APPENDIX I
AIR QUALITY - SUPPLEMENTAL INFORMATION

This appendix provides supporting information for Section 3.5 (Air Quality). Section 1 describes the affected environment, Section 2 describes the air emissions from each alternative, and Section 3 discusses the environmental consequences.

1.0 Affected Environment

The affected environment, as defined for the purposes of the air quality impact assessment, includes the ambient air affected by non radiological air pollutants emitted from activities associated with the release, handling, processing, transportation, and disposal of solid materials generated from licensed facilities under the Alternatives, and the General Public potentially exposed to such non radiological air pollutants. The affected environment also includes environmental receptors potentially affected by air emissions from activities associated with the Alternatives.

This section describes the environmental setting and baseline national air emissions to which air emissions associated with the Alternatives are compared in the environmental consequences analysis and also includes a discussion of baseline ambient air quality. National air emissions rather than baseline ambient air quality, is used as the baseline for assessment of air quality impacts because site-specific baseline ambient air quality cannot be determined for the Draft GEIS.

1.1 Baseline Ambient Air Quality

Air quality is assessed by measurements collected at thousands of air quality monitoring stations around the country, and these monitoring data are used to assess baseline ambient air quality associated with site-specific actions. Management of air quality is generally conducted on a local or regional scale and is achieved by controlling air emissions sources within the area that contribute to violations of the NAAQS. Potential air quality environmental consequences of site-specific actions are generally compared to baseline ambient air quality data. However, site-specific analyses cannot be conducted for the Alternatives, as the specific quantities of licensee-released materials that would flow into and through each air quality management area, and the affect of those activities on associated local air concentrations, cannot be estimated. Therefore, the air emissions estimated for each of the Alternatives are compared to total national emissions for each air pollutant for which there is an ambient air quality standard, and no site-specific baseline ambient air quality data are included in the Draft GEIS.

1.2 Emissions

Management of air quality is achieved by controlling sources that contribute the air pollutants associated with each air quality standard. Emissions from air emissions sources are typically estimated using emission factors. An emission factor is a parameter that describes the air pollutant emission rate of a particular process in terms of some common and easily quantified activity that is directly related to the emissions activity. For example, emissions from secondary ferrous metal processing (recycling) are estimated by applying an emission factor that represents the average emission rate of particulate matter for each ton of scrap ferrous metal processed. If the total tons of scrap ferrous metal to be processed in a ferrous metal mill is known, the total emissions resulting from the process can be estimated by multiplying the total tons throughput by the emission factor in units of pounds of emissions per ton of ferrous metal processed.

Many of the processes associated with the Alternatives are regulated to ensure that emissions are controlled to specified levels. The types and performance of air pollution control equipment in use at any given facility will differ. Typically, air pollutant emission factors are expressed as the uncontrolled emission rate, and the result of the estimate produced for any specific facility is adjusted to account for the control efficiency of the air pollution control system.

Air quality management programs are typically implemented on a local or urban area scale. Information on the specific rates of activities conducted within the specific local or urban scale air quality management areas is required to complete these local analyses. Activity rate data would include, for example, total vehicle miles traveled in the area each year, or the total tons of ferrous metal produced in the area each year. However, the quantities of licensee-released materials that would flow into and through each air quality management area for each of the Alternatives cannot be estimated for the Draft GEIS, and, therefore, no site-specific or region-specific air quality analyses can be conducted. Since the affect of meteorology and climatology on environmental impacts is only relevant for local analyses, it is not meaningful to discuss meteorology and climatology in this study.

Since air emissions associated with activities conducted under each Alternative can only be estimated on a national scale, the total national emissions (in units of tons per year) of each pollutant for each process and activity associated with each Alternative is used as the environmental setting (air quality baseline) for the purposes of evaluating the air quality impacts of the Alternatives. The national emissions of each pollutant from each industry sector and process (e.g., ferrous metal production) are included in the EPA National Emissions Inventory (NEI) (EPA 2004a). The same emission factors used by EPA to prepare the NEI are applied to appropriate estimates of the material flow through each process to estimate the incremental effects on air quality associated with each Alternative.

The NEI, used in this Draft GEIS to establish the affected environment, is prepared annually by the Emission Factors and Inventories Group (EFIG) within the EPA Office of Air Quality Planning and Standards (OAQPS). The development of the annual NEI by EPA is a requirement of the Clean Air Act. The EPA coordinates closely with State air quality planning agencies to ensure that the database is as accurate as possible and that local conditions are represented to the extent possible. The EPA NEI database is available at http://www.epa.gov/ttn/chief/net/1999inventory.html (EPA 2004a). Emissions estimates are available in the NEI for each of the specific process activities that can be quantified, as well as for the equipment and transportation activities that are associated with the Alternatives.

The total national emissions (in units of tons per year) of each pollutant for each process and associated activity is used as the environmental setting (air quality baseline) for the purposes of evaluating the air quality impacts of the alternatives. The national emissions of each pollutant from each industry sector and process (e.g., ferrous metal production) are included in the NEI. A summary of national emissions by source activity for the processes related to the alternatives for 1999 is provided in Table I-1. The annual period 1999 is used as the baseline measure because it is the most recent annual, national, air emissions inventory that has received extensive quality assurance.

Table I-1 National Annual Air Metric Emissions from Specific Processes for 1999 (metric tons per year)

Source Category	SO_2	VOC	PM10	PM2.5	NO_x	CO
Concrete Recycling	10	43	51	47	115	200
Secondary Ferrous Metal Production	7,997	3,361	7,609	7,074	5,326	22,346
Secondary Copper	48	336	1,833	1,792		
Secondary Aluminum	1,272	18,068	11,640	11,148	2,745	1,701
Subtitle D Landfills	1	1,393	609	250	13	65
Solid Waste Incinerators	11,852	1,190	2,393	2,128	30,127	10,775

Source: EPA NEI database at http://www.epa.gov/ttn/chief/net/1999inventory.html.

2.0 Air Emissions From Alternatives

The EFIG maintains a compilation of the recommended emission factors for use in estimating emissions from various air emissions source types, including air emissions processes and activities associated with each Alternative. The record of emission factors for stationary sources is the Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume 1: Stationary Point and Area Sources http://www.epa.gov/ttn/chief/ap42/index.html (EPA 2003e). Emission factors for highway mobile sources (e.g., diesel trucks) are developed by use of the MOBILE6 model that is maintained and updated by the EPA Office of Transportation and Air Quality (OTAQ) (EPA 2003f). Emission factors for mobile sources are dependent on the vehicle type, vehicle age, and speed, among other influences. Highway emission factors for heavy duty trucks that would be used to transport materials under the Alternatives will be developed using the MOBILE6 model. Input conditions representative of the average conditions anticipated for transportation of materials under the Alternatives will be selected to derive these average emission factors. The emission factors will then be applied to estimates of the total miles of transport required for each of the alternatives.

Emissions from heavy equipment operations are estimated by the use of another model developed by OTAQ called the NONROAD model (EPA 2003g). This model includes assumptions about the distribution and activity levels of various types of off road mobile sources. The output of the model provides estimates for specific types of equipment. Emissions from non-road heavy equipment (e.g., ferrous metal scrap pile loaders), are developed by applying an estimate of the total anticipated hours of operation for a representative type of heavy equipment that is commonly used for the particular type of process. The appropriate emission factor for that type of heavy equipment is used to derive a reasonable estimate of the air emissions for each Alternative.

2.1 Concrete

Fugitive Particulate Emissions

Concrete released from licensed facilities for the No Action, Unrestricted Release, and Limited Dispositions Alternatives would be broken up to remove ferrous metal reinforcing bars, and to create pieces in size ranges that can be moved and loaded onto trucks at the licensed facilities. These size-reduction processes can emit fugitive dust. Additional fugitive releases may be generated as the material is loaded into trucks for removal from the site. Similarly, other size-reduction processes at transfer station operations at which concrete rubble is processed are also potential sources of fugitive dust emissions. The fugitive dust generated by these mechanical activities includes mass in the smaller size range (<2.5 µm diameter particles) and has the potential to be transported to downwind receptor locations. Most of the particles larger than 10 µm are removed from the atmosphere by gravitational settling near the air emission source and are not generally considered in air quality analyses. Depending upon wind speed and direction and other atmospheric conditions, populations living close to the licensee's facility or to other facilities where concrete rubble is processed for size reduction could be exposed to ambient air concentrations of fugitive dust. Such exposures would depend upon the hours of operation of the processes and dust suppression measures that are applied during the process.

Combustion Source Emissions

Movement and size-reduction of concrete would involve use of heavy equipment, such as dozers and loaders. Such equipment is commonly powered by diesel engines. Diesel engines emit NO_x and VOC, the precursors of ozone, CO, particulate matter in the fine size fraction, and CO_2. The precursors of ozone and the particulate matter emissions have the potential to combine with other pollutants generated by mobile and stationary sources in the general area to affect regional air quality.

Transportation Emissions

Under the No Action and Unrestricted Release Alternatives large pieces of concrete would be loaded into heavy duty trucks or rail cars at the licensee facility for transport to the concrete recycling process facilities. Transport of concrete rubble does not have a high potential to generate fugitive emissions, however, transportation of crushed aggregate suitable for use at a roadway construction site could contribute fugitive emissions during transport if the truck trailer is not securely covered. Truck engines used to transport materials would emit NO_x, VOC, CO, particulate matter in the fine size range and CO_2. The General Public along the transportation routes would be exposed to the diesel combustion exhaust and any fugitive emissions released.

Process Emissions

Once the concrete reaches the concrete recycling process site, additional mechanical processing would be conducted to further reduce the concrete rubble into the appropriate aggregate size range for end use as road bed fill. The process involves grinding and crushing and would generate fugitive dust. Wind erosion could result in the generation of fugitive particulate emissions from aggregate storage piles. The mass of emissions would depend on the length of time the storage pile remains undisturbed, the moisture content of the aggregate, and the wind speed. The potential for population exposure would depend upon the wind speed and direction and the distance between the facility and human receptors.

Table I-2 summarizes air emission sources, processes and activities by material type (concrete, ferrous metal and trash disposal) for the No Action, Unrestricted Release and Limited Disposition Alternatives.

2.2 Ferrous Metal, Aluminum, and Copper

Processing of ferrous metal, aluminum, and copper for recycling under the No Action and Unrestricted Release Alternatives involves similar activities with similar air emissions characteristics. Similar processes and activities are associated with the release of the materials at the licensee sites and the transport of the materials to the recycling facilities. There are specific differences in the magnitude and constituents of air emissions from the recycling processes for ferrous metal, aluminum, and copper as a result of the furnace types used to melt the scrap and the characteristics of the metals themselves, but the process activities for the secondary metals processing are similar for all three materials. This section provides a generic description of the process and the specific emissions characteristics for the different kinds of furnaces used to melt metal scrap.

<u>Fugitive Particulate Emissions</u>

Fugitive dust emissions sources associated with the processing of the metal scrap at the licensed facility are associated with the bulk loading of the scrap metal into trucks or railcars. These processes have only a minimal potential for dispersion of the fugitive emissions from the licensed facility site because the emissions are characterized by large particle sizes that settle under gravitational influences and do not tend to disperse from the source.

<u>Process Emissions</u>

Several different types of cutting machines or shredders might be used to reduce the size of the scrap metal pieces for transport either at the licensed facility site or at secondary processing facilities. The scrap metal processing could result in metal fumes emissions. Ozone precursors would be generated from the diesel or gasoline engines used to power the equipment.

While the processes that are used at the recycling facilities to recycle ferrous metal, aluminum, and copper are conceptually the same, different types of furnaces are used for each metal. Therefore, different emission rates and constituents are associated with each metal recycling process. The scrap metal is processed by reducing the scrap to the molten state in a furnace, separating the impurities from the metal, and casting the recovered metal into intermediate or final products. Recovered metal is often cast into ingots that would then be further processed into finished materials (e.g., automobile engine blocks) at some other facility, or cast into new products at the recycling facility site.

Table I-2 Air Emissions Sources, Processes, and Activities Associated with No Action, Unrestricted Release, and Limited Dispositions Alternatives

Material	Activity	Air Emissions Source	Exposed General Public
Concrete (No Action, Unrestricted Release, and Limited Dispositions Alternatives)	Crushing/Grinding	Fugitive Dust	Vicinity of licensed facility
	Loading for Transport	Fugitive Dust Heavy Equipment Engine Emissions	Vicinity of licensed facility, and incremental contribution to urban and regional air quality inventory
	Transport to Road Bed Material Processing Facility	Fugitive Dust Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
	Unloading/Storage Piles	Fugitive Dust Heavy Equipment Engine Emissions	Vicinity of processing facility, and incremental contribution to urban and regional air quality inventory
	Processing into Road Bed Material	Fugitive Dust Heavy Equipment Engine Emissions	Vicinity of processing facility, and incremental contribution to urban and regional air quality inventory
	Transport to Road Building Site	Fugitive Dust Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
	Final Use - Roadbed Construction	Fugitive Dust Heavy Equipment Engine Emissions	Near road construction site, and incremental contribution to urban and regional air quality inventory
	Disposal of Concrete Dust in Landfill	Fugitive Dust Heavy Equipment Engine Emissions	Vicinity of landfill, and incremental contribution to urban and regional air quality inventory

Table I-2 Air Emissions Sources, Processes, and Activities Associated with No Action, Unrestricted Release, and Limited Dispositions Alternatives (continued)

Material	Activity	Air Emissions Source	Exposed General Public
Ferrous Metal, Copper, Aluminum (No Action and Unrestricted Release Alternatives)	Sorting/sizing for removal	Torches and Cutting Tools Heavy Equipment Engine Emissions	Vicinity of licensed facility, and incremental contribution to urban and regional air quality inventory
	Loading for Transport	Heavy Equipment Engine Emissions	Vicinity of licensed facility, and incremental contribution to urban and regional air quality inventory
	Transport to Recycling Facility	Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
	Unloading/Storage/Preparation for Recycling	Torches and Cutting Tools Heavy Equipment Engine Emissions	Vicinity of processing facility, and incremental contribution to urban and regional air quality inventory
	Smelting/Refining	Furnace	Vicinity of processing facility
	Transport to Secondary Casting	Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
	Secondary Melting casting	Furnace	Vicinity of secondary processing facility
	Molding/cutting/shaping in new use	Torches and Cutting Tools	Near reuse manufacturing facility
	Transport of Final Product to point of use	Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
	Transport of Recycling Process wastes to Landfill	Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
Trash Disposal (No Action, Unrestricted Release, and Limited Dispositions Alternatives)	Unloading and disposal of trash at EPA/State-regulated landfill	Heavy Equipment Engine Emissions	Vicinity of landfill or disposal facility
	Disposal in EPA/State-regulated landfill	Heavy Equipment Engine Emissions	Vicinity of landfill or disposal facility

The principal air pollutant emitted from any type of secondary metals processing activity is particulate matter. The particulate matter results from the condensation of metal fumes that are emitted from the molten metal processes when they are released into the ambient air. The resulting particulate matter is primarily in the form of metal oxides. These metal oxide emissions form in the small size ranges that can disperse from process stacks and vents into the ambient air and then disperse from the facility location. Particulate emissions from secondary metal processing facilities are subject to air quality regulations and subject to air emissions control requirements.

Processing and disposal of the impurities generated as slag from these furnaces can also cause emissions of particulate matter. These processes are conducted in ways that minimize the release of air pollutants.

Ferrous Metal

Scrap ferrous metal is recycled by incorporating scrap into a furnace along with virgin ferrous metal scrap (i.e., scrap ferrous metal generated at the ferrous metal mill from ferrous metal processing) and pig iron. The mixture is melted and impurities are extracted. The final ferrous metal melt is tapped and used to form either cast products, ingots or rolled sheets for use in a variety of applications. The furnaces used to process scrap ferrous metal can be part of an integrated ferrous metal mill where iron ore is processed in addition to ferrous metal, but it is more often completed at specialty iron and ferrous metal foundries that concentrate on secondary ferrous metal processing. Most of the furnaces used to process ferrous metal do not use external heat sources. The main types of secondary ferrous metal furnaces are basic oxygen furnaces and electric arc furnaces (EAF). Scrap ferrous metal may also be melted directly in a foundry. In the blast furnace process, molten pig iron from a blast furnace is used to melt the scrap. Scrap may also be melted by heat generated through electrical resistance in EAFs. Oxygen lancing is often used to remove impurities by forming oxides that create the furnace slag. The oxidation reactions are exothermic and create additional heat for the process. Some smaller foundries use gas fired furnaces to melt scrap ferrous metal. The primary air pollutant emissions from ferrous metal furnaces are particulate matter resulting from fumes released by the melt. These fumes are most commonly in the form of metal oxides. Ferrous metal blast furnaces and foundries emit combustion products from combustion of fuel to provide heat to melt the ferrous metal. EAF furnaces result in secondary emissions of combustion products from generation of electricity.

Aluminum

Aluminum scrap is processed primarily in reverberatory furnaces. Reverberatory furnaces are generally natural gas fired immediately above the melt and have a curved roof that redirects the rising heat back into the melt. Emissions from the furnace fuel use are estimated as a separate process. The primary emissions from aluminum recycling are particulate matter resulting from fumes released by the melt, and combustion products from burning of natural gas.

Copper

Copper scrap may be processed in cupola furnaces, reverberatory furnaces, or electric arc furnaces. Copper scrap is generally mixed with virgin copper and clean scrap. The pure metal is separated from the impurities and tapped to form ingots or in some applications is cast directly into new products, such as copper pipe. The copper recycling processes emits metal fume particulate matter and combustion emissions.

2.3 Trash

Under the No Action, Unrestricted Release, EPA/State-Regulated Disposal, and Limited Dispositions Alternatives, trash released from licensed facilities is assumed to be directly disposed in a Subtitle D landfill. Air emissions sources and emission factors associated with disposal of trash are discussed in Section 3.3.

3.0 Environmental Consequences

Total national air emissions (in units of tons per year) from processes and activities associated with the Alternatives are estimated using emission factors. For example, the total amount of particulate matter (PM) associated with the recycling of ferrous metal under the Unrestricted Release Alternative is estimated by multiplying the total amount of ferrous metal released from licensed facilities that is recycled in ferrous metal mills (in units of tons per year) by a factor for the amount of particulate matter emitted per ton of ferrous metal recycled (in units of mass particulate matter per ton ferrous metal processed). The same emission factors used to prepare the NEI are applied to appropriate estimates of the material flow through each process to estimate the incremental effects on air quality associated with each Alternative.

Approximately 15 to 20 million tons of concrete and approximately 2 million tons of ferrous metal would be released from licensed commercial nuclear reactor facilities under any of the Alternatives (Appendix F). It is assumed that all of the concrete would be sent for recycle as road-bed. The amount of ferrous metal is compared to approximately 82 million metric tons per year in the United States. Conversely, approximately 6,600 metric tons of copper and 200 tons of aluminum are anticipated to be released from commercial nuclear reactor facilities. Therefore, air quality impacts associated with recycling and disposal of aluminum and copper are not discussed quantitatively in the Draft GEIS. Less than 0.07 million tons of trash would be released from licensed nuclear reactor facilities, and less than 0.9 million tons of trash is anticipated to be released from licensed facilities other than commercial nuclear reactors. This compares with estimates of approximately 209 million tons per year of municipal solid waste. The air quality impact analysis for trash is based on the disposal of trash in either EPA/State-regulated landfills, EPA/State-regulated incinerators, or LLW disposal facilities. Trash is not assumed to be recycled or reused under any of the Alternatives.

Sources and activities associated with the Alternatives to which NESHAP standards apply are shown in Table I-3. Process emissions of hazardous air pollutants (HAPs) would be released from the recycling of ferrous metal under the No Action and Unrestricted Release Alternatives, The emission factors for HAPs for ferrous metal recycling are small compared to the emission

Table I-3 Summary Table – Total Air Emissions from Alternatives (metric tons)

Total Emissions					
No Action Alternative and Unrestricted Release Alternative	PM_{10}	SO_2	NO_x	VOC	CO
Concrete (recycling)	1,219	Neg.	4,654	1,132	910
Ferrous metal (recycling)	8,362	2,905	7,248	4,614	--
Trash (landfill disposal)	67	Neg.	186	94	94
TOTAL EMISSIONS	9,648	2,905	12,124	5,839	1,004
EPA/State-Regulated Disposal Alternative					
Concrete (landfill disposal)	1,210	Neg.	4,583	1,132	910
Ferrous metal (landfill disposal)	36	Neg.	776	60	326
Trash (landfill disposal)	67	Neg.	186	94	94
Trash (incineration)	171	117	337	94	157
TOTAL EMISSIONS	1,417	117	5,696	1,285	1,394
Limited Dispositions Alternative					
Concrete (recycling)	1,219	Neg.	4,646	1,132	910
Ferrous metal (landfill disposal)	36	Neg.	776	60	326
Trash (landfill disposal)	67	Neg.	186	94	94
TOTAL EMISSIONS	1,320	Neg.	5,570	1,285	1,330
LLW Disposal Alternative					
TOTAL EMISSIONS	93	7	889	94	94
Annual Emissions					
No Action Alternative and Unrestricted Release Alternative					
Annual Emissions (metric tons/year)	205	62	258	124	21
EPA/State-Regulated Disposal Alternative					
Alternative Not Including Trash Incineration					
Annual Emissions (metric tons/year)	28	Neg.	118	26	28
Alternative Including Trash Incineration					
Annual Emissions (metric tons/year)	30	3	121	27	30
LLW Disposal Alternative					
Annual Emissions (metric tons/year)	2	0.2	19	2	2
Limited Dispositions Alternative					
Annual Emissions (metric tons/year)	33	Neg.	139	32	33

Neg = Negligible

factors for the criteria (NAAQS) air pollutants for ferrous metal recycling, in terms of emissions per ton of ferrous metal recycled. Therefore, the HAP emissions from ferrous metal recycling would be small as compared to the total inventory of HAPs emitted on a national basis. Similarly, the HAP emissions associated with disposal of material in Subtitle D landfills or EPA/State-regulated incinerators would also be small as compared to the total inventory of HAPs emitted from landfill disposal and incineration of solid waste. In addition, the facilities where these materials would be processed are already subject to HAP emissions limitation standards whether or not the materials from licensed facilities are processed. Therefore, HAP emissions from ferrous metal recycling and landfill disposal and incineration of wastes generated from ferrous metal recycling are not discussed quantitatively in the DGEIS.

3.1 No Action Alternative

Air emissions sources, processes, and activities that are anticipated to contribute air pollutant emissions for the No Action, Unrestricted Release, and Limited Dispositions Alternatives for each material are listed in Table I-4. Air emissions sources, processes, and activities associated with the No Action Alternative are similar to those for the Unrestricted Release Alternative for recycling of concrete, ferrous metal, aluminum, and copper and disposal of trash. Under the Limited Dispositions Alternative, concrete would be recycled and other material would be disposed of in landfills. Air emissions associated with the No Action Alternative would be similar to those for the Unrestricted Release Alternative based on the amount of solid material that would be released and potentially recycled under these two Alternatives. For the purposes of the air emissions environmental consequences analysis it is assumed that all of the released solid material for both the No Action and Unrestricted Release Alternatives are recycled and that none is disposed of, and for the Limited Dispositions Alternative, it is assumed that all of the concrete is recycled. These assumptions maximize the air emissions estimated for the Alternatives. Sources, activities, and air emissions for the Unrestricted Release Alternative are presented in Section 3.2 below.

3.2 Unrestricted Release Alternative

As discussed in Section 3.1, air emissions sources, processes, and activities for the No Action Alternative are similar for those for the Unrestricted Release Alternative with respect to the recycling of concrete, ferrous metal, aluminum, and copper and disposal of trash and also for the Limited Dispositions Alternative for concrete and trash (Table I-4). The activities that result in air emissions for each of the materials assessed can be grouped in four general categories: materials processing, heavy equipment operation, recycling operations, and transportation. Each of the materials must be segregated and sized to allow transportation from the site. These processes require the use of heavy equipment, such as crushers, and equipment to load the processed materials into trucks or railcars. The materials are then transported to appropriate processing or disposal facilities by trucks or railroad. Similar types of heavy equipment are used to unload the materials at a suitable processing or disposal facility. At a processing facility the materials are used as feed stock for the process that results in the recyclable materials. Finally, the processed materials and unwanted waste products from the processing activity must be transported to the end use site or to the appropriate disposal site. These processes and their associated air emissions are described below for each of the solid materials.

Table I-4 Air Emissions Sources, Processes, and Activities Associated with No Action, Unrestricted Release, and Limited Dispositions Alternatives

	Activity	Regulated Pollution	Exposure Location
Concrete	Crushing/Grinding	Fugitive Dust Heavy Equipment Engine Emissions	Vicinity of licensed facility; Vicinity of the processing facility
	Loading, Unloading, Storage Piles	Fugitive Dust Heavy Equipment Engine Emissions	Vicinity of licensed facility; Vicinity of the processing facility
	Transportation from licensed facility and to final use site, or to landfill	Fugitive Dust Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
	Final Use - Roadbed Construction	Fugitive Dust Heavy Equipment Engine Emissions	Near road construction site, and incremental contribution to urban and regional air quality inventory
	Disposal of Concrete Dust in Landfill	Fugitive Dust Heavy Equipment Engine Emissions	Vicinity of landfill, and incremental contribution to urban and regional air quality inventory
Ferrous metal	Sorting/sizing for removal	Torches and Cutting Tools Heavy Equipment Engine Emissions	Vicinity of licensed facility
	Loading and unloading	Heavy Equipment Engine Emissions	Vicinity of licensed facility, and vicinity of processing facility
	Transportation between processing facilities, or landfill (for Limited Dispositions Alternative)	Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
	Smelting/Refining/Casting	Furnace	Vicinity of processing facility
	Molding/cutting/shaping in new use	Torches and Cutting Tools	Near reuse manufacturing facility
	Transport of Final Product to point of use	Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
Trash	Loading and unloading for transport	Heavy Equipment Engine Emissions	Vicinity of licensed facility, and vicinity of processing facility
	Transportation from licensed facility to waste incinerator or landfill	Heavy-Duty Truck Highway Emissions	Along the transportation route, and incremental contribution to urban and regional air quality inventory
	Disposal in EPA/State-Regulated Landfill	Heavy Equipment Engine Emissions	Vicinity of the landfill

Transportation

Transportation of the intermediate and completely processed concrete aggregate, ferrous metal, and trash will contribute exhaust emissions from truck engines. Exhaust emissions from heavy duty diesel trucks are calculated by the application of emission factor models that represent the distribution of truck engines in service. Those emission factors are applied to estimates of the miles traveled by trucks with each engine type.

There is also a possibility of fugitive dust emissions from the load. A cover is required for trucks and railcars that are transporting these types of materials to limit the fugitive dust emissions and the contributions from this type of activity are assumed to be negligible. There is no approved or recommended method to estimate these emissions. Therefore, fugitive emissions are not included in the emissions estimate from transportation processes.

Air emissions estimates for transportation activities associated with the Unrestricted Release and Limited Dispositions Alternatives represent the total emissions expected for transportation of all of the materials to be released from licensed facilities. Material specific estimates used in this air quality analysis were estimated by allocating the transportation emissions based on the relative quantities of the materials. Table I-5 summarizes the allocation of the transportation emissions for concrete, ferrous metal and trash. Total emissions for all heavy duty diesel trucks for 1999, the most recent year for which data have been published by EPA, is 2,390,000 metric tons per year for NO_x, and 130,909 metric tons per year for PM10. The average annual national emissions for NO_x and PM10 for transportation of concrete are well under 0.001 percent of total heavy duty diesel emissions and are insignificant from an air quality management perspective.

Table I-5 Unrestricted Release and Limited Dispositions Alternatives Transportation Emissions

Material	Quantity Released (10^6 tons)[1]	Material Mass Fraction	Total Emissions (metric tons/year)			
			NO_x	PM10	SO_2	CO_2
Concrete (metric tons)	20	0.89	5	0.2	Neg.	5,062
Ferrous metal (metric tons)	2	0.11	0.62	0.02	Neg.	626
Trash (metric tons)	0.066	0.003	0.12	Neg.	Neg.	17
Unrestricted Release Alternative Total (metric tons)	22	1	6	0.22	0.05	5,075
Total US Annual Emissions[2]	–	–	2,390,900	130,909	90,909	na

[1]Solid Material Generated by Commercial Nuclear Power Reactors.
[2] (EPA 2004a) NEI Total emissions for all heavy duty diesel engines in 1999. CO_2 emissions are not reported in the NEI totals.

<u>Concrete</u>

Initially, large pieces of reinforced concrete are generated during the demolition process. These large pieces must be broken up into smaller pieces that can be loaded into trucks and to remove the ferrous metal reinforcing bars. The concrete that is targeted for disposal is loaded into trucks for transportation to landfills. The concrete that is to be used as road bed aggregate is loaded into trucks for transport to a facility that will break the pieces into smaller sizes, using similar equipment as that used at the licensed facility. Finally, the sized aggregate is transported to the road construction site, and the unusable pieces to a disposal facility.

Concrete Rubbilization

The size-reduction processes can emit fugitive dust. Additional fugitive releases may be generated as the material is loaded into trucks for removal from the site. Similarly, other size-reduction processes at transfer station operations at which concrete rubble is processed are also potential sources of fugitive dust emissions. The fugitive dust generated by these mechanical activities includes mass in the smaller size range (<10 μm diameter particles) and has the potential to be transported to downwind receptor locations. Most of the particles larger than 10 μm are removed from the atmosphere by gravitational settling near the air emission source and are not generally considered in air quality analyses. Depending upon wind speed and direction and other atmospheric conditions, populations living close to the licensee's facility or to other facilities where concrete rubble is processed for size reduction could be exposed to ambient air concentrations of fugitive dust. Such exposures would depend upon local meteorological conditions, the hours of operation of the processes, and dust suppression measures that are applied during the process.

Fugitive dust emissions from these types of operations are typically controlled by wetting the materials or some other dust suppression method. Emissions from these activities are low and estimates are not included as a separate source category in routine air emissions inventories. Emission factors for stone and aggregate crushing, screening and secondary crushing processes are used as a surrogate to represent an estimate of the contribution of these processes to air emissions loads. Emission factors for fugitive dust emissions in the PM10 size range from the crushing processes range from 0.0007 to 0.015 expressed in units of lbs/ton of processed material. The emission factors for fugitive dust during loading and unloading processes range from 0.000016 to 0.0001 (lb/ton loaded or unloaded). Emission factors for the 2.5 μm size range have not been finalized for many of these processes. EPA estimates PM2.5 emissions in the NEI by applying size fraction assumptions to source categories that lack a PM2.5 emission factor. Emissions of PM10 associated with the Alternatives are compared to annual PM2.5 emissions estimates to provide a conservative assessment of the potential air impacts.

Total fugitive dust emissions generated by crushing and sorting the concrete is estimated to be 157.5 metric tons if all 19.8 million tons of the concrete is completely processed into road bed aggregate. This total assumes two loading and unloading operations (one at the licensed facility and one at the aggregate processing facility). Emissions are smaller for the concrete that is disposed in a landfill because less crushing and screening is required. If it is assumed that these operations will occur uniformly over a 47 year period, the annual emissions are 3.35 metric tons per year. The annual emissions of the smaller size fraction PM2.5 represented in the 1999 NEI inventory (EPA 2004a) for crushing and screening processes is 46.2 short tons.

Heavy Equipment Operation

A variety of types of equipment that use heavy duty diesel engines can be used to process the concrete. These engines emit particulate matter in both size ranges, oxides of nitrogen (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), and small amounts of HAP pollutants. The emission factors for these engines are represented in units of grams per horsepower-hour. The following assumptions were used to develop emissions estimates for the heavy equipment engines. Primary crusher engines rated at 200 horsepower can process 10 short tons of concrete per hour. Bull dozers rated at 100 horsepower can create piles of concrete at a rate of 10 short tons per hour. Finally, front end loaders rated at 100 horsepower, can load five tons of concrete per hour into trucks. These assumptions result in emissions estimates of 1,050 metric tons of particulate matter, 4,376 metric tons of NO_x, 910 metric tons of CO, and 1,132 metric tons of VOC.

Road Bed Construction

The aggregate produced from recycled concrete is assumed to be incorporated into road bed underlayment during road construction. Following road way preparation, and before paving, this aggregate is spread on the road bed to serve as a support for the paving materials, and to stabilize the materials under the asphalt or concrete used as paving material. There is a potential for fugitive dust emissions during these processes, but in most cases dust suppression methods are applied during road construction. EPA has not published recommended emissions estimation methods or emission factors for this activity, and typically emissions from these processes are not included in standard air emissions inventories. Since emissions are expected to be minimal, and there is no recommended estimation method, emissions from this activity are not addressed quantitatively in this Draft GEIS.

Overall criteria pollutant emissions from processing and transportation of concrete released from licensed facilities under the Unrestricted Release and Limited Dispositions Alternatives represents a small fraction of the total national emissions associated with processing and transportation of concrete generated from all demolition and concrete recycling operations nationwide. A comparison of total estimated criteria pollutant emissions associated with the Unrestricted Release and Limited Dispositions Alternatives and total national emissions is shown in Table I-6. Overall emissions from recycling of concrete released from licensed facilities is estimated to be 0.2 percent or less of national emissions from concrete recycling.

<u>Ferrous Metal</u>

Processing ferrous metal for recycling under the Unrestricted Release Alternative involves the same general categories of emission sources as those described for concrete. Ferrous metal would not be recycled under the Limited Dispositions Alternative, but would be disposed of in landfills. Air emissions from landfill disposal of ferrous metal are included in Section 3.3. The process of breaking the concrete into smaller pieces to remove ferrous metal reinforcing bars is

Table I-6 Unrestricted Release and Limited Dispositions Alternatives Emissions from Concrete Recycling (metric tons)

	PM_{10}	VOC	NO_x	CO
Concrete Rubblization (metric tons)	158	Not applicable	Not applicable	Not applicable
Heavy Equipment Operation (metric tons)	1,050	1,132	4,376	910
Transportation (metric tons)	10	Not available	278	Not available
Road Bed Construction	[emission factors for road bed construction unavailable]			
Total Emissions (metric tons)	1,219	1,132	4,654	910
Annual Emissions (metric tons/year)	26	24	99	19
National Average Emissions (metric tons per year, all heavy duty diesel highway vehicles)	145,152	36,817	1,404,080	217,531
Percent of National Average	0.02	<0.01	< 0.01	<0.01

(1) Total emissions are projected to occur over a period of 47 years.

the same process described for concrete and no additional fugitive dust emissions would be generated solely because of the extraction of ferrous metal reinforcing bars. Heavy equipment will be used to load the ferrous metal into trucks, transportation sources will create air emissions during the transport of the ferrous metal, and emissions result from the furnaces where the ferrous metal is melted to be recast into ingots, sheets, rolls or bars.

Smelting Furnace

The recycled ferrous metal scrap is assumed to be recycled in one of three specific furnace types. Since it is not possible to determine the exact flow of ferrous metal to different reprocessing facilities, an average emission factor has been used. The average emission factor is based on the assumption that all of the recycled ferrous metal scrap is processed in one of the three primary furnace types used in commercial ferrous metal recycling. The three types of furnaces are electric arc furnace, the basic oxygen furnace (or an oxygen lanced foundry), and the open hearth foundry furnace. NUREG-1640 provides an estimate of the percent of scrap ferrous metal recycled in the U.S. that flows through each of these major recycling furnace types. Table I-7 summarizes the PM10 emission factors for each furnace type (EPA Compilation of Emission Factors, EPA Publication AP-42). NRC has assumed for the purposes of the air emissions impact assessment that the percent of ferrous metal scrap throughput directed to each furnace type for the licensee-released scrap ferrous metal is the same as that for the U.S. as a whole. The percent throughput estimate is used as a weighting factor for each process-specific particulate emission factor to derive a weighted average emission factor for the scrap ferrous metal smelting process. This factor is multiplied by the estimated total tonnage of scrap ferrous metal to be released under the Unrestricted Release Alternative to derive the emission rate for the smelting process. The weighting calculation for the particulate emission factor is summarized in Table I-7.

Table I-7 Ferrous Metal Scrap Smelting Particulate Emission Factor Derivation

Furnace Type	Emission Factor (lb/ton)	Fractional Throughput	Weighting Contribution
Electric Arc Furnace	13	0.581	7.553
Open Hearth Foundry	11	0.216	2.376
Oxygen Lanced Foundry	10	0.203	2.03
Weighted Average emission factor			11.959 lb/ton (5.98 kg/MG)

Application of the weighted average emission factor, and assuming that all 2.45 million tons of ferrous metal is recycled yields a total emission estimate for uncontrolled particulate matter of 13,319 metric tons. Typically, ferrous metal furnaces employ a particulate matter control device that achieves an average of 95 percent control efficiency. Applying that level of control yields 666 metric tons of particulate matter from the furnace operation. Additional particulate matter emissions result when metal fumes condense during the pours to form ingots, rolls, or sheets of ferrous metal that can be used in further processing. The emission factor for that process is 2.8 lb/ton (1.4kg/MG). Since it is more difficult to control those emissions resulting from the pours, no control efficiency is applied to the emissions from that process. It is assumed that the complete processing of recycled ferrous metal requires two melts and two pours. The first set of melt and pour is assumed to create an ingot, roll of sheet output, convenient for storage and transport to a second processing site where some final use product is cast. The total emissions of particulate matter for the recycling operation is 8,362 metric tons or 178 metric tons per year. That total represents 8.8 percent of the total annual particulate matter emissions from secondary ferrous metal production in the 1999 NEI inventory.

The emissions of SO_2, NO_x, CO and VOC associated with ferrous metal furnaces is dependent on the fuels used, and other operating characteristics of the furnaces. The emissions of these other air pollutants are assumed to change by the same 8.8% factor that was calculated for particulate matter.

Heavy Equipment Operation

Heavy equipment powered with heavy duty diesel engines are used to collect the scrap ferrous metal at the demolition site, transfer the ferrous metal to trucks or rail cars, and to transfer the ferrous metal to the feed stock at the ferrous metal processing furnaces. Similar types of equipment as those described for the removal of concrete are used to remove the ferrous metal. The estimate for emissions from heavy equipment used to process ferrous metal assumes that a bull dozer rated at 100 horsepower can aggregate 2 short tons of scrap ferrous metal per hour, and that a front end loader can transfer 20 short tons of ferrous metal per hour into trucks or rail cars. The total emissions assume two cycles of the transfer process, one at the licensed facility and one at the processing facility.

Summary

Overall criteria pollutant emissions from processing and transportation of ferrous metal released from licensed facilities under the Unrestricted Release Alternative represents a small fraction of the total national emissions associated with processing and transportation of ferrous metal generated from all ferrous metal recycling operations nationwide. A comparison of total estimated criteria pollutant emissions associated with the Unrestricted Release Alternative and total national emissions is shown in Table I-8. The emissions resulting from the smelting operation may approach 8% of the emissions from a typical year of ferrous metal processing. Overall emissions from the transportation and recycling of ferrous metal released from licensed facilities are estimated to be <0.01 percent of the average annual emissions that result from the combined effect of heavy equipment, heavy-duty highway diesel engines and recycling.

Table I-8 Unrestricted Release Alternative
Air Emissions from Ferrous Metal Recycling
(metric tons)

	PM_{10}	SO_2	VOC	NO_x
Smelting Furnace	8,325	2,905	4,554	7,022
Heavy Equipment Operation	36	-	60	772
Transportation	0.864	NA	NA	2,294
Total Emissions	8,362	2,905	4,614	7,248
Total Emissions (metric tons/year)	178	62	98	154
National Average Emissions (metric tons per year)	43,999	9,121	33,538(1)	547,788
Percent of National Average	0.4	0.67	2.9	<0.01

(1) Secondary ferrous metal production only.

<u>Trash</u>

Under the No Action, Unrestricted Release, and Limited Dispositions Alternatives, trash would be disposed of in an EPA/State-regulated landfill. No recycling or reuse of trash is anticipated under any Alternative. Air emissions from trash landfill disposal and trash incineration are discussed under the EPA/State-Regulated Disposal Alternative in Section 3.3.

3.3 EPA/State-Regulated Disposal Alternative

The EPA/State-Regulated Disposal Alternative has similar emissions characteristics to the No Action, Unrestricted Release, and Limited Dispositions Alternatives with respect to handling and transportation of the materials released at licensed facilities. Under the No Action, Unrestricted Release, and Limited Dispositions Alternatives and the EPA/State-Regulated Disposal Alternative, materials released from licensed facilities would be processed to size and sorted at the licensed facility, and then transported from the licensed facility. These activities and their emissions characteristics would be identical for the EPA/State-Regulated Disposal Alternative.

However, under the EPA/State-Regulated Disposal Alternative, all of the materials would be disposed rather than recycled. Mobile source emissions and fugitive dust emissions would be associated with the placement of the materials in EPA/State-regulated disposal facilities.

Concrete and Ferrous Metal

Under the EPA/State-Regulated Disposal Alternative solid materials would not be recycled but would be transported to an EPA/State-regulated landfill for disposal. For concrete, the same rubbilization, heavy equipment, and transportation activities would be conducted under the EPA/State-Regulated Disposal Alternative as under the No Action, Unrestricted Release, and Limited Dispositions Alternatives, and the air emissions per ton of concrete processed are assumed to be identical. Under the EPA/State-Regulated Disposal Alternative, the rubbilized concrete would be transported in trucks an average of 58 miles (93.3 kilometers) to an EPA/State-regulated disposal facility rather than transported an average of 198 miles (318.6 kilometers) to a recycling location. Fugitive particulate emissions from disposal of concrete rubble in a EPA/State-regulated landfill would be negligible (see assumptions in Appendix K).

For ferrous metal the overall emissions would be lower under the EPA/State-Regulated Disposal Alternative and the Limited Dispositions Alternative than under the No Action and Unrestricted Release Alternatives, as under the EPA/State-Regulated Disposal Alternative and Limited Dispositions Alternative there would be no process emissions from smelting of the ferrous metal. Air emissions from transportation of ferrous metal to the EPA/State-regulated disposal facility are assumed to be identical to those estimated for the No Action and Unrestricted Release Alternatives.

Trash

Trash released by licensed facilities is assumed to be sent to either EPA/State-regulated landfills or to EPA/State-regulated solid waste incinerators. Trash will be collected and sorted if necessary to produce waste piles at the licensed facilities. Heavy equipment will be used to load that waste into trucks for transport to the landfill or incinerator location. The potential for fugitive dust emissions during these processes is minimal, since trash will contain a very small amount of particulate matter that can be dislodged to find its way into the air. The loaded trucks will generate air emissions during transport. Additional heavy equipment will be used to transfer the trash to feed stock at the incinerator, or to place the trash in the landfill. The assumptions used to estimate air emissions from the removal of trash and the resulting emissions estimates are described.

Heavy Equipment Operation

It is assumed that a bull dozer rated at 100 horsepower can gather 0.5 short tons of released trash per hour, and that front loaders rated at 100 horsepower can load 0.5 short tons of trash into trucks per hour. The same assumption is used for unloading at the facility and moving the material into place as either a feed stock for an incinerator or into position in the landfill. The emissions estimates for the assumed 66,000 metric tons of trash from power generating reactor units yields an estimate of 67 metric tons of PM10, 186 metric tons of NO_x, and 94 metric tons of CO.

Transportation

Transportation air emissions for the EPA/State-Regulated Disposal Alternative for trash are the same as the estimates for the No Action, Limited Dispositions, and Unrestricted Release Alternatives for trash.

EPA/State-Regulated Landfill Disposal

Typically, operations at EPA/State-regulated landfills are controlled to keep the potential for fugitive emissions at a minimum. Currently, there are no recommended approaches to estimate these emissions and it is assumed that any fugitive dust emissions from the landfilling process are negligible.

EPA/State-Regulated Incineration

Under the EPA/State-Regulated Disposal Alternative, trash could be incinerated. EPA/State-regulated solid waste incinerators are designed to achieve near complete combustion of the organic material included in the trash stream. Therefore, a well designed and operated incinerator typically results in very low emissions of CO. As with all combustion sources some of the nitrogen in the air supplied to the unit would be oxidized to NO_x during the combustion process. The emission rates of VOC and PM from the incinerator would depend on the specific combustor design and operation, the nature of the trash, and the characteristics of the incinerator air emission control system. Inorganic materials in the trash could be released as particulate matter in the incinerator flue gas stream to the incinerator stack, and these emissions would disperse into the atmosphere and be transported to off site receptors. Some organic materials in the trash may not achieve complete oxidation and result in formation of products of incomplete combustion, which would also be emitted in the stack gas. Depending upon the composition of the trash and the conditions of the incineration process and air emission control system, polycyclic organic matter and chlorinated dioxins and furans could be formed in the incinerator and emitted in the stack gas. Incinerators are subject to emissions limitation standards to control the amount of these hazardous air pollutants and the incremental contribution of the trash released from licensed facilities is negligible.

There are three primary types of combustion technology used in solid waste incinerators: mass burn, refuse-derived fuel (RDF), and modular combustors. Mass burn units charge the combustion chamber with waste that has not been separated or processed prior to firing. Typically, these units operate by moving the waste material through the combustion zone on a grate and add both underfeed and overfeed air. The excess air facilitates near complete combustion but can also increase the particulate matter emissions, by causing some of the PM to entrain into the flue gas stream rather than being collected in the ash pit beneath the traveling grate.

In RDF combustors the fuel is processed by shredding or by finely dividing the fuel into a dust that is suitable for co-firing with pulverized coal. The waste is typically processed by sorting out all noncombustible materials and shredding the remaining fuel. The use of the shredded fuel increases the heat value of the fuel and facilitates near complete combustion.

Modular combustors also use unprocessed waste as the fuel but include two chambers. In one style of modular combustor the initial chamber is operated in a starved air mode to drive off volatile organic compounds (VOC) and CO. The exhaust is then subject to a second round of combustion with excess air to achieve the near complete combustion result. Another form uses excess air in the initial chamber and refires the exhaust in the second chamber again. The use of these designs is dependent on the nature of the waste stream.

The impacts of trash disposal from licensed facilities is estimated by applying the expected emissions from the use of heavy equipment to collect and transfer the material from the facilities to trucks and then from the trucks to the disposal site. Emissions from the highway transport of the trash are assumed to be negligible in comparison to the overall average annual heavy duty highway diesel vehicle emissions. Similarly, fugitive dust emissions during the process of landfill disposal are assumed to be negligible.

Overall criteria pollutant emissions from heavy equipment operation, transportation, and landfill disposal or incineration of trash released from licensed facilities under the EPA/State-Regulated Disposal Alternative represents a small fraction of the total national emissions associated with solid waste transportation, landfill disposal, and incineration. Emissions impacts from landfill disposal are estimated to be less than for the incineration option since landfill disposal does not include the combustion process. A comparison of total estimated criteria pollutant emissions associated with the EPA/State-Regulated Disposal Alternative and total national emissions is shown in Table I-9. Overall emissions are estimated to be 0.01 percent or less of the national emissions for solid waste disposal.

Table I-9 EPA/State-Regulated Disposal Alternative – Trash Air Emissions from Trash Landfill Disposal/Incineration

	PM_{10}	NO_x	CO
Heavy Equipment (metric tons)	67	186	94
Transportation (metric tons)	negligible	0.11	negligible
Landfill Disposal	negligible	negligible	negligible
Incineration (metric tons)	104	151	58
Total Emissions			
Landfill Disposal (metric tons)	67	186	94
Incineration (metric tons)	171	202	152
National Average Emissions (metric tons per year)			
Landfill Disposal	27,880	280,083	207,811
Incineration	29,810	307,415	216,109
Percent of National Average			
Landfill Disposal	<0.01	<0.01	<0.01

Table I-9 EPA/State-Regulated Disposal Alternative – Trash Air Emissions from Trash Landfill Disposal/Incineration

Incineration	0.01	<0.01	<0.01

3.4 Low-Level Waste Disposal Alternative

Activities that would generate air emissions for the LLW Disposal Alternative would be similar to those for the EPA/State-Regulated Disposal Alternative, with the exception that trash would not be incinerated under the LLW Disposal Alternative and solid materials may be transported to the LLW disposal facility by railcar in addition to by truck.

For this Alternative all of the potentially clearable materials generated from licensed facilities would be transported to a LLW disposal facility. For the purposes of this analysis all materials are assumed to be taken to the Envirocare disposal facility in Utah. For the LLW Disposal Alternative, all of the processes associated with handling and loading the solid materials would be identical to those discussed above for the No Action, Unrestricted Release, Limited Dispositions, and EPA/State-Regulated Disposal Alternatives. The transportation emissions would be much higher for the LLW Disposal Alternative, however, because the average transportation distance from the licensed facilities to the LLW disposal facility is 1,544 miles (2,482 kilometers) rather than 58 miles (93.3 kilometers) for the EPA/State-Regulated Disposal Alternative. The transportation emissions calculated for the LLW Disposal Alternative are 7 metric tons or 0.15 metric tons per year for SO_2, 703 metric tons or 15 metric tons per year for NO_x, and 26 metric tons or 0.6 metric tons per year for PM10. These emission totals are insignificant relative to the total annual emissions for heavy duty diesel trucks based on national emissions trends.

3.5 Limited Dispositions Alternative

For the Limited Dispositions Alternative, it is assumed that air emissions from reuse of tools and equipment are negligible. Air emissions from recycling of concrete into road bed material under the Limited Dispositions Alternative would be similar to the air emissions for concrete under the No Action and Unrestricted Release Alternatives as discussed in section 3.2. Air emissions from EPA/State-regulated landfill disposal of ferrous metal and trash would be similar to the air emissions for ferrous metal and trash landfill disposal under the EPA/State-Regulated Disposal Alternative as discussed in Section 3.3. Thus, as discussed in Sections 3.2 and 3.3, the impacts to air quality for the Limited Dispositions Alternative would be small.