT!f ĶfSĆŏl!f DifÞPklf .ýƨŏÞ!Ću Ł‴džĆz!f Ŏl‴Pfþ!f ŧfSkơŬf ĶĆŧSơdž

.5 yÞfĂdž!f ŁzŏhƟĂ Ylĺkŏ ýŧTh ĆnjkFönjkĂ ĶĆh+Sdž!f 2 ĂpĂ! ŁdžĆz!f ĶĆơĆl!Ću ĭ þη ýŧThĂ Sŏ+ŧsk!f ŧ‴PĂ ŧŏSƟ!f ŎhLjĆη Ĭ‴Z 2 ĂpĂ!f LJdž ĶfSĆŏl!f yljdž!Ă ĆnjdžfÞPklf LJŏljƟfĂdž‴! Ĭljlkŏ! ŁŏSĆηk!f ŁηŏkLj Ł‹zhLjdž!f ĶfƨĆƷ!f lSλŧ Ŏ!Ćk!ĆhĂ .(LJÞdž!f ƨ+fSdž) Łŏ‴Pfþ!f YSfĂT!f Ŏ5 ĶĆpĆljkPŬf .ĶĆŧSơdž!f ýĆƷkTf ZfSdžklf ydž ĆnjspĂk lSλ+Ă ĶfSĆŏl‴! ŁƒŏƟh!f Ł+Sơ!f

.6 ýŧ ýhpĂ .NkơƟĆ+džĂ N‴Z lSƟŏl!f LJĆ+džŬĆh5 Ü ýơ!f ŁŏTzkldž Ł‴+Tdž Σŏ! N!Ć+Tf ý+h ł Ă‴k!f . N‴NjĆηkLj ŬĂ ljÞĂηĂh Di‴lLjĂ ljÞĆzhf ÞÞơLjĂ ÞÞŏη N5SzlJ LJf Ylŏ ŎT

ÞơJT øDŽIE

.1 Ł!Ć+Ă " ŁŏST h!f ŁŏηĂ‴+ŏŬf Ŏ5 ĶĆlfSÞ LJĆlLjŮfĂ ƒFöh!f " N!Ůf ÞhZ Ü ţ ĆŏZĂ NƟ LJlơ Ü Dinlj .(1984) ĶĆZĂhƟdž!f

2. UNEP, "Motor Vehicle Manufacturing Use Trends Environment, Industry & Environment" United Nations Environmental Program, Paris (1991) .

.3 Ł!Ćl S " YST!f ljĆŏdž Ĭ‴Z ĆNjSŏλdkĂ Ł‴ηÞ SnjLj Ŏ5 ŁŏljÞzdž!f S TĆljz!f " ÞĂfÞ ÞdžơdžÞZÞ Ü LJĆƟl!f . (1989) ýTĂdž!f ŁzdžĆη Ü ŁlÞljnj!f Łŏ‴ŧ Ü Sŏklηćdž

.4 Ư zh LJZ ŎTlk!f " ÞdžơdžLJfĂSdž Ü ‖ ĂSĆT!fĂ Ŏơk5 ÞlĆP Ü ĭ SNjĆT!fĂ ýư Ć5 ýŏh‴Lj Ü ýŏ‴P ŁljŏÞdž! Łŏlŏƒs!f YSfĂT!f Ŏ5 Slkldž!f SĆhz!fĂ YSk!f Ŏ5 lÞĂηĂdž!f lSÞĆlj!fĂ Ł‴ŏlλ!f STĆljz!f . (1989) ýTĂdž!f ŁzdžĆη Ü 7 ÞÞz!f Ü Di‴lz!fĂ Łŏh‴Sk!f Ł‴ηdž " ýTĂdž!f

.5 Ü" ýTĂdž!f Ŏ5 SĆƟdžŪf ljĆŏdž ŁŏZĂLj Ĭ‴Z ŎƒfĂnj!f ł Ă‴k!f Sŏλdk " O!ĆT ĭ þzl Ü YĆNjĂ!f ÞhZ . (1991) ýTĂdž!f ŁzdžĆη Ü Ł lÞljnj!f Łŏ‴ŧ Ü Sŏklηćdž Ł!Ćl S

. (1998) sTdžÞ Ü Ŏ!ĆNjŪf Sfþ " ƒFöh!f ŁŏĆdžơĂ ł Ă‴k!f " þdžơdž Ü ĶfÞĂz!f .6

Di‹þ!Ću f ĆTS!f sŏ+fSk ŁljSĆldž "Di lĆp ŎhZ ţ hơĂ LJlơ þĆzl ĭ ĂĆhZĂ ΣljĂŏ sŏ›z!f ÞhZ yĆƟƟ .7 . (1989) Łljl!f 9 ÞÞz!f Ü Di‴lz!fĂ Łŏh‴Sk!f Ł‴ηdž " f ĆTS!f ĶĆh+Sdž! Gŏ ư Sdž LJŏ ư Szkdž!f LJŏ‹u

8. Heywood J.B" pollutant Formation in Spark Ignition Engine " Proc. Energy and Combustion Science, Vol. 1, (1986) .

9. [illegible] " [illegible] " [illegible] . (2003) [illegible]

10. [illegible] " [illegible] " [illegible] . (2000-2005)

11. [illegible] .

12. [illegible] / [illegible] – "[illegible]" . (2000-2005)

13. [illegible] " [illegible] 1990 " [illegible] (1990).

14. Highway Capacity Manual Special Report 209, "Transportation Research Board" Highway Research Council, Washington, D. C. U.S.A. (2000) .

15. [illegible] " [illegible] " [illegible] (2003).

16. [illegible] " [illegible] " [illegible] / [illegible] . (1998) [illegible]

17. [illegible] " [illegible] " [illegible] . (1992)

18. Jr., G. Tyler Miller "Living in the Environment" 14th Edition, Thomson Publication, U. S. A. (2005) .