CREATE — KEEPING THE GO IN CHICAGO

Chicago Region Environmental and Transportation Efficiency (CREATE) Program
Guidance for Analyzing Mobile Source Air Toxics (MSATs)
October 31, 2014

The purpose of this document is to provide guidance on Mobile Source Air Toxics (MSAT) analysis under the National Environmental Policy Act (NEPA) review process for CREATE Program rail projects. The Federal Highway Administration (FHWA) has developed an *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA* (December 6, 2012), which is focused on highway projects.

In consideration of MSAT in NEPA evaluations, the FHWA developed a tiered approach with three categories for analyzing the seven priority MSAT in NEPA documents, depending on specific project circumstances:

- Category 1: No analysis for projects with no potential for meaningful MSAT effects;
- Category 2: Qualitative analysis for projects with low potential MSAT effects; or
- Category 3: Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

The guidance FHWA developed for highway projects is not directly transferable to the types of projects being developed in the CREATE Program. Therefore, the highway guidance was used as a framework to develop procedures specific to the CREATE Program for analyzing MSATs. Summarized below are further details of the adapted analysis approach.

FHWA, in coordination with IDOT, has determined that the CREATE Program Tower projects qualify for exclusion from project-level MSAT analysis because they would not result in meaningful impacts to train and vehicular traffic volumes. In general, IDOT and FHWA have determined that the types of actions associated with CREATE Program rail infrastructure improvement projects will generally qualify as Category 2 projects due to their ability to influence train traffic volumes. This guidance document discusses how to analyze MSATs for three types of rail projects:

1. For CREATE Program rail projects that do not include closure of an at-grade highway-rail crossing(s) and would result in decreased fuel usage (based on data provided from the CTCO train model), the following prototype language should be included in the NEPA document (Note: Yellow highlighted text should be refined, as needed, for each specific project. Also, it is suggested that the prototype text be included in the Environmental Class of Act Determination (ECAD) Record as a separate sub-category under the “Air Quality” resource with its own journal entry. Under this approach, “Mobile Source Air Toxics (MSATs)” would be sub-category #3 and “Construction-Related Particulate Matter” would become sub-category #4.):

   Mobile Source Air Toxics
   The U.S. Environmental Protection Agency (USEPA) regulates Mobile Source Air Toxics (MSATs). MSATS are compounds emitted from highway vehicles and non-road equipment (e.g. locomotives and construction vehicles) that have the potential to cause adverse health effects. Since the CREATE COMPONENT PROJECT IDENTIFIER Project would improve freight and/or passenger rail

operations, this project was classified as a project with low potential MSAT emissions. Since emissions are directly related to fuel usage, the fuel usage for each alternative was compared.

For the Build Alternative, the amount of MSATs emitted would be proportional to the amount of fuel used assuming that other variables (such as travel not associated with the project) are the same for each alternative. The estimated fuel usage for the Build Alternative is approximately X% less than the No-Build Alternative (see Table X). The decreased fuel usage is associated with the reduction in time it would take trains to operate within or traverse the project corridor and/or the reduction in the time trains spend idling.

Table X: Fuel Consumption Data from CTCO Train Model[1]

Alternative	***Fuel Consumption (Gallons) (96 hours)***
Existing	*X,XXX*
No Build Alternative (XXXX)	*X,XXX*
CREATE Build Alternative (XXXX)[2]	*X,XXX*

Notes:
[1] The fuel consumption data from the CTCO Train Model is for the CREATE XXX Project corridor only.
[2] The CREATE Build Alternative evaluates the implementation of the entire CREATE Program.

The additional freight rail activity contemplated as part of the Build Alternative could have the effect of increasing diesel emissions in the vicinity of homes, schools, and businesses in the project area. Therefore, under the Build Alternative, there may be localized areas where ambient concentrations of MSATs would be greater than under the No-Build Alternative. However, the magnitude and duration of these potential increases cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. Even though there may be differences among the alternatives, on a region-wide basis, USEPA's non-road emission regulations, coupled with locomotive turnover and re-builds, will cause substantial reductions over time and, in almost all cases, the region-wide MSAT levels in the future will be substantially less than today.

2. For CREATE Program rail projects that include closure of an at-grade highway-rail crossing(s), the following prototype language should be included in the NEPA document (Note: Yellow highlighted text should be refined, as needed, for each specific project context and condition. Also, it is suggested that the prototype text be included in the ECAD Record as a separate sub-category under the "Air Quality" resource with its own journal entry. Under this approach, "Mobile Source Air Toxics (MSATs)" would be sub-category #3 and "Construction-Related Particulate Matter" would become sub-category #4.):

Mobile Source Air Toxics

The U.S. Environmental Protection Agency (USEPA) regulates Mobile Source Air Toxics (MSATs). MSATS are compounds emitted from highway vehicles and non-road equipment (e.g. locomotives and construction vehicles) that have the potential to cause adverse health effects. Since the CREATE COMPONENT PROJECT IDENTIFIER Project would improve freight and/or passenger rail operations, this project was classified as a project with low potential MSAT emissions. Since emissions are directly related to fuel usage, the fuel usage for each alternative was compared.

For the Build Alternative, the amount of MSATs emitted would be proportional to the amount of fuel used assuming that other variables (such as travel not associated with the project) are the same for each alternative. The estimated fuel usage for the Build Alternative is approximately X% less than the No-Build Alternative (see Table X). The decreased fuel usage is associated with the reduction in time it would take trains to operate within or traverse the project corridor and/or the reduction in the time trains spend idling.

Table X: Fuel Consumption Data from CTCO Train Model[1]

Alternative	***Fuel Consumption (Gallons) (96 hours)***
Existing	*X,XXX*
No Build Alternative (XXXX)	*X,XXX*
CREATE Build Alternative (XXXX)[2]	*X,XXX*

Notes:
[1] The fuel consumption data from the CTCO Train Model is for the CREATE XXX Project corridor only.
[2] The CREATE Build Alternative evaluates the implementation of the entire CREATE Program.

The additional freight rail activity contemplated as part of the Build Alternative could have the effect of increasing diesel emissions in the vicinity of homes, schools, and businesses in the project area. Additionally, the proposed closure of an existing at-grade crossing would cause changes in travel patterns on local roadways. Therefore, under the Build Alternative, there may be localized areas where ambient concentrations of MSATs would be greater than under the No-Build Alternative. However, the magnitude and duration of these potential increases cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. Even though there may be differences among the alternatives, on a region-wide basis, USEPA's vehicle, fuel and non-road emission regulations, coupled with fleet and locomotive turnover as well as locomotive re-builds, will over time cause substantial reductions over time and in almost all cases, the region-wide MSAT levels in the future will be substantially less than today.

3. For CREATE Program rail projects that would result in increased fuel usage (based on data provided from the CTCO train model), a Tech Memorandum was prepared to develop and analyze MSAT emissions specific to Cook County (see Attachment A). The purpose of the analysis was to supplement the national-level trends presented in FHWA's *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA*. The analysis concluded that the localized level of MSAT emissions for CREATE Program projects could be higher relative to the No-Build condition, but this could be offset to some degree by increases in speeds and reductions in congestion (which are associated with MSAT emissions). Also MSAT emissions will be lower in other locations when traffic shifts away from them. On a regional basis, EPA's vehicle and fuel regulations, coupled with fleet and locomotive turnover as well as locomotive re-builds, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT emission levels in the future to be substantially less than today.

   For CREATE Program rail projects that would result in increased fuel usage (based on data provided from the CTCO train model), the following prototype language should be included in the NEPA document (Note: Yellow highlighted text should be refined, as needed, for each specific project. Also, it is suggested that the prototype text be included in the Environmental Class of Act Determination (ECAD) Record as a separate sub-category under the "Air Quality" resource with its own journal entry. Under this approach, "Mobile Source Air Toxics (MSATs)" would be sub-category #3 and "Construction-Related Particulate Matter" would become sub-category #4.):

   Mobile Source Air Toxics
   The U.S. Environmental Protection Agency (USEPA) regulates Mobile Source Air Toxics (MSATs). MSATS are compounds emitted from highway vehicles and non-road equipment (e.g. locomotives and construction vehicles) that have the potential to cause adverse health effects. Since the CREATE COMPONENT PROJECT IDENTIFIER Project would improve freight and/or passenger rail operations, this project was classified as a project with low potential MSAT emissions. Since emissions are directly related to fuel usage, the fuel usage for each alternative was compared.

   For the Build Alternative, the amount of MSATs emitted would be proportional to the amount of fuel used assuming that other variables (such as travel not associated with the project) are the same for each alternative. The estimated fuel usage for the Build Alternative is approximately X% more than the No-Build Alternative (see Table X). This increased fuel usage is the result of the additional rail capacity that would be constructed with the Build Alternative.

***Table X: Fuel Consumption Data from CTCO Train Model*[1]**

Alternative	***Fuel Consumption (Gallons) (96 hours)***
Existing	*X,XXX*
No Build Alternative (XXXX)	*X,XXX*
CREATE Build Alternative (XXXX)[2]	*X,XXX*

Notes:
[1] The fuel consumption data from the CTCO Train Model is for the CREATE XXX Project corridor only.
[2] The CREATE Build Alternative evaluates the implementation of the entire CREATE Program.

The additional freight rail activity contemplated as part of the Build Alternative would have the effect of increasing diesel emissions in the vicinity of homes, schools, and businesses located in the project area. Therefore, under the Build Alternative, there would be localized areas where ambient concentrations of MSATs would be higher than under the No-Build Alternative. However, the magnitude of these potential increases cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. The higher MSAT emissions may potentially be offset to some degree by two factors: 1) the decrease in regional truck traffic due to increased use of rail for inbound and outbound freight; and 2) increased speeds on area highways due to the decrease in truck traffic. The extent to which these factors will offset rail traffic-related emissions increases is not known.

A Technical Memorandum was prepared to develop and analyze MSAT emissions specific to Cook County (see Appendix X). The purpose of the analysis was to supplement the national-level trends presented in the FHWA's Interim MSAT Guidance. The analysis concluded that EPA's adopted regulations for diesel locomotive engine/exhaust systems and fuels are predicted to result in reductions in activity-based emission rates that more than counteract predicted increases in locomotive activity levels throughout the project area. The anticipated result is a decrease in annual MSAT emissions from locomotives despite those projected activity level increases. Specifically, emissions from locomotives were estimated to be reduced by more than 60 percent from 2010 to 2030.

In sum, the localized level of MSAT emissions for CREATE Program projects—including the CREATE COMPONENT PROJECT IDENTIFIER project—could be higher relative to the No-Build condition, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Also, MSAT emissions will be lower in other locations when traffic shifts away from them. On a regional basis, EPA's vehicle and fuel regulations, coupled with fleet and locomotive turnover as well as locomotive re-builds, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT emission levels in the future to be substantially less than today.

For all CREATE Program rail projects, the following prototype language will be included after the MSAT qualitative analysis text to clarify the potential limitations of the MSAT analysis due to incomplete or unavailable information:

INCOMPLETE OR UNAVAILABLE INFORMATION FOR PROJECT-SPECIFIC MSAT HEALTH IMPACTS ANALYSIS

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a project. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The U.S. Environmental Protection Agency (USEPA) is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The USEPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (USEPA, http://www.epa.gov/iris/). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update on Mobile source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are; cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI, http://pubs.healtheffects.org/view.php?id=306).

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts - each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain *science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70-year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.*

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways and other transportation facilities; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The USEPA (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI (http://pubs.healtheffects.org/getfile.php?u=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the USEPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires USEPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld USEPA's approach to addressing risk in its two step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to *decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.*

ATTACHMENT A

TECHNICAL MEMORANDUM

Locomotive and On-Road Vehicle Class-Specific MSAT Emissions Trends Data Incorporating County-Specific Baseline Emissions Estimates

CREATE Program

October 2014

TECHNICAL MEMORANDUM

Locomotive and On-Road Vehicle Class-Specific MSAT Emissions Trends Data Incorporating County-Specific Baseline Emissions Estimates

CREATE Program

October 2014

This memorandum documents the development and analysis of Mobile Source Air Toxics (MSAT) emissions for Cook County, Illinois. This data, which is more specific to the context of the Chicago Region Environmental and Transportation Efficiency (CREATE) Program, is being developed to supplement the national-level trends presented in the FHWA's Interim MSAT Guidance (FHWA, 2012). This data will be used as part of the MSAT analyses conducted for the CREATE Program projects.

1. Background

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants (HAPs). The Environmental Protection Agency (EPA) has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (EPA, 2007), and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System, or IRIS (EPA, 2012a). These compounds are commonly referred to as Mobile Source Air Toxics (MSATs). In addition, from their 1999 National Air Toxics Assessment (NATA) the EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers. These are acrolein, benzene, 1,3-butidiene, diesel particulate matter (DPM), formaldehyde, naphthalene, and polycyclic organic matter (POM). The Federal Highway Administration (FHWA) has published updated guidance (*Interim MSAT Guidance*) for analyzing MSAT impacts generated by highway projects (FHWA, 2012). The FHWA identifies the preceding seven compounds as priority MSATs. The following summarizes HAPs of particular concern for which mobile sources make substantial contributions to total emissions. This information is taken from the most recently-released NATA (EPA, 2012b), which uses 2005 as a base analysis year:

National cancer risk driver:

- Formaldehyde

Regional cancer risk drivers:

- Benzene
- Polycyclic Aromatic Hydrocarbons (PAHs), a subset of POM
- Naphthalene

National cancer risk contributors:

- 1,3-Butadiene

- Acetaldehyde

National noncancer hazard drivers:

- Acrolein

Regional noncancer hazard drivers:

- DPM

2. Methodology

The FHWA's Interim MSAT Guidance includes a chart that demonstrates predicted future national trends in vehicle miles traveled (VMT) and emissions of the priority MSATs for the entire on-road vehicle fleet. However, relevant, source category-specific future MSAT emissions predictions for a region-wide superset of the study area (i.e., Cook County) were not available.

To better assess the MSAT implications of the CREATE Program projects, Cook County trend data was developed that is more specific to the Program context than the national-level trends presented in the FHWA's Interim MSAT Guidance for on-road vehicles as a whole (FHWA, 2012). The benefits of this greater specificity include:

- Provision of a more geographically-specific emissions baseline;
- Inclusion of a key mobile emissions source (locomotives) that is both the subject of this project and an unusually important baseline emissions source within the project study area; and
- Isolation of an on-road vehicle source category – heavy-duty trucks – that is also particularly important within the project study area and whose activity could be affected by CREATE projects that influence freight transportation modes.

These trend data are not intended to represent project- and CREATE Program-specific MSAT emissions predictions; such predictions are beyond the reasonable scope of the air quality assessment conducted as part of the Environmental Impact Statement to fulfill the requirements of the National Environmental Policy Act (NEPA). Rather, they are intended to provide a more appropriate and relevant estimate of baseline and future emissions that takes into account both the geographic context and the type of vehicles affected by the proposed project.

Cook-County-specific Baseline Emissions Estimates

To accomplish this, EPA-promulgated predictions of future nationwide trends in emissions (EPA, 2008) were utilized to forecast relative changes in predicted 2008 baseline county-wide emissions (EPA, 2013). Predicted changes in emissions over time reflect both anticipated changes in emissions rates per unit of activity (e.g., vehicle miles traveled, gallons of fuel consumed, etc.) and changes in activity rates (e.g., the number of active vehicles and the amount of activity – miles traveled or gallons consumed, etc. – per vehicle). The baseline national data was taken from the most recent (2008) EPA National Emissions Inventory (NEI).

Table 1 presents an excerpt of an emissions data processing spreadsheet that includes Cook-County-specific estimates of locomotive MSAT emissions from that dataset (EPA, 2013). Table 2 presents corresponding data for on-road vehicular emissions.

Incorporation of National-level Predicted Future Emissions Trends

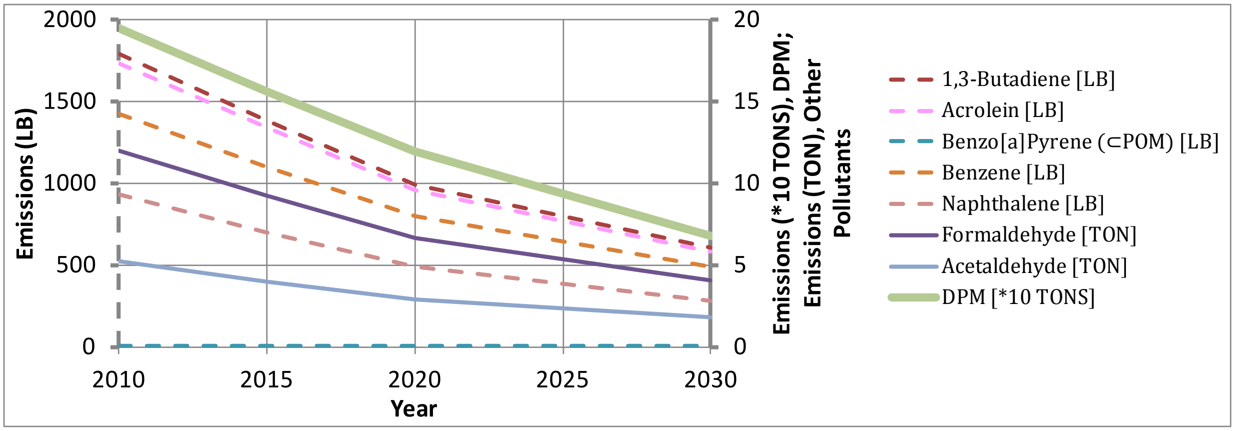
In the absence of identified geographically-specific future MSAT emissions predictions, this assessment applies predicted relative trends in future nationwide MSAT emissions to the aforementioned Cook County baseline emissions data. Table 3 includes relevant EPA-derived (EPA, 2008) predicted future trends in gaseous MSAT emissions from locomotives. Table 4 provides analogous data for particulate matter less than 10 microns in diameter (PM_{10}), the relative trend data for which is applied here as a surrogate for future trends in diesel PM (DPM) emissions. Finally, Table 5 summarizes EPA-promulgated predictions of future nationwide MSAT emissions from on-road vehicles (EPA, 2005 and 2006) and the relative future emissions trends derived from them.

3. Results

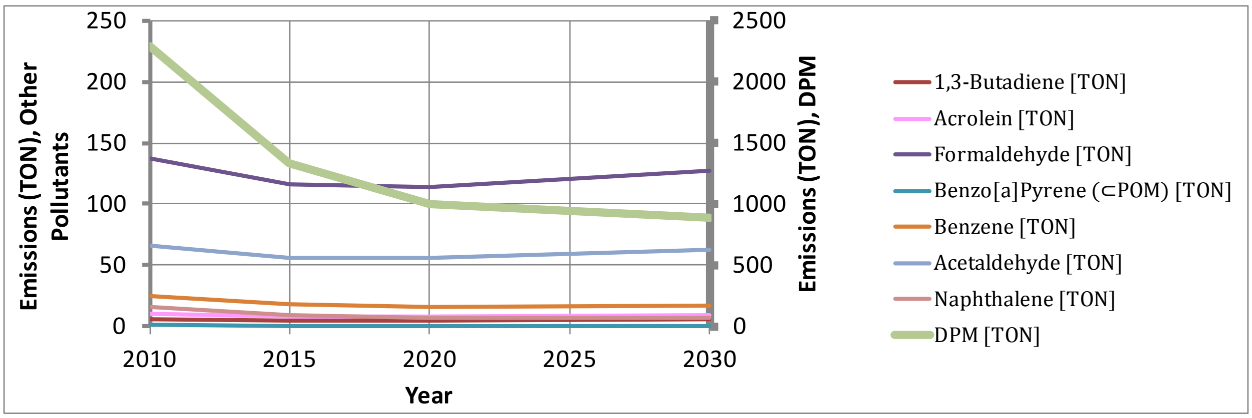
EPA's adopted regulations for diesel locomotive engine/exhaust systems and fuels are predicted to result in reductions in activity-based emission rates that more than counteract predicted increases in locomotive activity levels throughout the nation. As Figure 1(a) shows, the anticipated result is a decrease in annual MSAT emissions from locomotives despite those projected activity level increases.

Figures 1(b) and 1(c) demonstrate that MSAT emissions from light- and heavy-duty on-road motor vehicles are expected to decrease or – in the case of DPM for light-duty on-road vehicles – increase slightly over time. In the case of DPM, future reductions in emissions from heavy-duty on-road vehicles are predicted to exceed future increases in emissions from corresponding light-duty vehicles. Given the projected future reductions in DPM emissions from locomotives, the overall national trend for DPM emissions from ground transportation sources is downward for areas influenced by emissions from both on-road vehicles and locomotives. In the case of formaldehyde and acetaldehyde, the corresponding overall nationwide trend for ground transportation sources is a decrease in emissions through 2020 followed by a slight increase in emissions (driven by heavy-duty on-road vehicles) over the subsequent ten years.

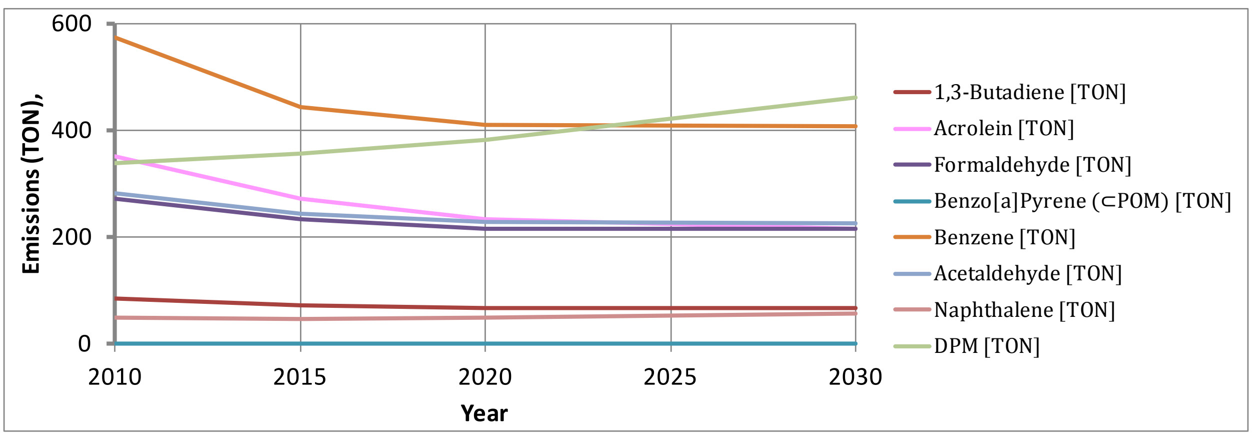
Within the area encompassed by the CREATE Program, the magnitude and the duration of these potential increases cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. In sum, the localized level of MSAT emissions for CREATE Program projects could be higher relative to the No Build condition, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Also, MSAT emissions will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT emission levels to be substantially lower than today.



(a) Locomotives



(b) Heavy-duty On-road Vehicles



(c) Light-duty On-road Vehicles

Sources: EPA, 2006, 2008, 2012

Figure 1: Predicted Annual Emissions of Priority MSATs within Cook County by Mobile Source Type

Table 1 – Excerpt of Spreadsheet Used to Process Cook-County-Specific Baseline MSAT Emissions Estimates as Reference for Prediction of Future MSAT Trends

ftp://ftp.epa.gov/EmisInventory/2008v2/nei2008v2_national_county_level_sector.zip													
												Final Units	
fips	stfips	ctyfips	state_abbr	county_name	EI_Sector		description	Representing	Equivalent	uom	2008		Pollutant
17031	17	31	IL	Cook	Mobile - Locomotives	Locomotives	1,3-Butadiene	1,3-Butadiene	1,3-Butadiene	LB	1936.285422	LB	1,3-Butadiene [LB]
17031	17	31	IL	Cook	Mobile - Locomotives	Locomotives	Acrolein	Acrolein	Acrolein	LB	1863.572657	LB	Acrolein [LB]
17031	17	31	IL	Cook	Mobile - Locomotives	Locomotives	Formaldehyde	Formaldehyde	Formaldehyde	LB	25821.69545	TON	Formaldehyde [TON]
17031	17	31	IL	Cook	Mobile - Locomotives	Locomotives	Benzo[a]Pyrene	Benzo[a]Pyrene (ÌPOM)	POM	LB	1.114772852	LB	Benzo[a]Pyrene (⊂POM) [LB]
17031	17	31	IL	Cook	Mobile - Locomotives	Locomotives	Benzene	Benzene	Benzene	LB	1542.21503	LB	Benzene [LB]
17031	17	31	IL	Cook	Mobile - Locomotives	Locomotives	Acetaldehyde	Acetaldehyde	Acetaldehyde	LB	11206.51198	TON	Acetaldehyde [TON]
17031	17	31	IL	Cook	Mobile - Locomotives	Locomotives	Naphthalene	Naphthalene	Naphthalene	LB	1044.725948	LB	Naphthalene [LB]
17031	17	31	IL	Cook	Mobile - Locomotives	Locomotives	PM10 Primary (Filt + Cond)	DPM	POM	TON	202.8152776	*10 TONS	*DPM [*10 TONS]*

Source: EPA, 2013; Parsons, 2013

Table 2 – Excerpt of Spreadsheet Used to Process Cook-County-Specific Baseline MSAT Emissions Estimates as Reference for Prediction of Future MSAT Trends

ftp://ftp.epa.gov/EmisInventory/2008v2/nei2008v2_national_county_level_sector.zip													
												Final Units	
fips	stfips	ctyfips	state_abbr	county_name	EI_Sector		description	Representing	Equivalent	uom	2008		Pollutant
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	HDVs	1,3-Butadiene	1,3-Butadiene	1,3-Butadiene	LB	15385.34198	TON	1,3-Butadiene [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	HDVs	Acrolein	Acrolein	Acrolein	LB	26305.04471	TON	Acrolein [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	HDVs	Formaldehyde	Formaldehyde	Formaldehyde	LB	323191.6845	TON	Formaldehyde [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	HDVs	Benzo[a]Pyrene	Benzo[a]Pyrene (ÌPOM)	POM	LB	2951.345857	TON	Benzo[a]Pyrene (⊂POM) [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	HDVs	Benzene	Benzene	Benzene	LB	61622.59152	TON	Benzene [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	HDVs	Acetaldehyde	Acetaldehyde	Acetaldehyde	LB	152010.341	TON	Acetaldehyde [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	HDVs	Naphthalene	Naphthalene	Naphthalene	LB	37446.62871	TON	Naphthalene [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	HDVs	PM10 Primary (Filt + Cond)	DPM	POM	TON	2756.551751	TON	DPM [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	LDVs	1,3-Butadiene	1,3-Butadiene	1,3-Butadiene	LB	215344.8759	TON	1,3-Butadiene [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	LDVs	Acrolein	Acrolein	Acrolein	LB	39917.19615	TON	Acrolein [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	LDVs	Formaldehyde	Formaldehyde	Formaldehyde	LB	705186.2426	TON	Formaldehyde [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	LDVs	Benzo[a]Pyrene	Benzo[a]Pyrene (ÌPOM)	POM	LB	395.1257378	TON	Benzo[a]Pyrene (⊂POM) [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	LDVs	Benzene	Benzene	Benzene	LB	1381630.356	TON	Benzene [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	LDVs	Acetaldehyde	Acetaldehyde	Acetaldehyde	LB	690511.9775	TON	Acetaldehyde [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	LDVs	Naphthalene	Naphthalene	Naphthalene	LB	111478.9019	TON	Naphthalene [TON]
17031	17	31	IL	Cook	Mobile - On-Road Diesel Heavy Duty Vehicles	LDVs	PM10 Primary (Filt + Cond)	DPM	POM	TON	395.1257378	TON	DPM [TON]

Source: EPA, 2013; Parsons, 2013

Table 3 – Excerpt of Spreadsheet Deriving Proportional Locomotive Gaseous MSAT Emission Trends from Absolute Trends Predicted by the EPA

EPA420-R-08-001										
Table 3-86 Control Case Air Toxic Emissions for Locomotives (short tons)										
HAP	2008	2010	2015	2020	2030	*2008*	*2010*	*2015*	*2020*	*2030*
BENZENE	85.5	79	61	44	27	*100%*	*92%*	*71%*	*51%*	*32%*
FORMALDEHYDE	1362.3	1,264	971	698	429	*100%*	*93%*	*71%*	*51%*	*31%*
ACETALDEHYDE	594.2	551	424	305	187	*100%*	*93%*	*71%*	*51%*	*31%*
1,3-BUTADIENE	99.6	92	71	51	31	*100%*	*92%*	*71%*	*51%*	*31%*
ACROLEIN	95.8	89	69	49	30	*100%*	*93%*	*72%*	*51%*	*31%*
NAPHTHALENE	44.9	40	30	21	12	*100%*	*89%*	*67%*	*47%*	*27%*
POM	26.8	25	20	15	8	*100%*	*93%*	*75%*	*56%*	*30%*

Source: EPA, 2008; Parsons, 2013

Table 4 – Excerpt of Spreadsheet Deriving Proportional Locomotive DPM Emission Trends from Absolute PM_{10} Emissions Trends Predicted by the EPA

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Table 3-81 Control Case PM10 Emissions for Locomotives (short tons)

Calendar Year	Large Line-haul	Large Switch	Small Railroads	Passenger/ Commuter	Total	
2006	28,477	2,304	492	1,023	32,296	
2007	28,401	2,329	500	1,011	32,241	
2008	23,287	2,019	442	822	26,569	*100%*
2009	22,804	2,039	449	807	26,100	*98%*
2010	22,248	2,019	456	774	25,498	*96%*
2011	21,234	2,037	464	741	24,476	*92%*
2012	20,203	1,987	471	701	23,362	*88%*
2013	18,945	1,972	469	647	22,034	*83%*
2014	18,313	1,928	477	611	21,329	*80%*
2015	17,451	1,942	481	574	20,448	*77%*
2016	16,329	1,891	485	532	19,237	*72%*
2017	15,214	1,904	490	490	18,097	*68%*
2018	14,363	1,883	494	448	17,188	*65%*
2019	13,540	1,895	498	407	16,341	*62%*
2020	12,938	1,798	502	375	15,613	*59%*
2021	12,324	1,809	507	350	14,990	*56%*
2022	11,675	1,752	511	325	14,263	*54%*
2023	11,016	1,732	515	300	13,563	*51%*
2024	10,367	1,655	520	275	12,817	*48%*
2025	9,712	1,543	524	250	12,029	*45%*
2026	9,091	1,505	528	227	11,351	*43%*
2027	8,492	1,460	533	207	10,692	*40%*
2028	7,915	1,412	537	188	10,053	*38%*
2029	7,363	1,361	542	172	9,438	*36%*
2030	6,844	1,305	543	157	8,849	*33%*
2031	6,349	1,244	544	144	8,281	*31%*
2032	5,879	1,179	545	132	7,735	*29%*
2033	5,431	1,111	546	121	7,209	*27%*
2034	5,026	1,040	547	111	6,723	*25%*
2035	4,653	969	547	101	6,270	*24%*
2036	4,326	897	548	93	5,864	*22%*
2037	4,033	840	548	86	5,508	*21%*
2038	3,775	801	549	81	5,205	*20%*
2039	3,556	761	549	76	4,941	*19%*
2040	3,375	720	549	72	4,717	*18%*

Source: EPA, 2008; Parsons, 2013

Table 5 – Excerpt of Spreadsheet that Distills Predicted Future MSAT Emissions Quantities from an Applicable EPA Dataset and Derives Relative Emissions Trends from those Quantities

					Emissions (ton/yr)						*Proportion of 2008 Base Emissions*				
					1999	*2008*	2010	2015	2020	2030	*2008*	*2010*	*2015*	*2020*	*2030*
Vehicle		Pollutant	Urban/Rural		Base	*Base*	Vehicle Controls	Fuel and Vehicle Controls	Fuel and Vehicle Controls	Fuel and Vehicle Controls	*Base*	*Vehicle Control*	*Base*	*Base*	*Base*
	HDVs	1,3-Butadiene	National	HDVs: 1,3-Butadiene: National	2.67E+03	1.39E+03	1.11E+03	8.93E+02	8.67E+02	9.62E+02	*100%*	*80%*	*64%*	*62%*	*69%*
	HDVs	Acetaldehyde	National	HDVs: Acetaldehyde: National	8.44E+03	5.39E+03	4.71E+03	4.00E+03	3.93E+03	4.42E+03	*100%*	*87%*	*74%*	*73%*	*82%*
	HDVs	Acrolein	National	HDVs: Acrolein: National	1.54E+03	7.72E+02	6.01E+02	4.80E+02	4.70E+02	5.28E+02	*100%*	*78%*	*62%*	*61%*	*68%*
	HDVs	Benzene	National	HDVs: Benzene: National	9.23E+03	4.92E+03	3.96E+03	2.87E+03	2.59E+03	2.61E+03	*100%*	*81%*	*63%*	*56%*	*56%*
	HDVs	Formaldehyde	National	HDVs: Formaldehyde: National	2.52E+04	1.52E+04	1.29E+04	1.09E+04	1.07E+04	1.20E+04	*100%*	*85%*	*72%*	*70%*	*79%*
	HDVs	Naphthalene	National	HDVs: Naphthalene: National	9.39E+02	5.51E+02	4.65E+02	2.80E+02	2.14E+02	1.91E+02	*100%*	*84%*	*51%*	*39%*	*35%*
	HDVs	POM	National	HDVs: POM: National	1.46E+02	8.35E+01	6.96E+01	4.05E+01	3.04E+01	2.69E+01	*100%*	*83%*	*49%*	*36%*	*32%*
	LDVs	1,3-Butadiene	National	LDVs: 1,3-Butadiene: National	2.12E+04	1.23E+04	9.67E+03	8.27E+03	7.79E+03	7.74E+03	*100%*	*78%*	*80%*	*85%*	*101%*
	LDVs	Acetaldehyde	National	LDVs: Acetaldehyde: National	2.14E+04	1.41E+04	1.15E+04	9.97E+03	9.29E+03	9.26E+03	*100%*	*82%*	*86%*	*92%*	*110%*
	LDVs	Acrolein	National	LDVs: Acrolein: National	2.30E+03	1.42E+03	1.14E+03	9.79E+02	9.12E+02	9.06E+02	*100%*	*80%*	*82%*	*87%*	*102%*
	LDVs	Benzene	National	LDVs: Benzene: National	1.74E+05	1.19E+05	9.88E+04	7.62E+04	7.05E+04	7.01E+04	*100%*	*83%*	*87%*	*90%*	*106%*
	LDVs	Formaldehyde	National	LDVs: Formaldehyde: National	5.52E+04	3.13E+04	2.40E+04	2.06E+04	1.92E+04	1.92E+04	*100%*	*77%*	*80%*	*85%*	*100%*
	LDVs	Naphthalene	National	LDVs: Naphthalene: National	3.12E+03	2.04E+03	1.79E+03	1.74E+03	1.77E+03	2.07E+03	*100%*	*88%*	*86%*	*87%*	*102%*
	LDVs	POM	National	LDVs: POM: National	3.51E+02	2.15E+02	1.85E+02	1.94E+02	2.09E+02	2.51E+02	*100%*	*86%*	*90%*	*97%*	*117%*

Source: EPA, 2005, 2006; Parsons, 2013

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