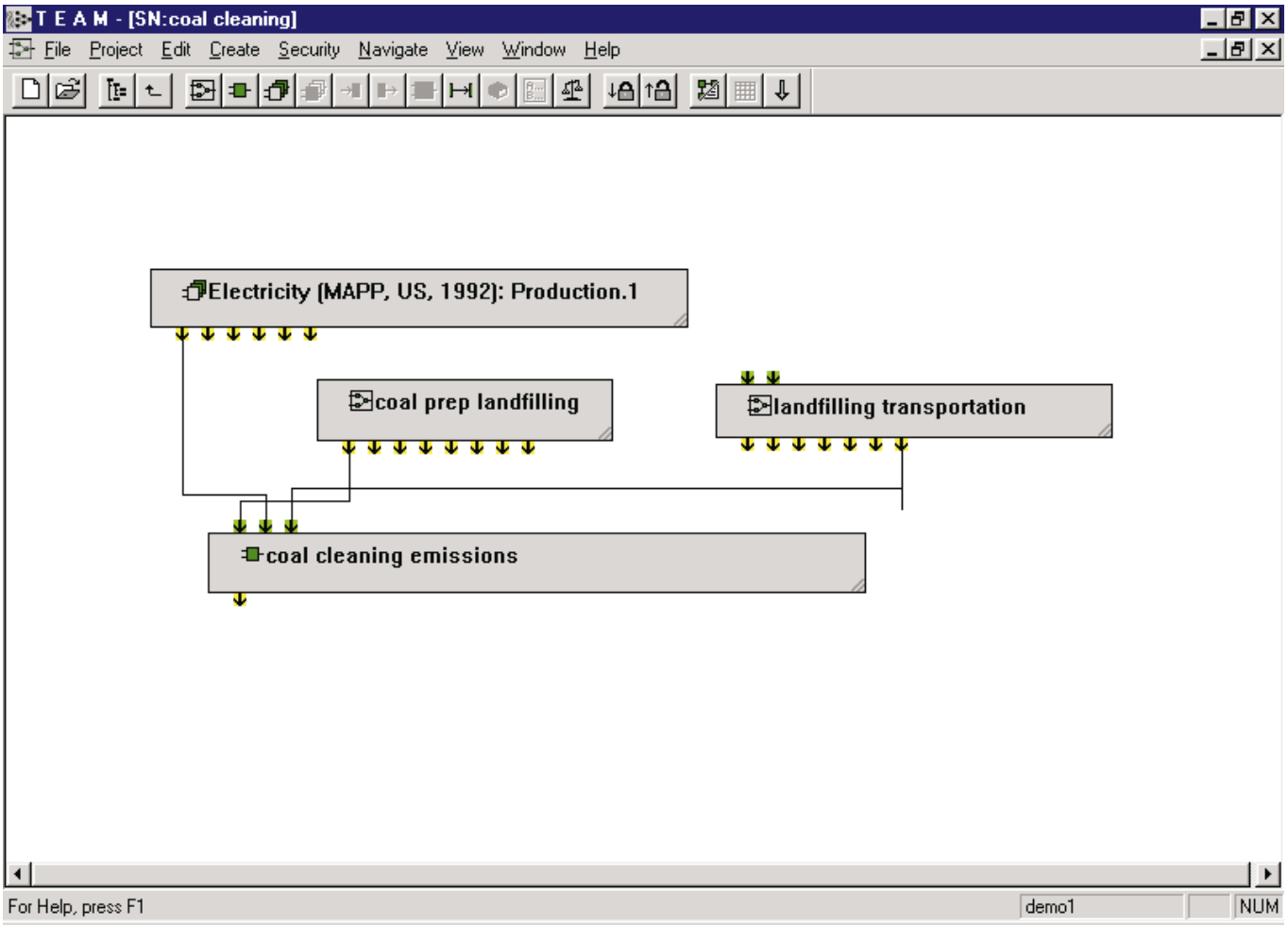
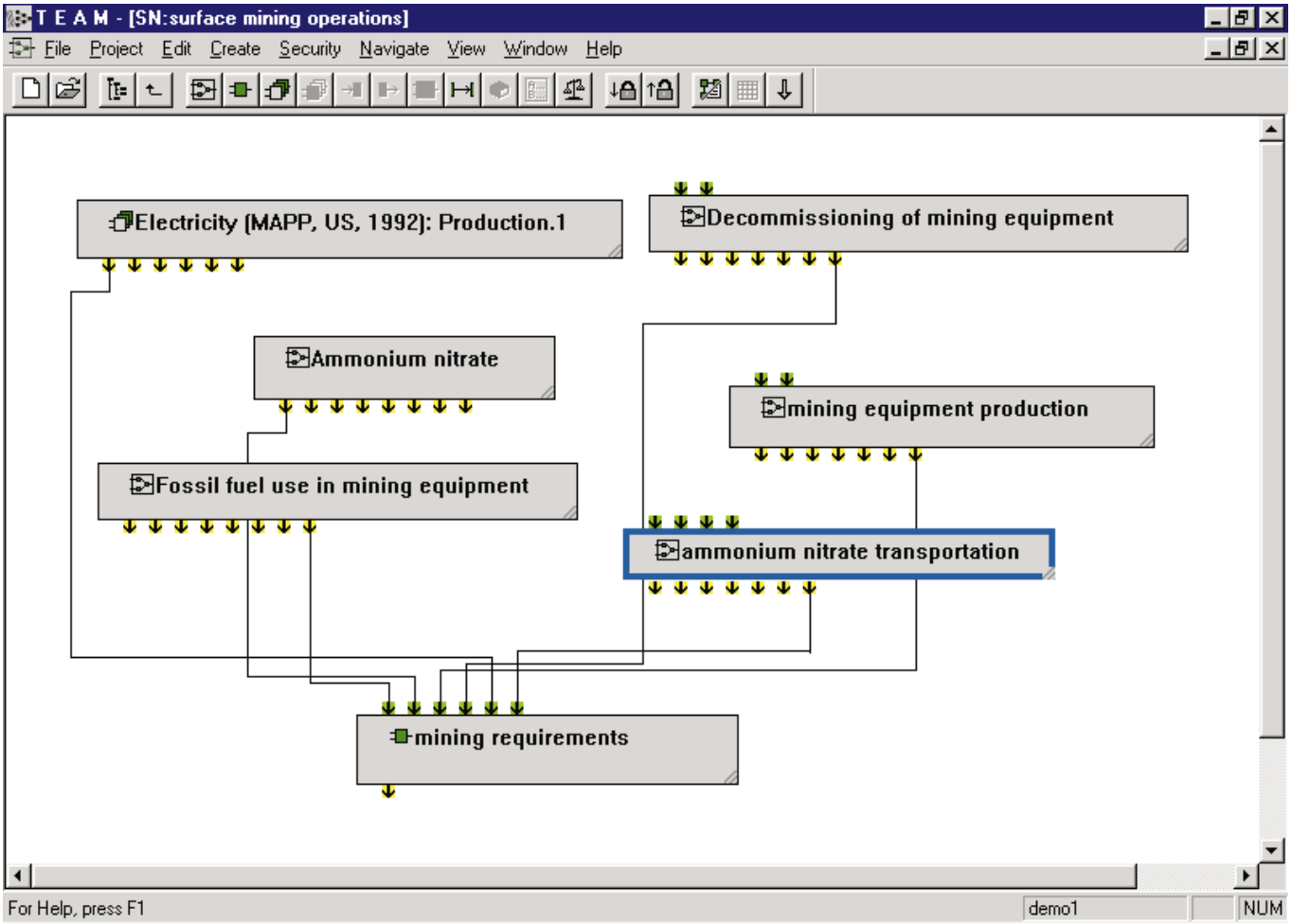
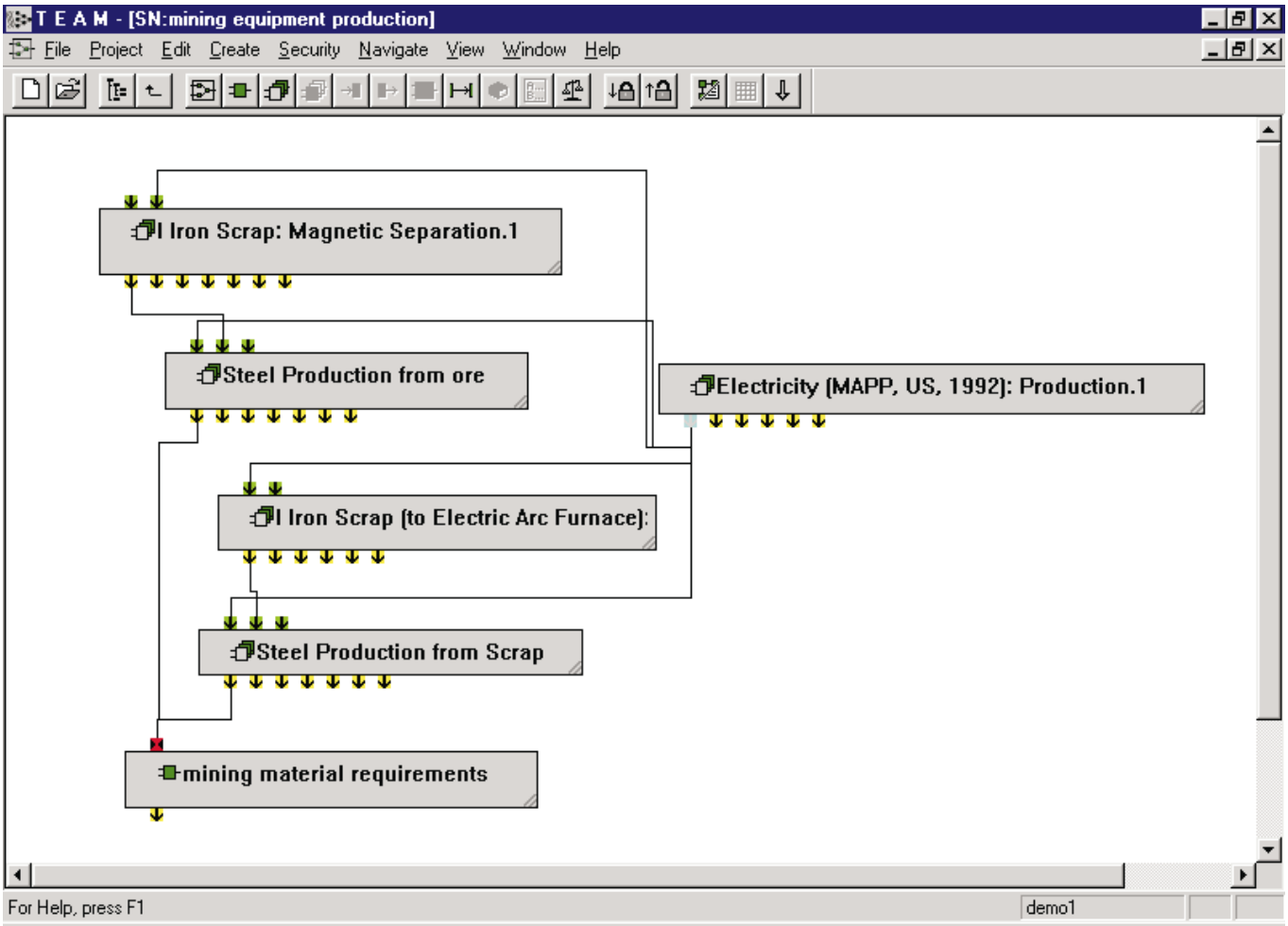
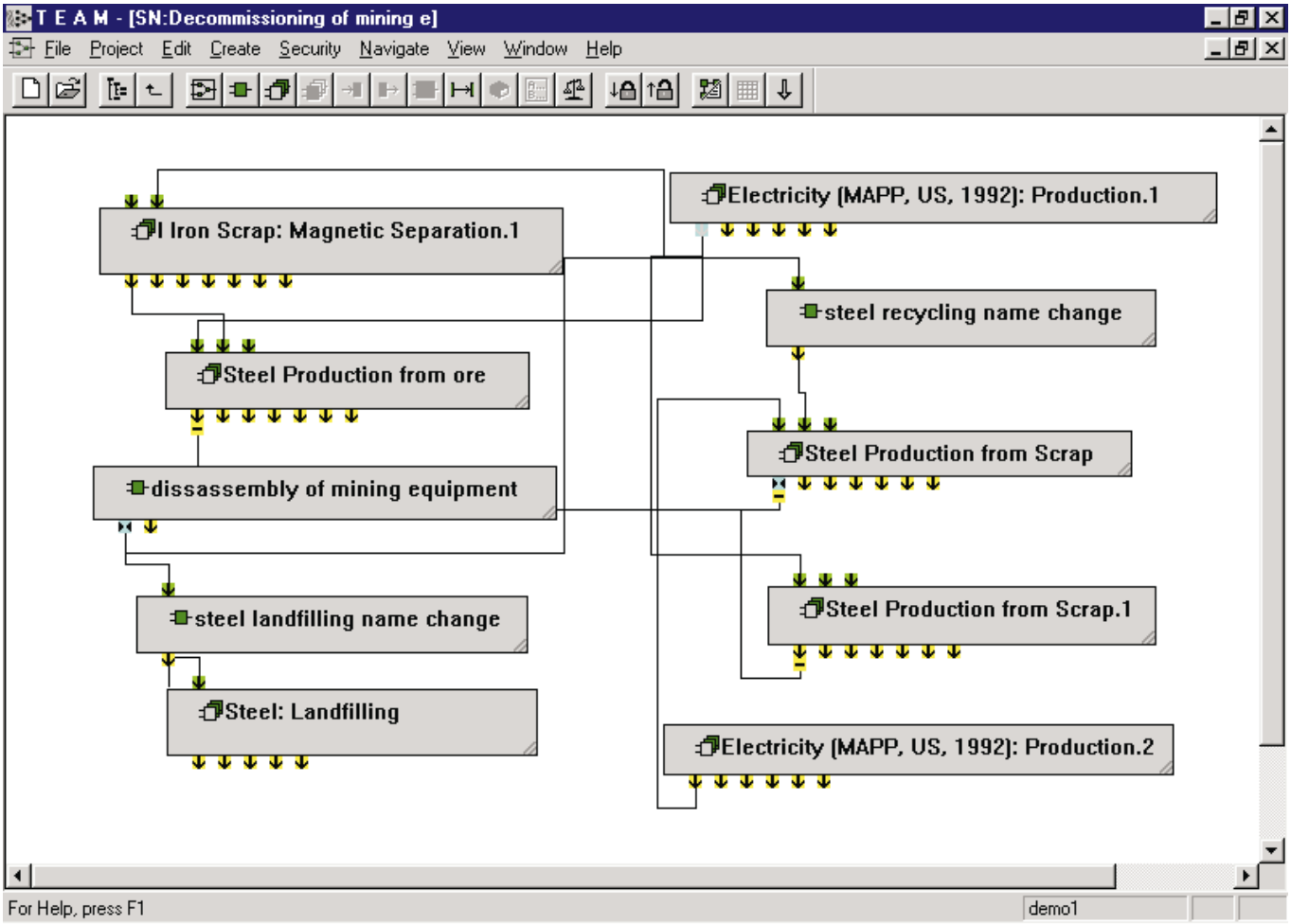
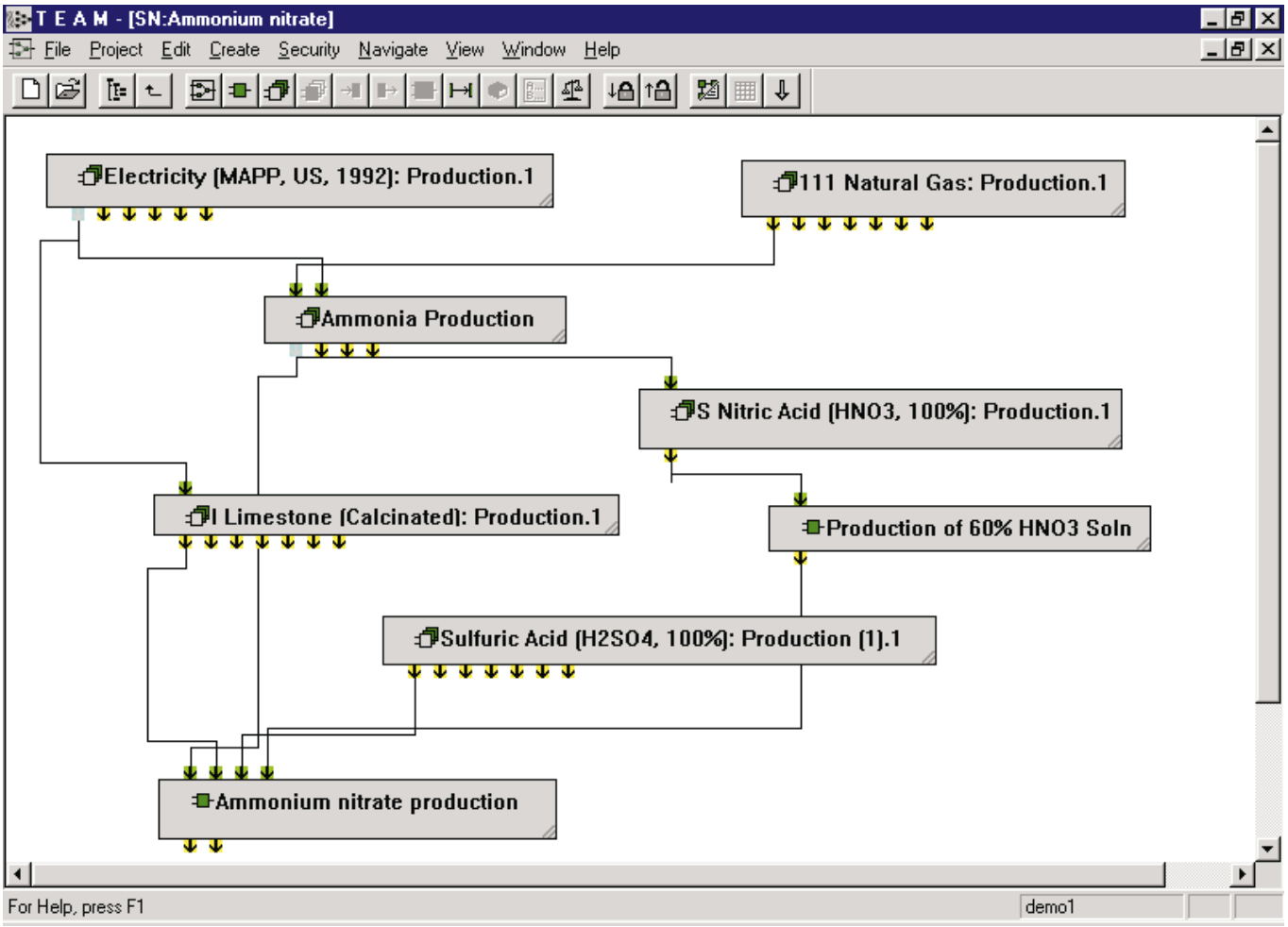
Appendix A: Graphical Representation of the LCA System in TEAM®

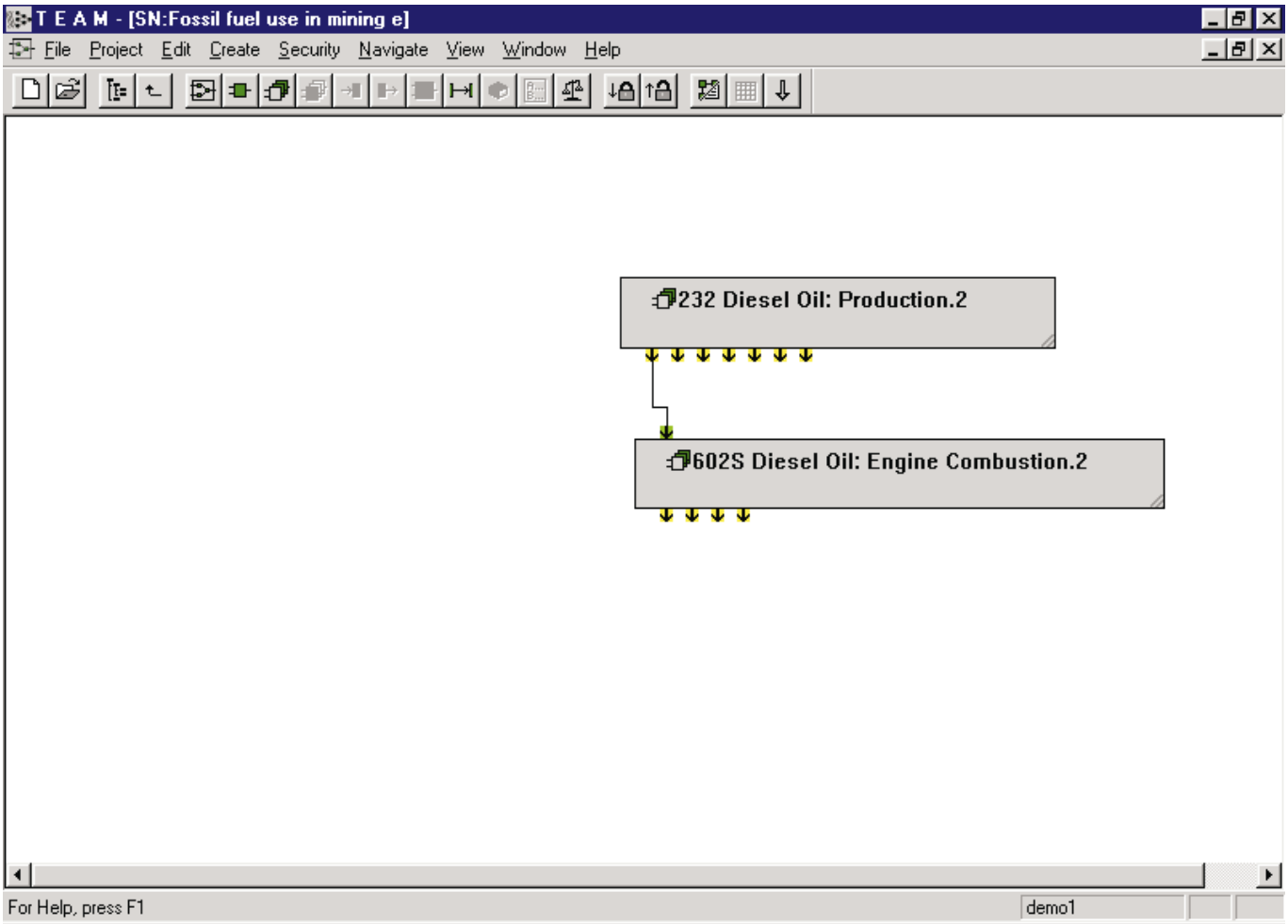

T E A M - [SN:coal cleaning]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.1
coal prep landfilling
landfilling transportation
coal cleaning emissions
For Help, press F1
demo1
NUM

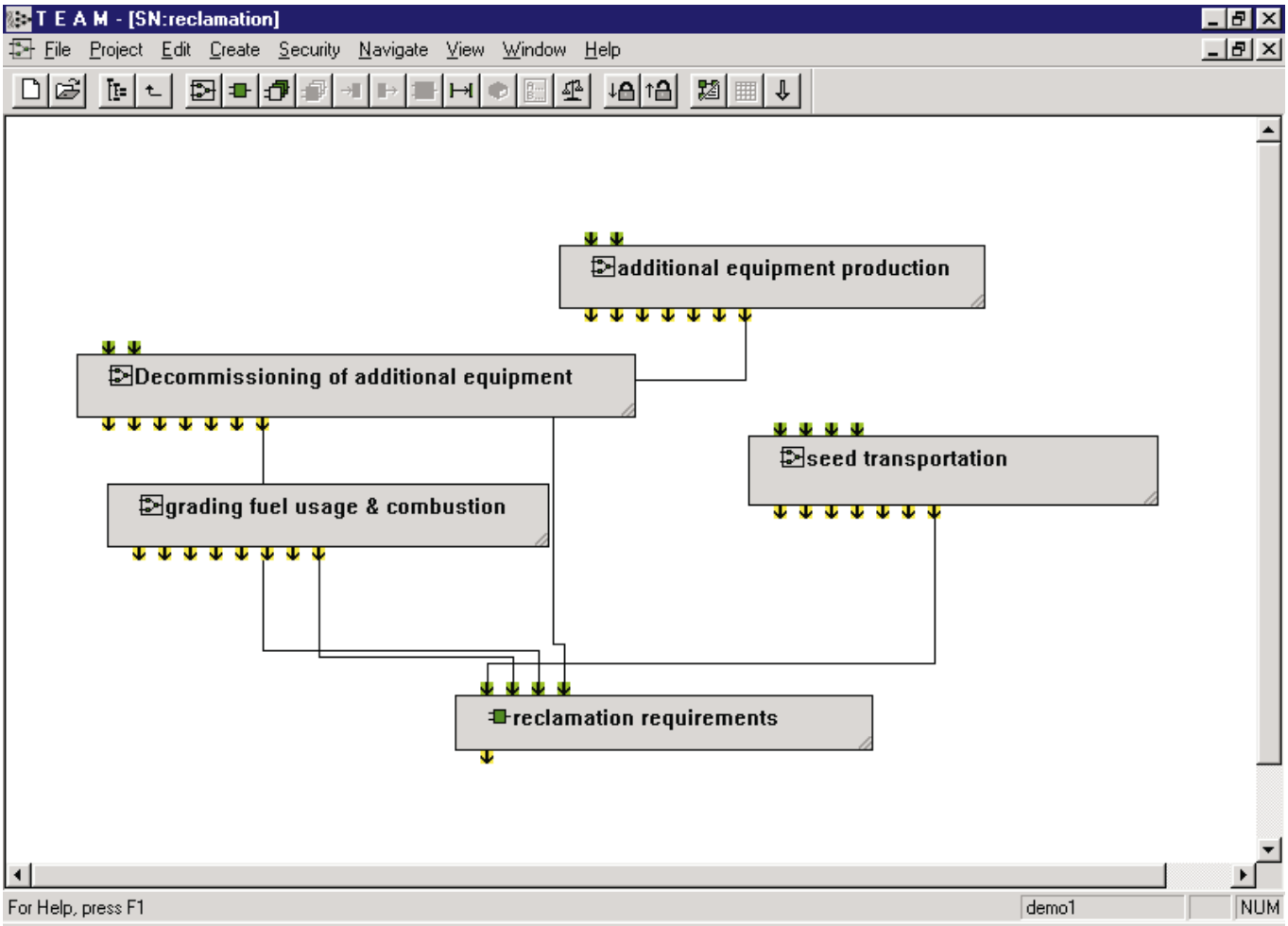

T E A M - [SN:surface mining operations]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.1
Decommissioning of mining equipment
Ammonium nitrate
mining equipment production
Fossil fuel use in mining equipment
ammonium nitrate transportation
mining requirements
For Help, press F1
demo1
NUM

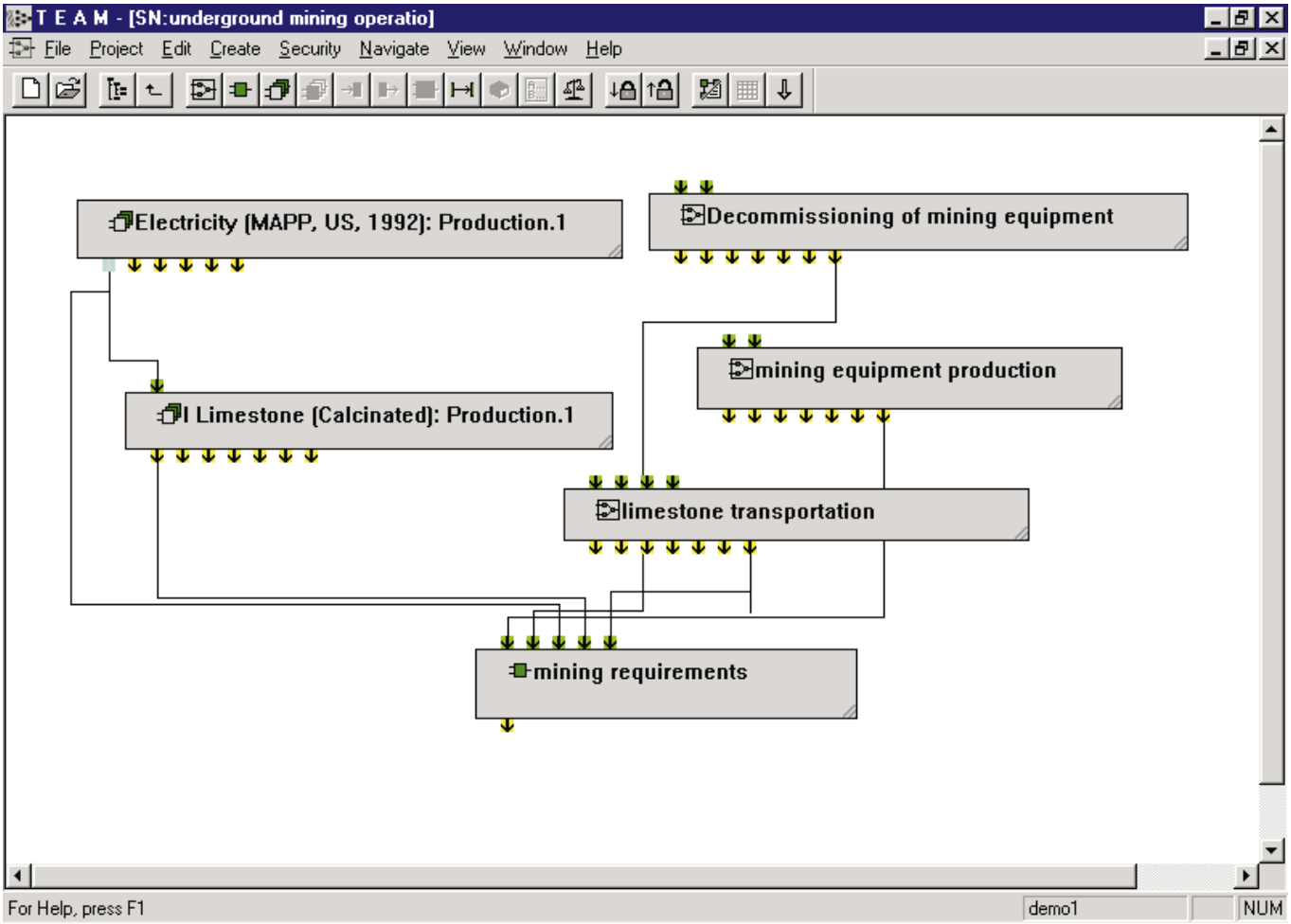

T E A M - [SN:mining equipment production]
File Project Edit Create Security Navigate View Window Help
I Iron Scrap: Magnetic Separation.1
Steel Production from ore
Electricity (MAPP, US, 1992): Production.1
I Iron Scrap (to Electric Arc Furnace):
Steel Production from Scrap
mining material requirements
For Help, press F1
demo1

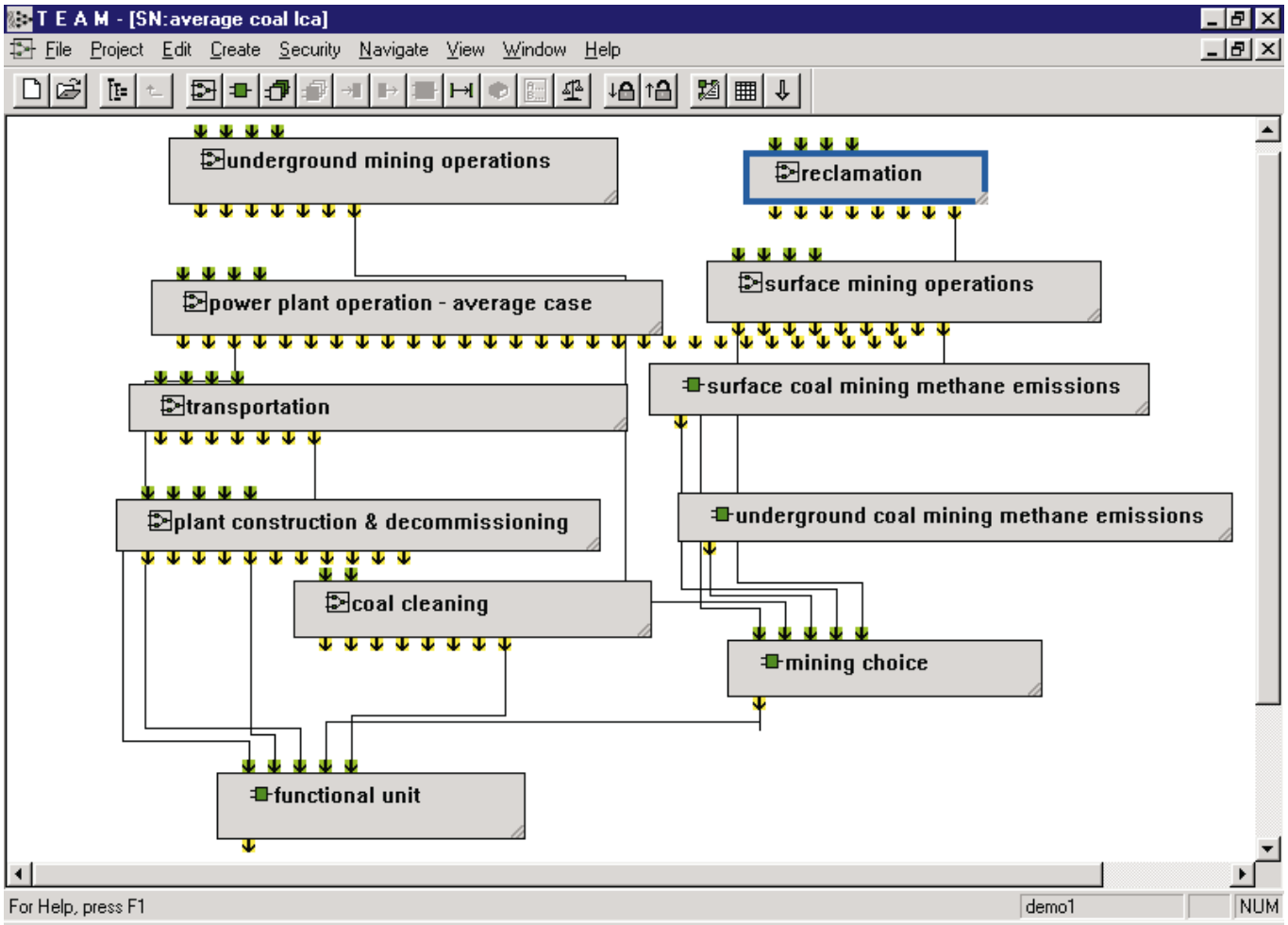

T E A M - [SN:Decommissioning of mining e]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.1
I Iron Scrap: Magnetic Separation.1
steel recycling name change
Steel Production from ore
Steel Production from Scrap
dissassembly of mining equipment
Steel Production from Scrap.1
steel landfilling name change
Steel: Landfilling
Electricity (MAPP, US, 1992): Production.2
For Help, press F1
demo1

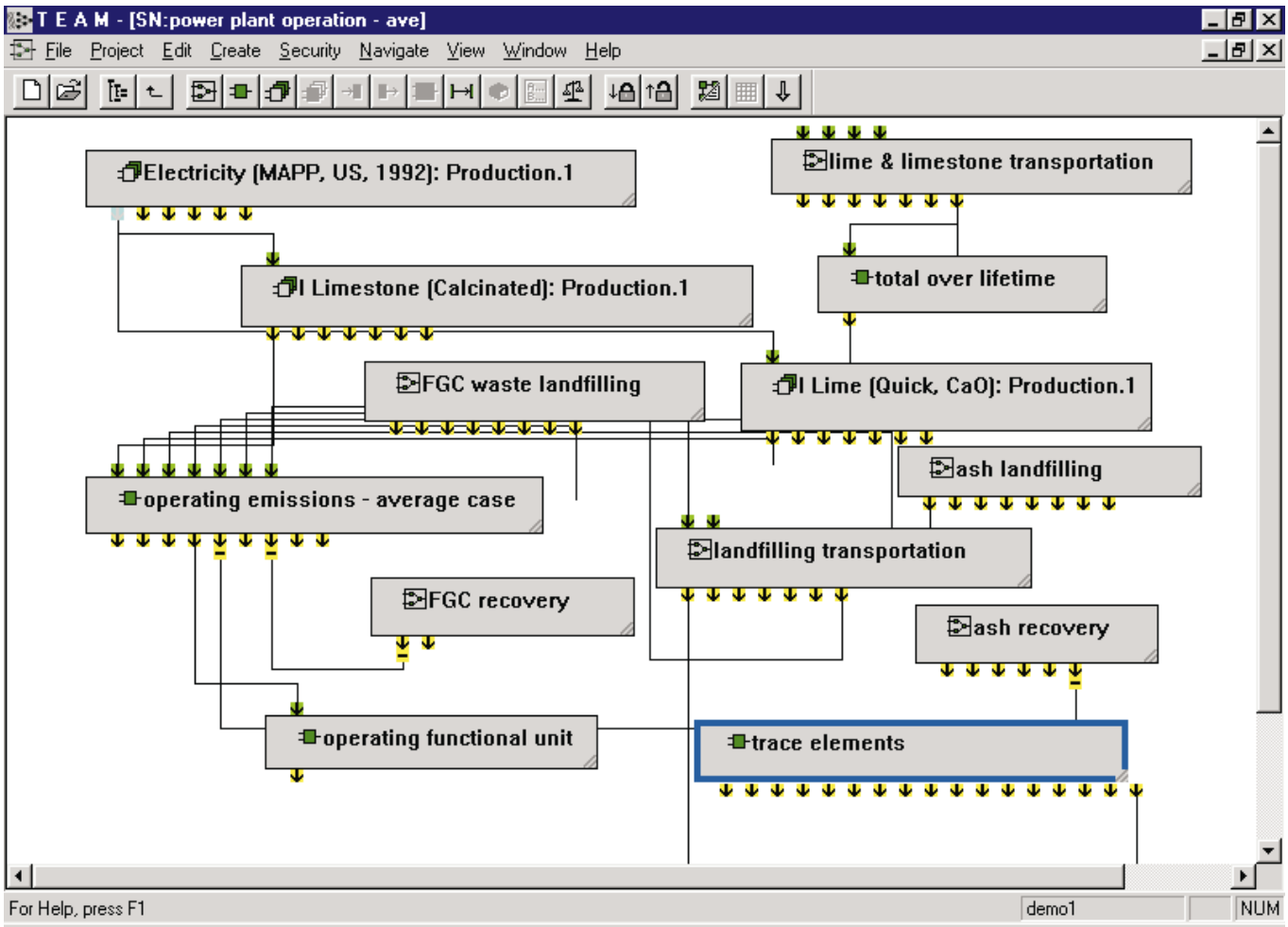

T E A M - [SN:Ammonium nitrate]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.1
111 Natural Gas: Production.1
Ammonia Production
S Nitric Acid (HNO3, 100%): Production.1
I Limestone (Calcinated): Production.1
Production of 60% HNO3 Soln
Sulfuric Acid (H2SO4, 100%): Production (1).1
Ammonium nitrate production
For Help, press F1
demo1

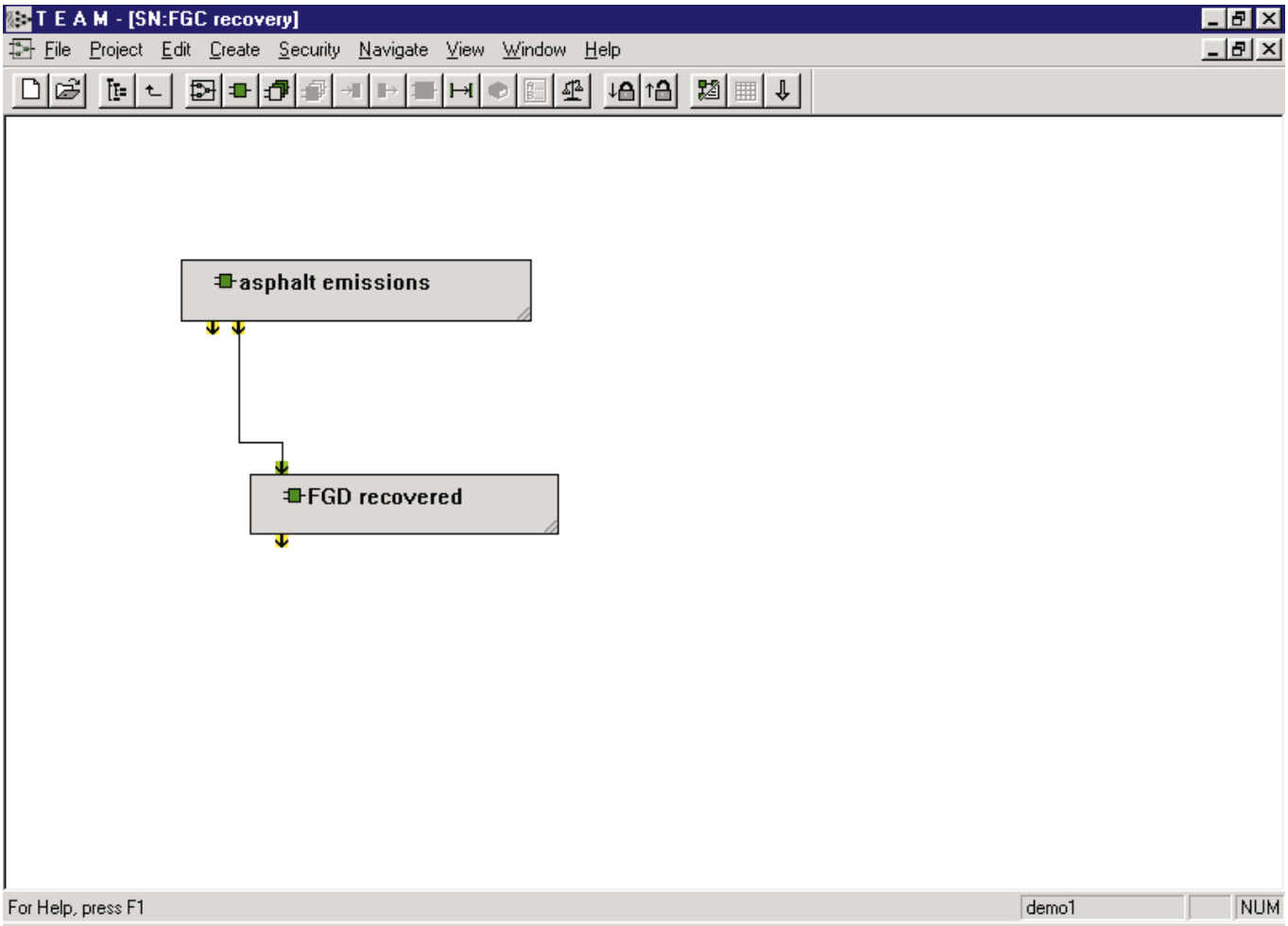

T E A M - [SN:Fossil fuel use in mining e]
File Project Edit Create Security Navigate View Window Help
232 Diesel Oil: Production.2
602S Diesel Oil: Engine Combustion.2
For Help, press F1
demo1

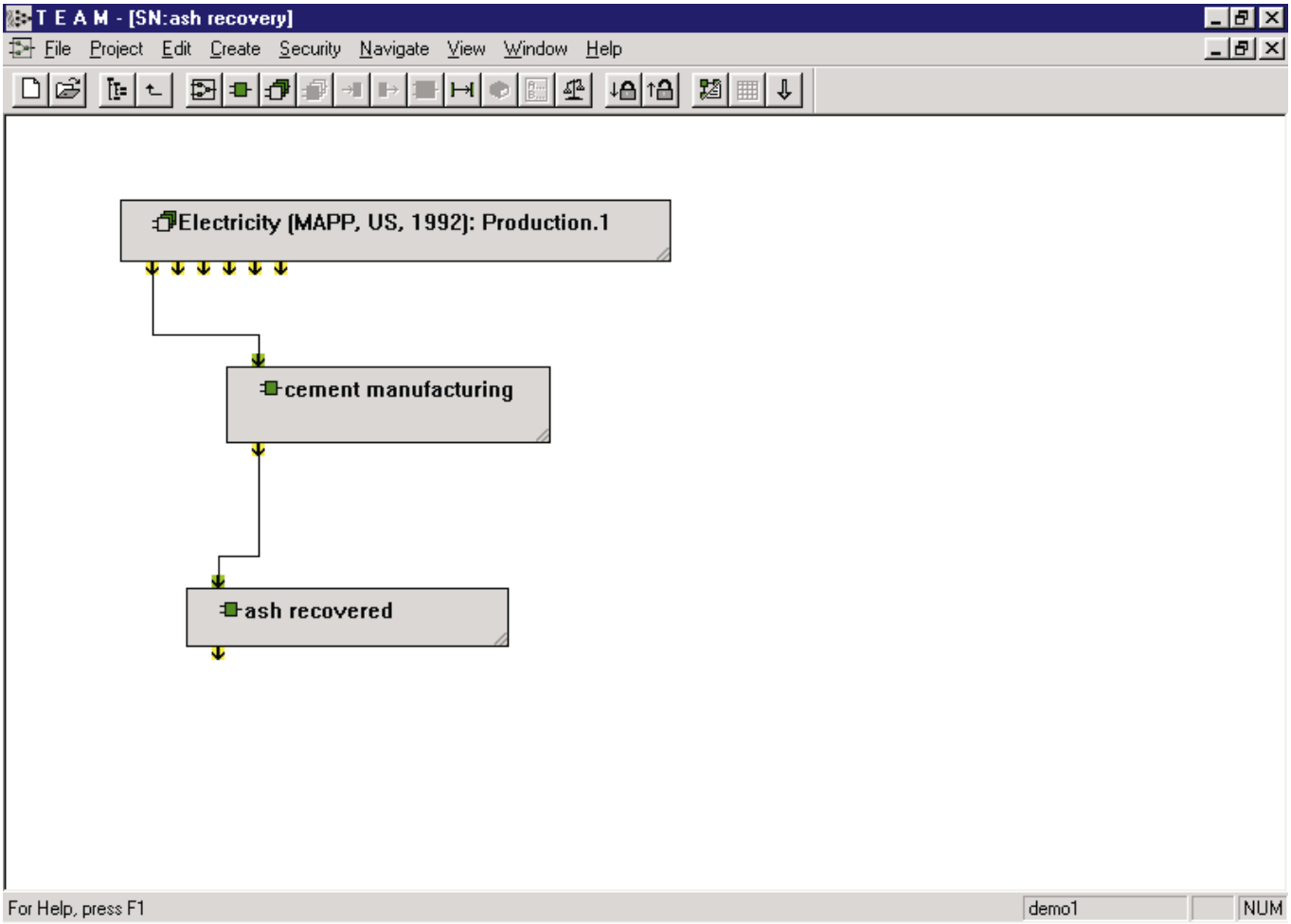

T E A M - [SN:reclamation]
File Project Edit Create Security Navigate View Window Help
additional equipment production
Decommissioning of additional equipment
seed transportation
grading fuel usage & combustion
reclamation requirements
For Help, press F1
demo1
NUM

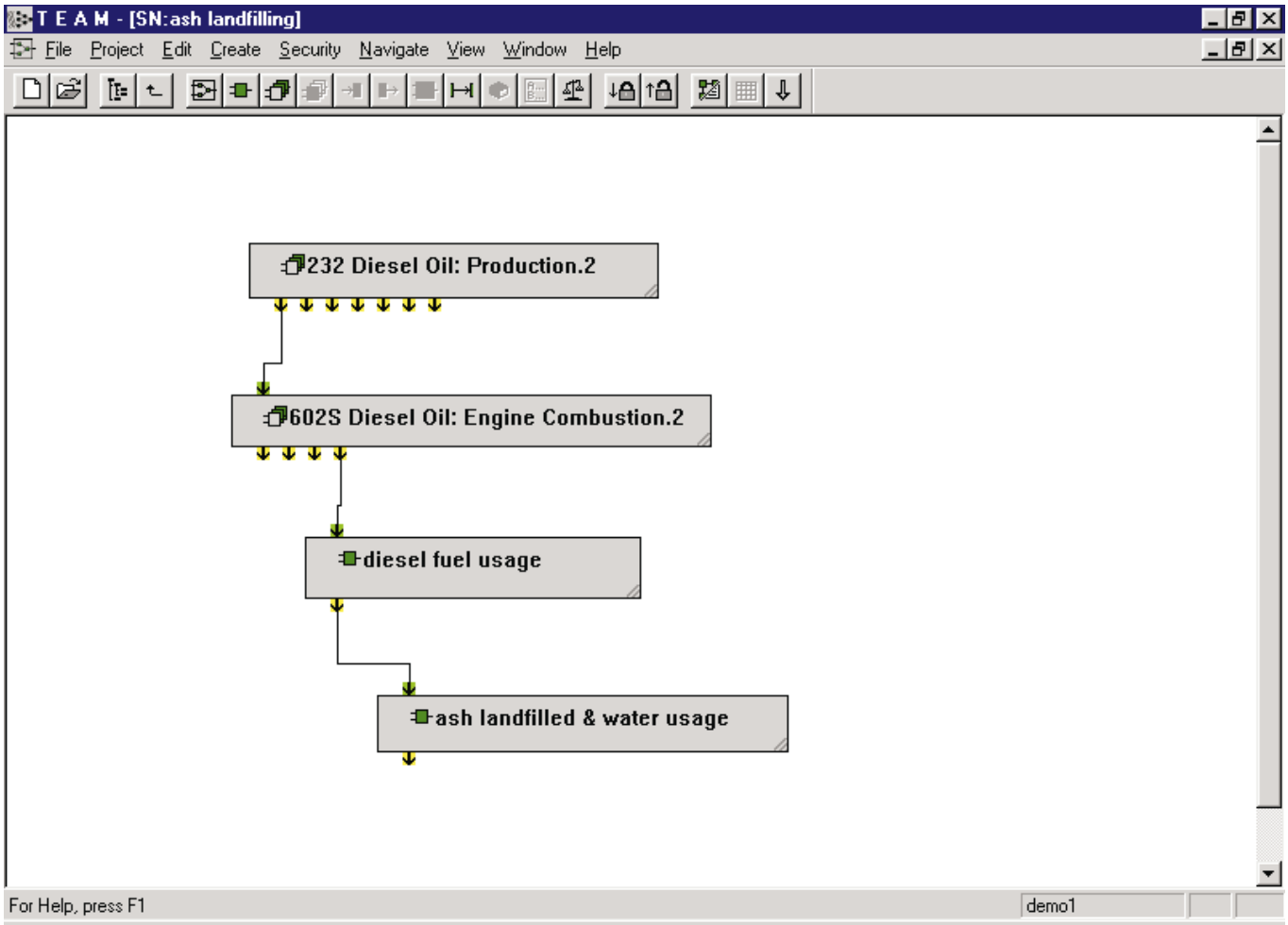

T E A M - [SN:underground mining operatio]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.1
Decommissioning of mining equipment
mining equipment production
I Limestone (Calcinated): Production.1
limestone transportation
mining requirements
For Help, press F1
demo1
NUM

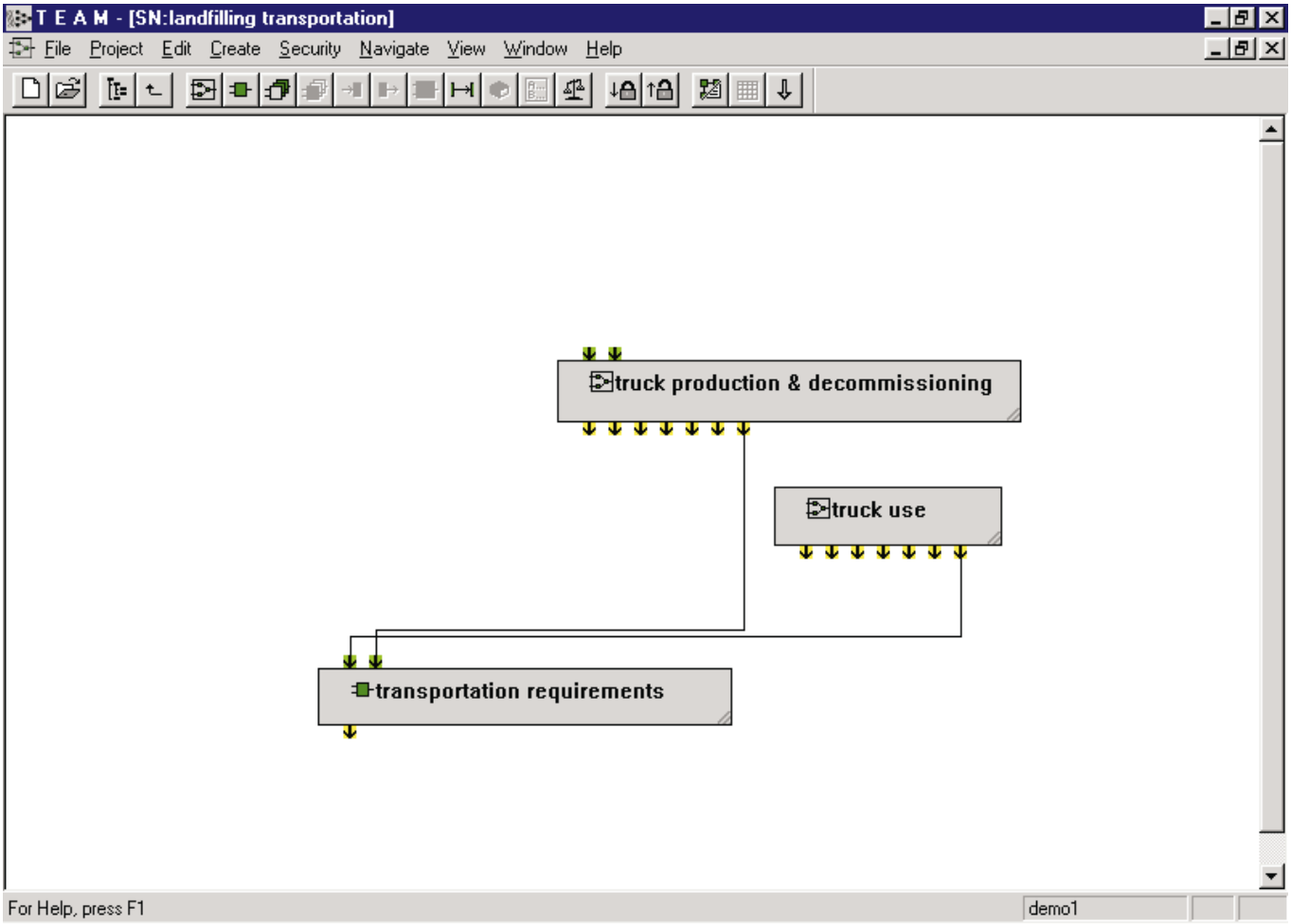

T E A M - [SN:average coal lca]
File Project Edit Create Security Navigate View Window Help
underground mining operations
reclamation
power plant operation - average case
surface mining operations
transportation
surface coal mining methane emissions
plant construction & decommissioning
underground coal mining methane emissions
coal cleaning
mining choice
functional unit
For Help, press F1
demo1
NUM

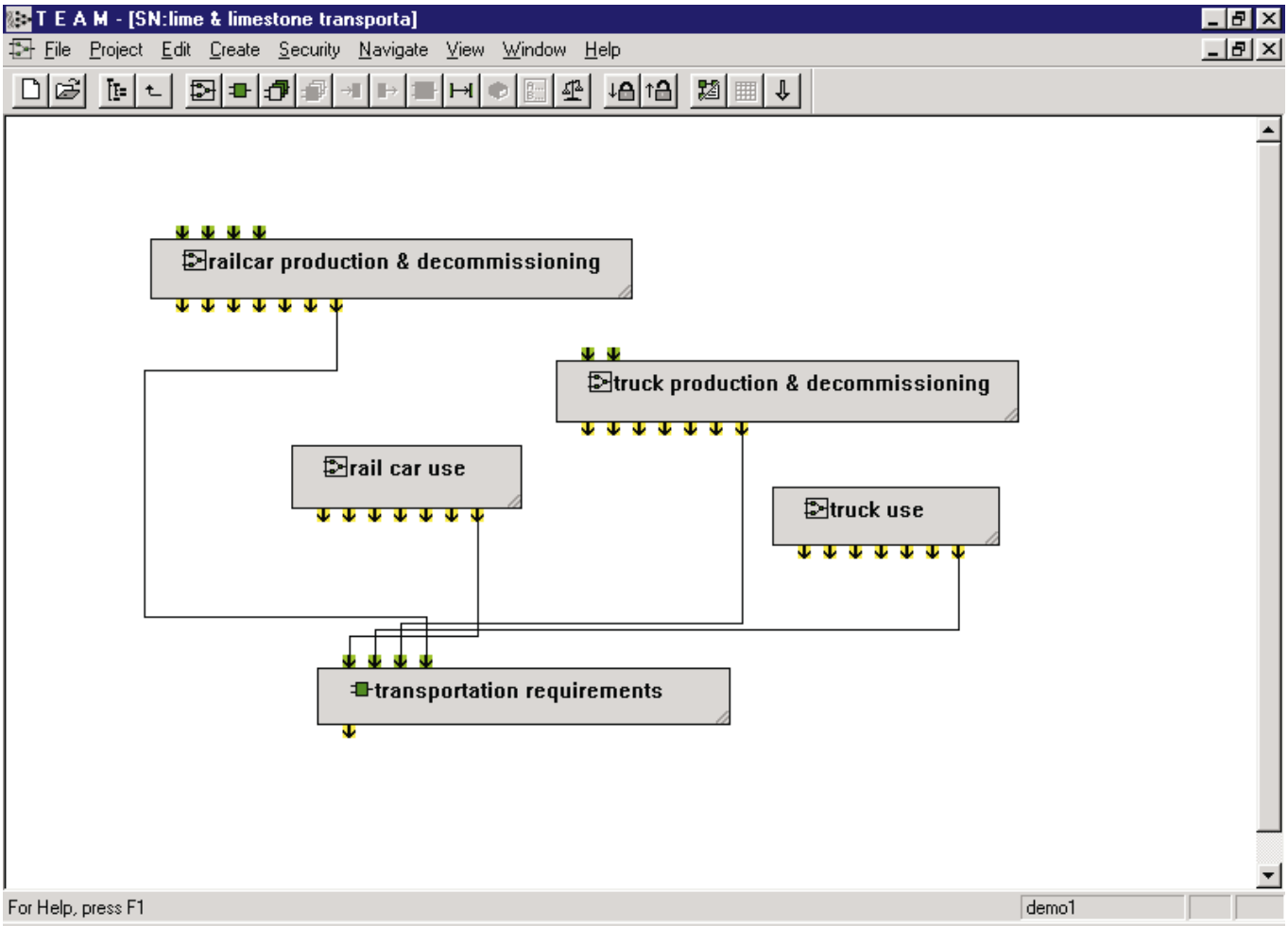

T E A M - [SN:power plant operation - ave]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.1
lime & limestone transportation
I Limestone (Calcinated): Production.1
total over lifetime
FGC waste landfilling
I Lime (Quick, CaO): Production.1
ash landfilling
operating emissions - average case
landfilling transportation
FGC recovery
ash recovery
operating functional unit
trace elements
For Help, press F1
demo1
NUM

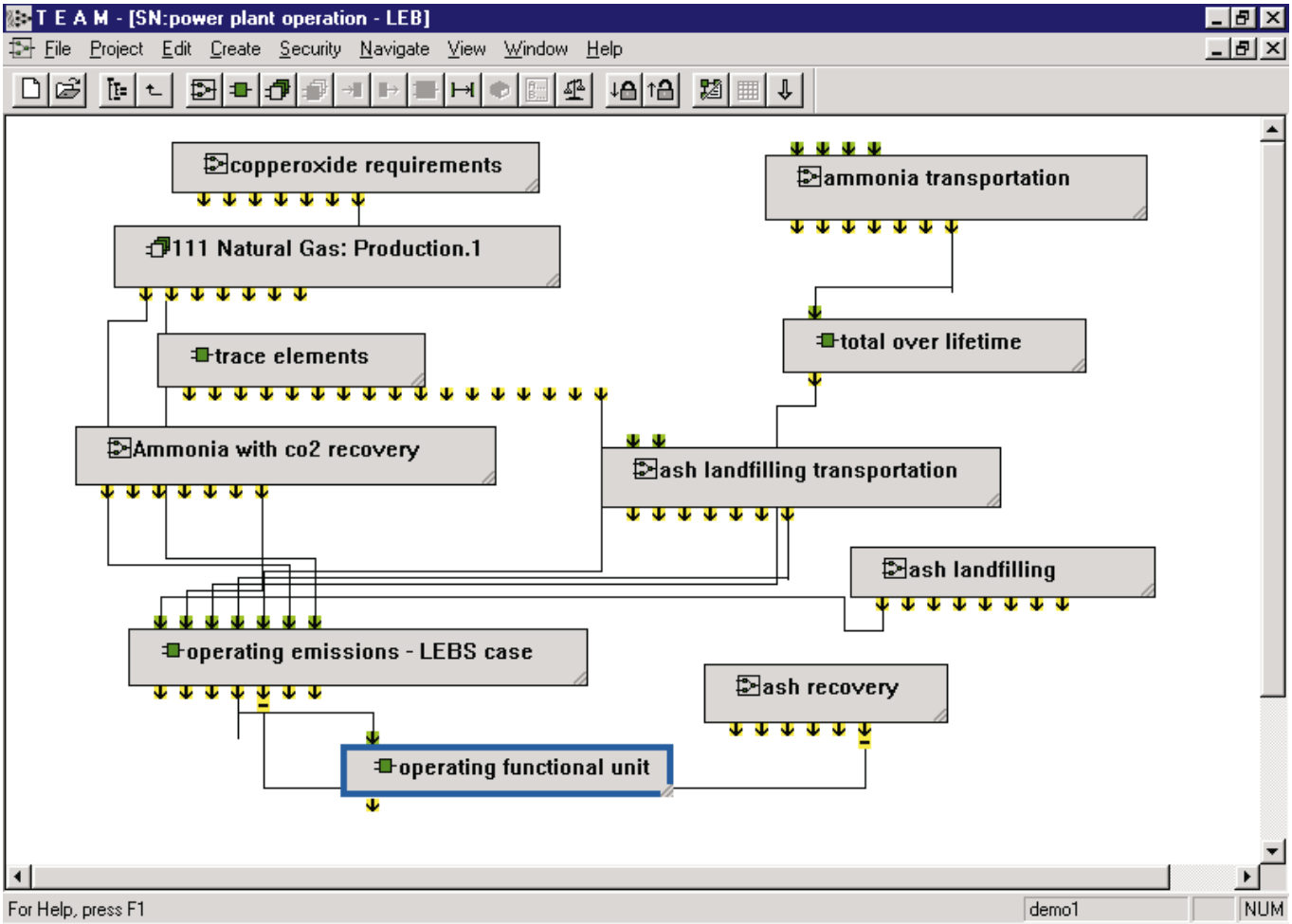

T E A M - [SN:FGC recovery]
File Project Edit Create Security Navigate View Window Help
asphalt emissions
FGD recovered
For Help, press F1
demo1
NUM

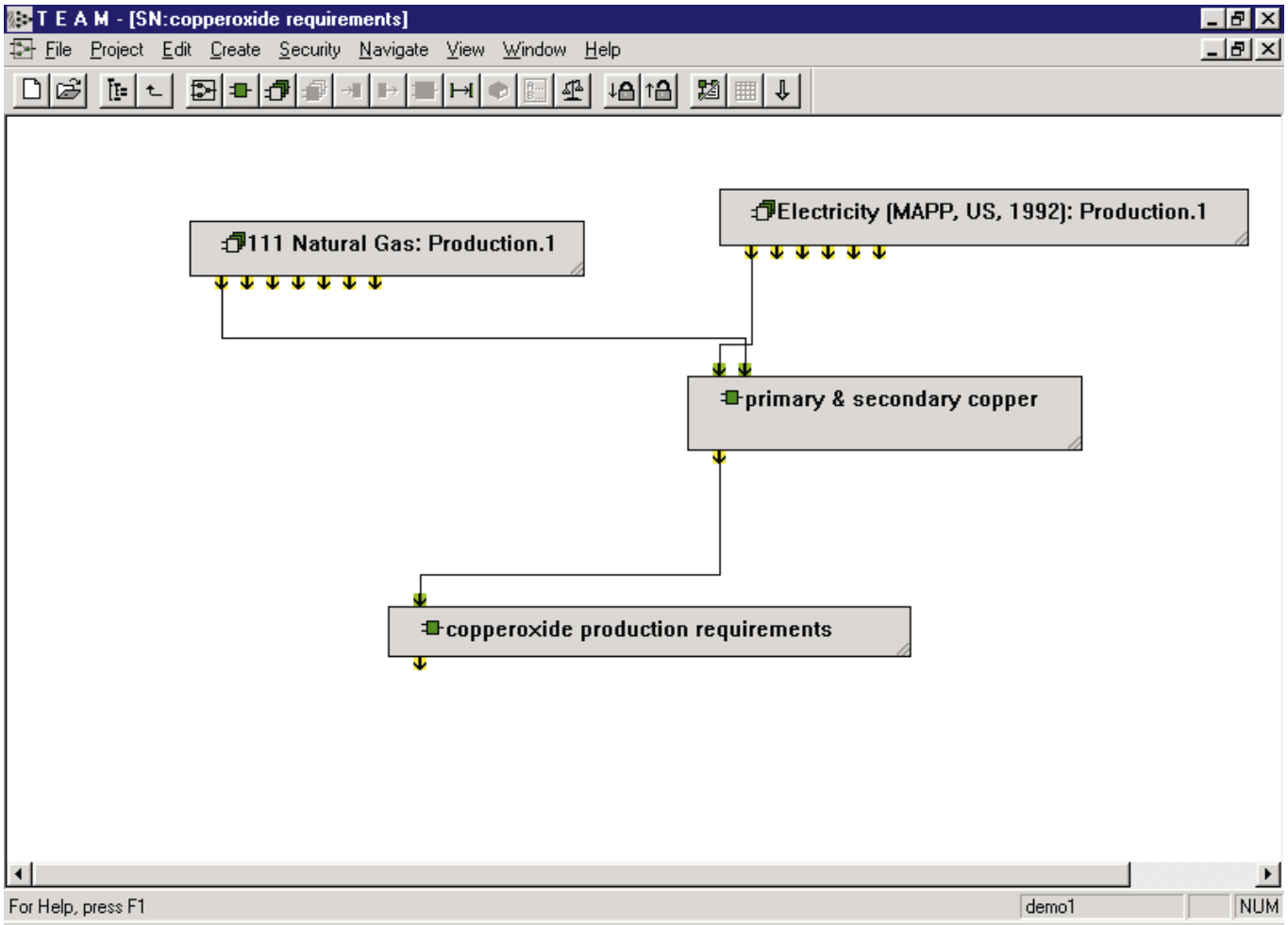

T E A M - [SN:ash recovery]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.1
cement manufacturing
ash recovered
For Help, press F1
demo1
NUM

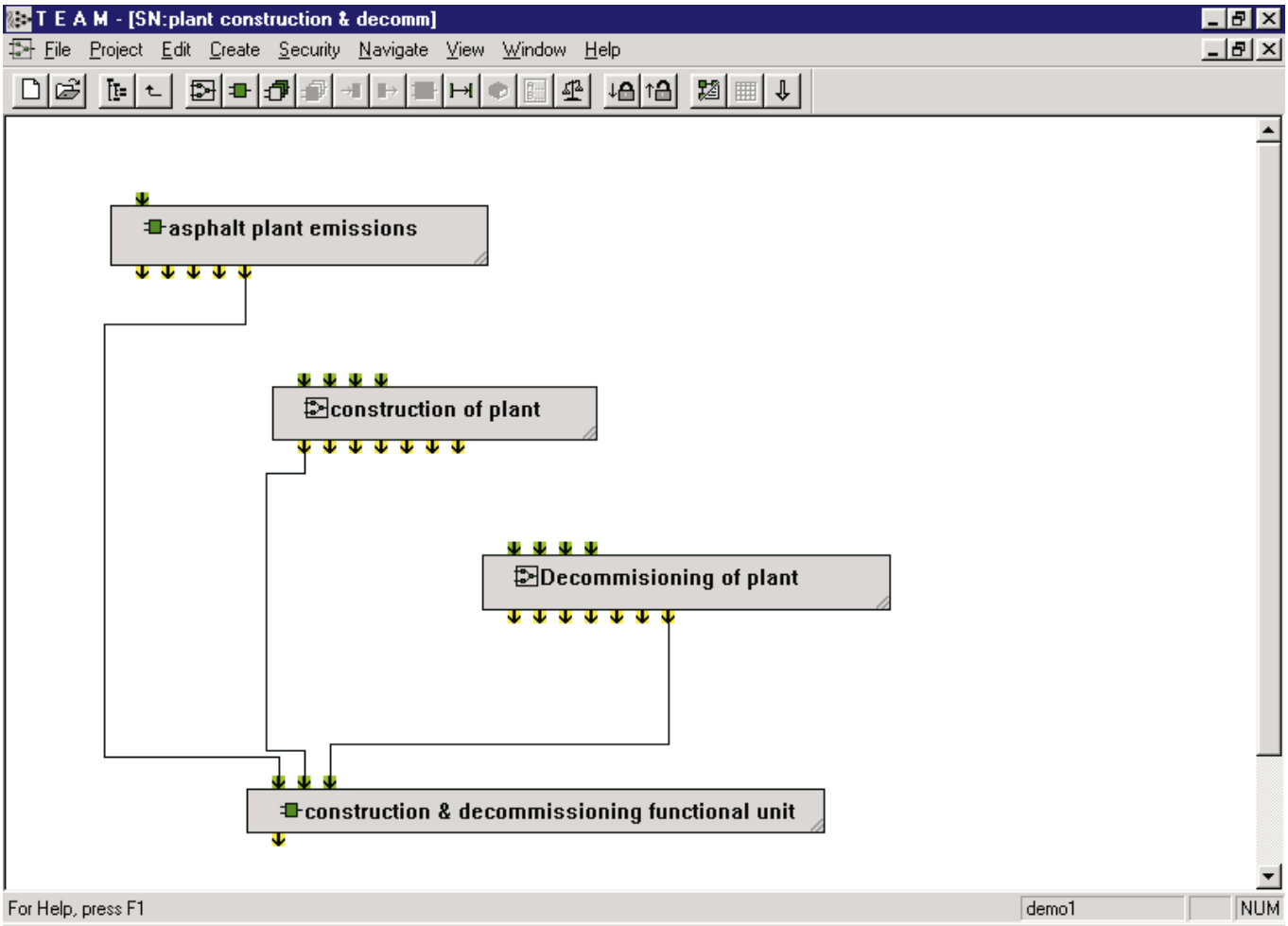

T E A M - [SN:ash landfilling]
File Project Edit Create Security Navigate View Window Help
232 Diesel Oil: Production.2
602S Diesel Oil: Engine Combustion.2
diesel fuel usage
ash landfilled & water usage
For Help, press F1
demo1

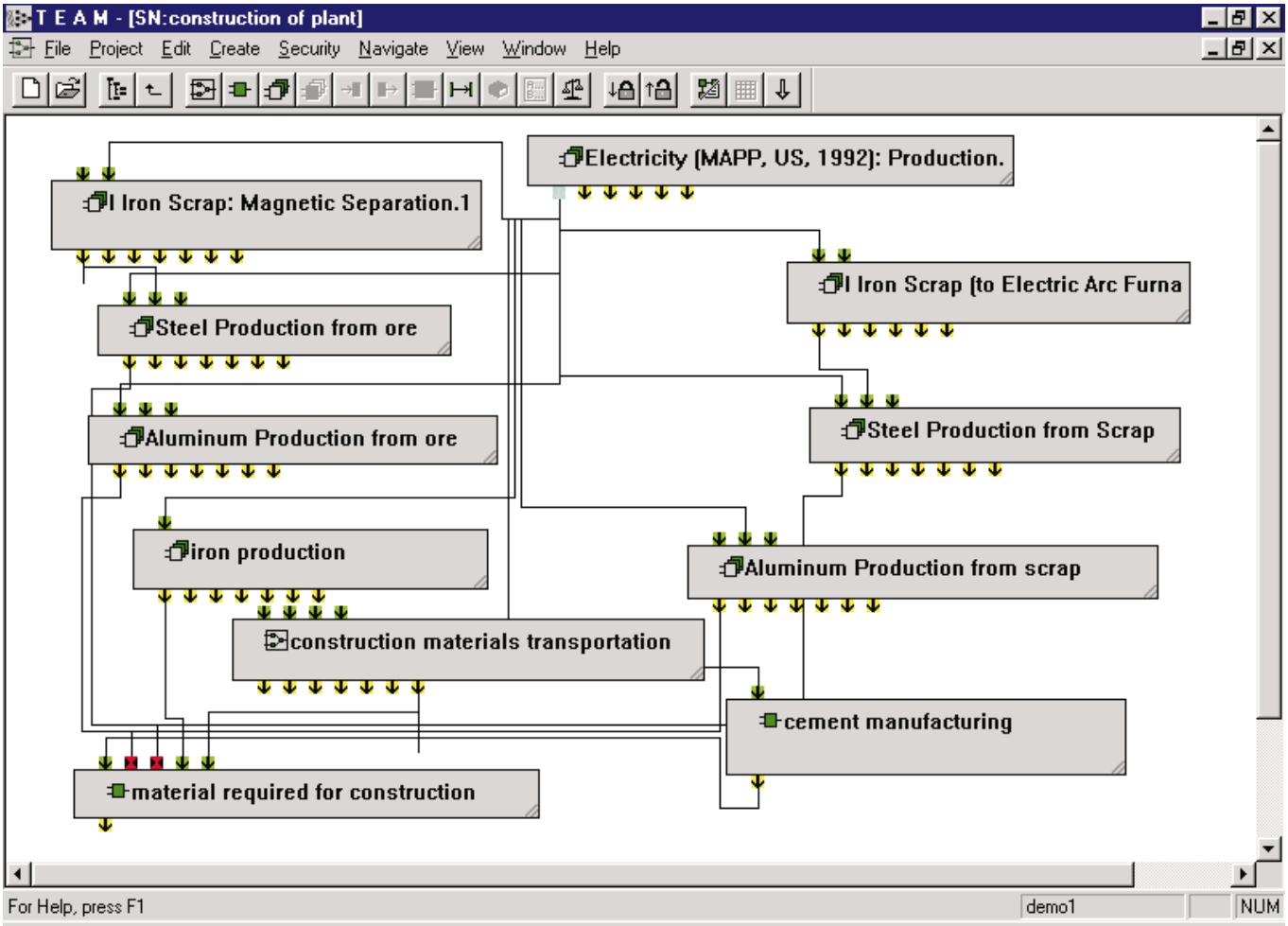

T E A M - [SN:landfilling transportation]
File Project Edit Create Security Navigate View Window Help
truck production & decommissioning
truck use
transportation requirements
For Help, press F1
demo1

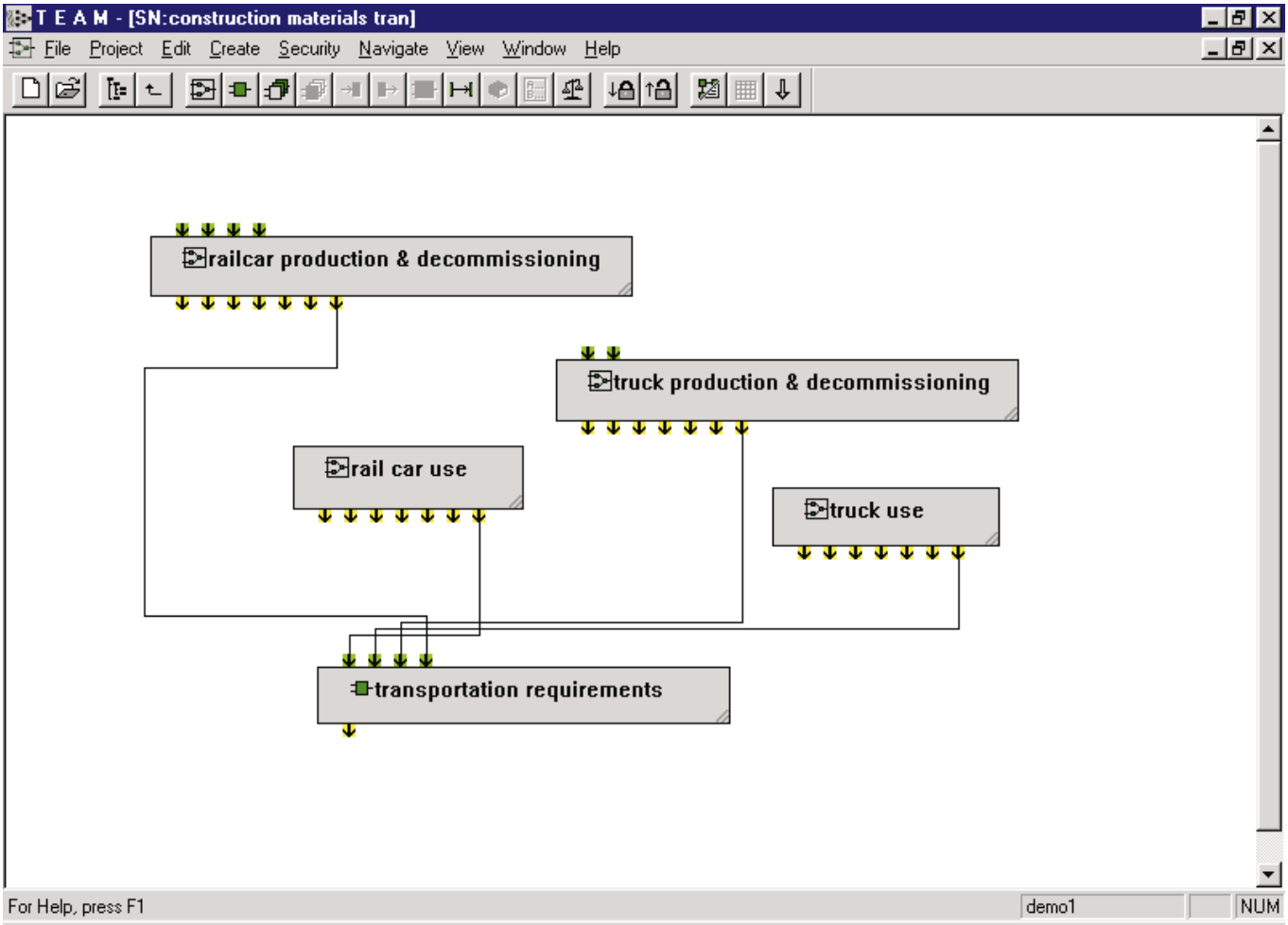

T E A M - [SN:lime & limestone transporta]
File Project Edit Create Security Navigate View Window Help
railcar production & decommissioning
truck production & decommissioning
rail car use
truck use
transportation requirements
For Help, press F1
demo1

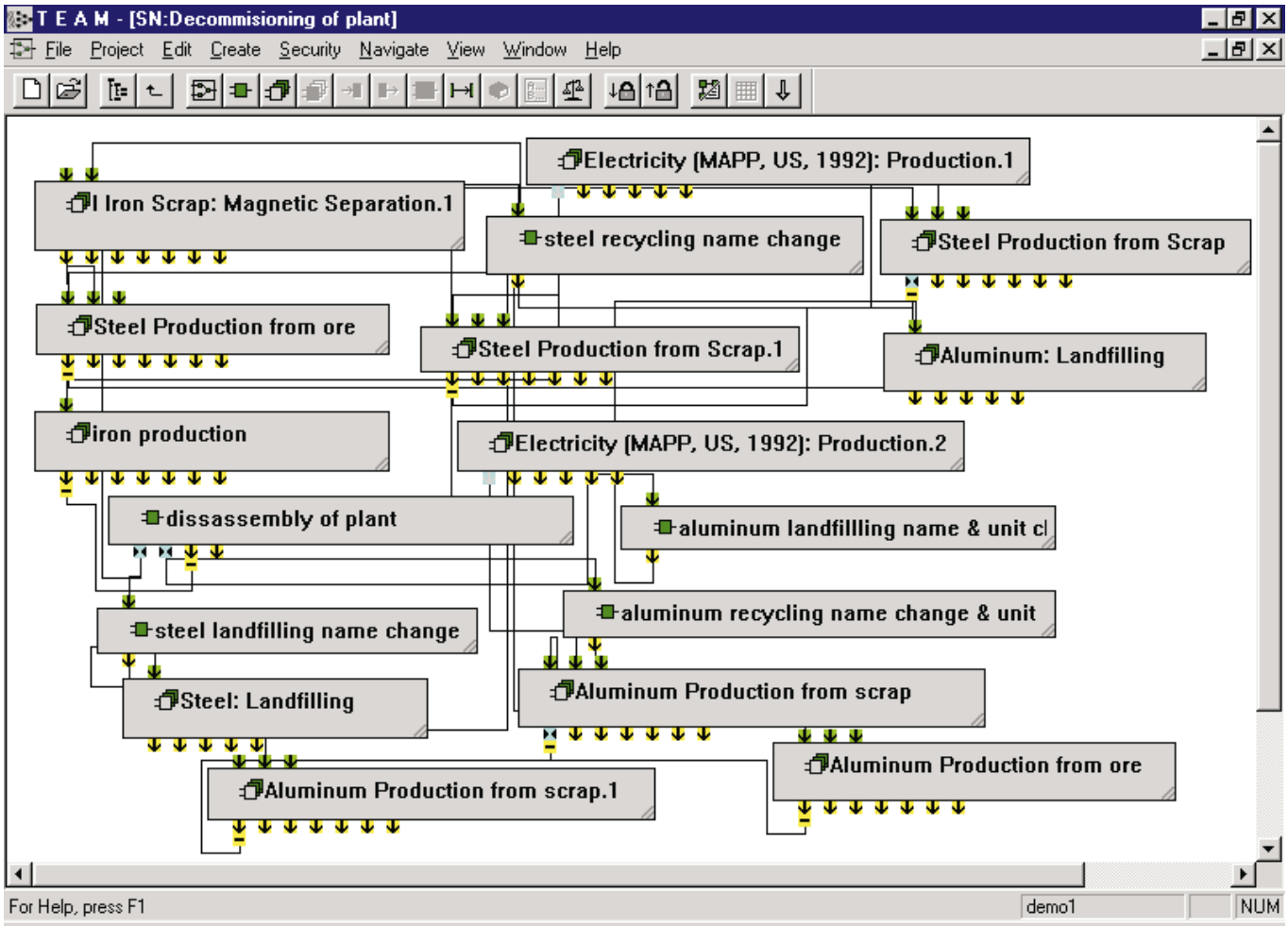

T E A M - [SN:power plant operation - LEB]
File Project Edit Create Security Navigate View Window Help
copperoxide requirements
ammonia transportation
111 Natural Gas: Production.1
total over lifetime
trace elements
Ammonia with co2 recovery
ash landfilling transportation
ash landfilling
operating emissions - LEBS case
ash recovery
operating functional unit
For Help, press F1
demo1
NUM

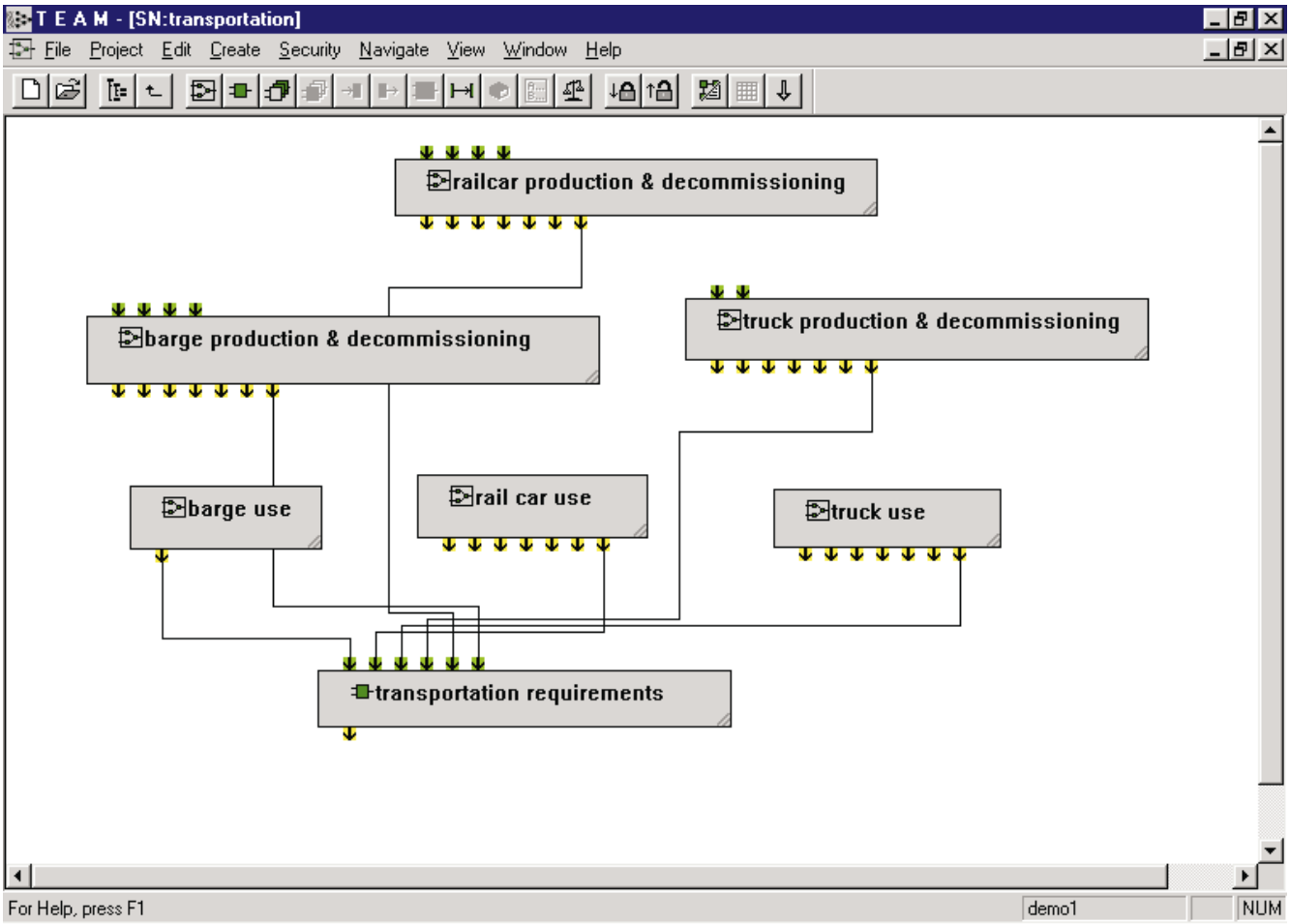

T E A M - [SN:copperoxide requirements]
File Project Edit Create Security Navigate View Window Help
111 Natural Gas: Production.1
Electricity (MAPP, US, 1992): Production.1
primary & secondary copper
copperoxide production requirements
For Help, press F1
demo1
NUM

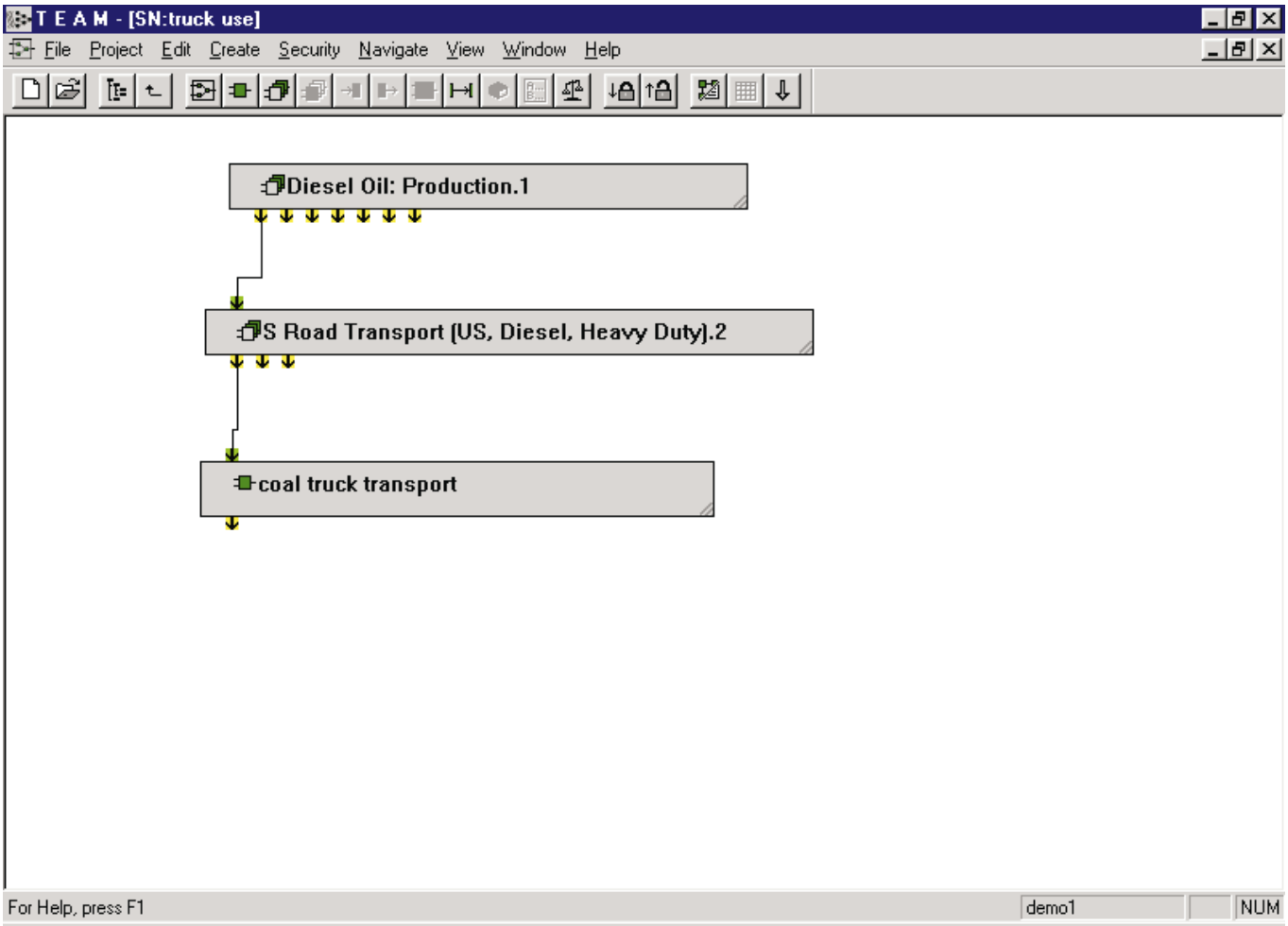

T E A M - [SN:plant construction & decomm]
File Project Edit Create Security Navigate View Window Help
asphalt plant emissions
construction of plant
Decommisioning of plant
construction & decommissioning functional unit
For Help, press F1
demo1
NUM

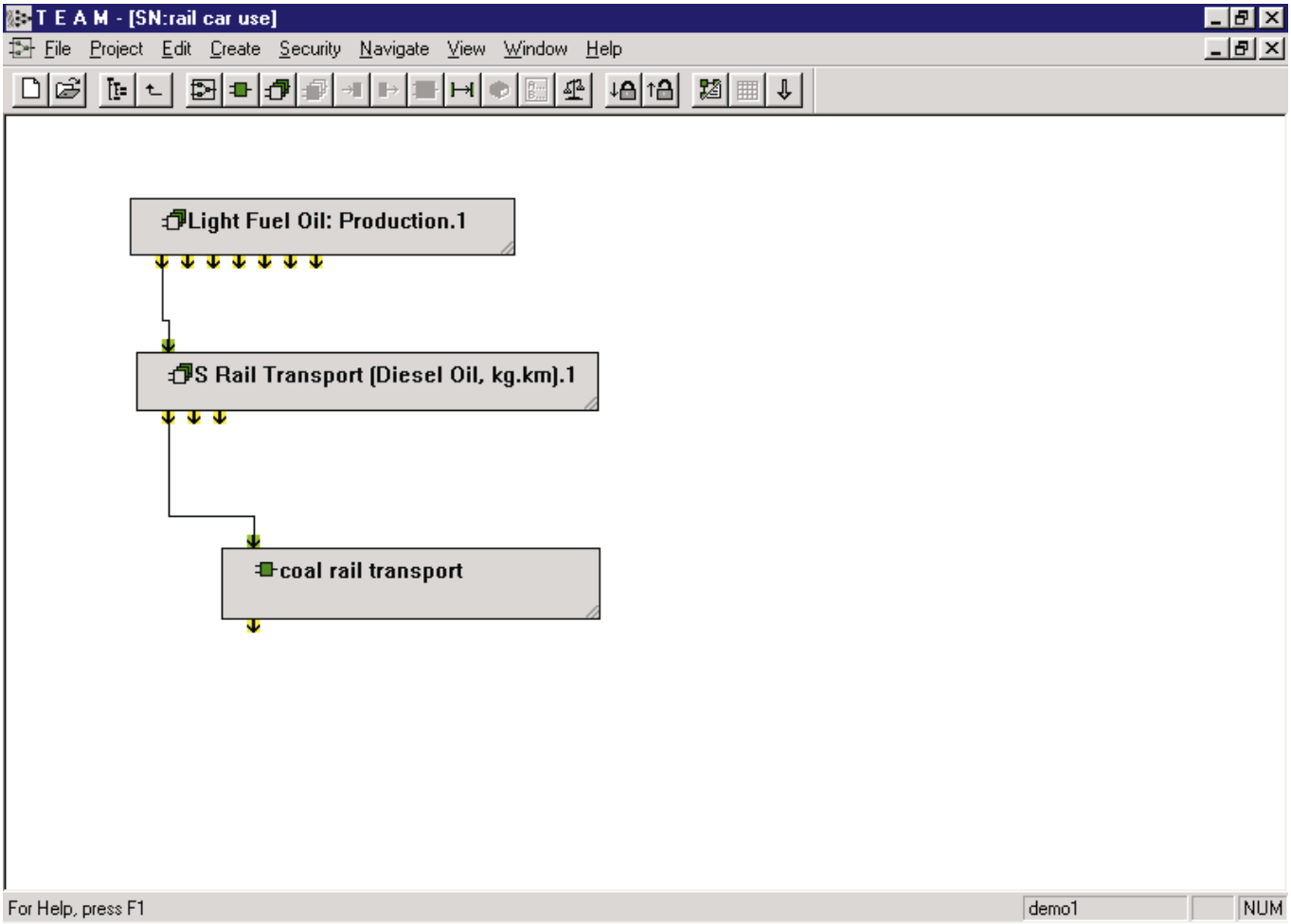

T E A M - [SN:construction of plant]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.
I Iron Scrap: Magnetic Separation.1
I Iron Scrap (to Electric Arc Furna
Steel Production from ore
Steel Production from Scrap
Aluminum Production from ore
iron production
Aluminum Production from scrap
construction materials transportation
cement manufacturing
material required for construction
For Help, press F1
demo1
NUM

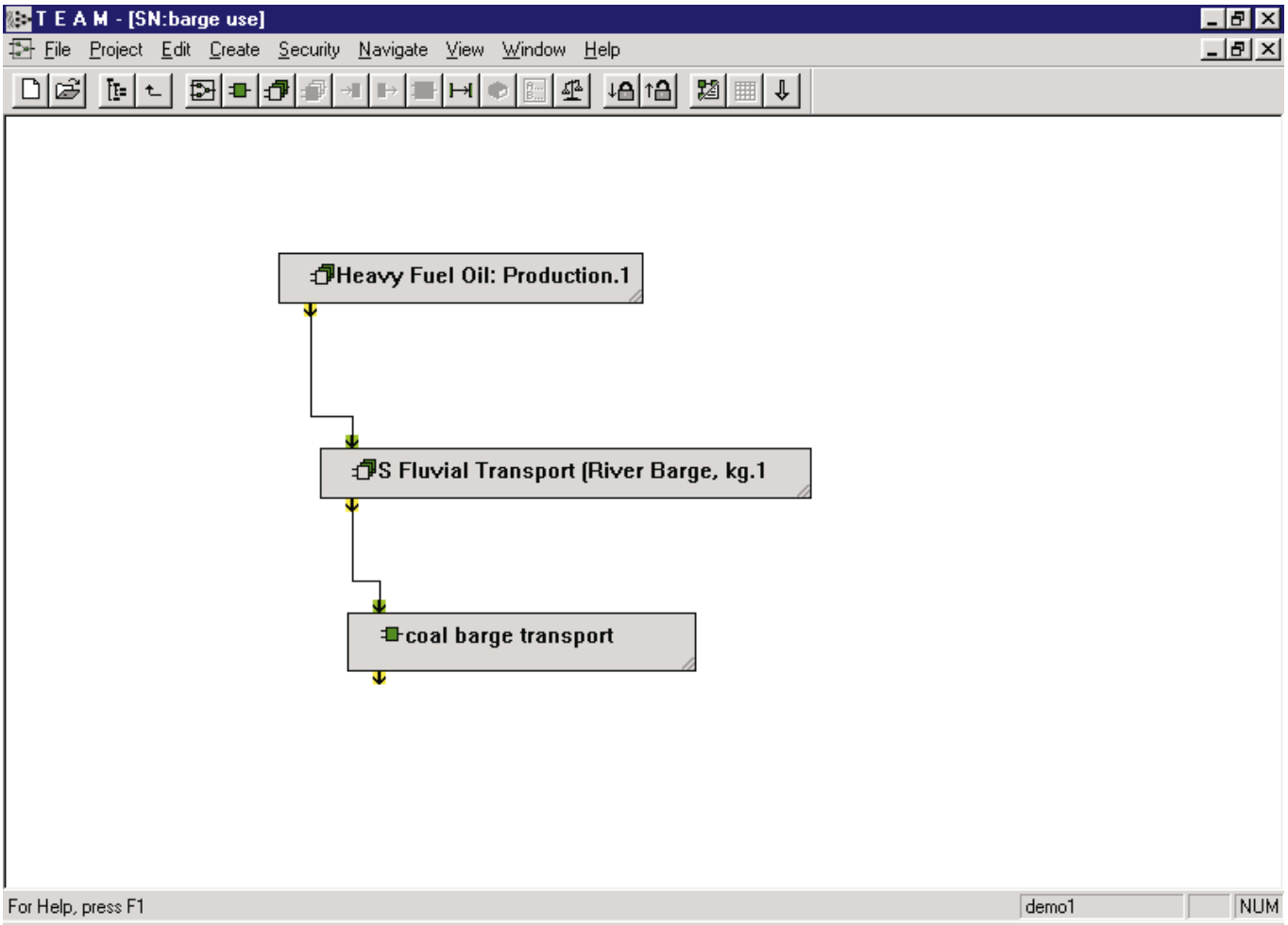

T E A M - [SN:construction materials tran]
File Project Edit Create Security Navigate View Window Help
railcar production & decommissioning
truck production & decommissioning
rail car use
truck use
transportation requirements
For Help, press F1
demo1
NUM

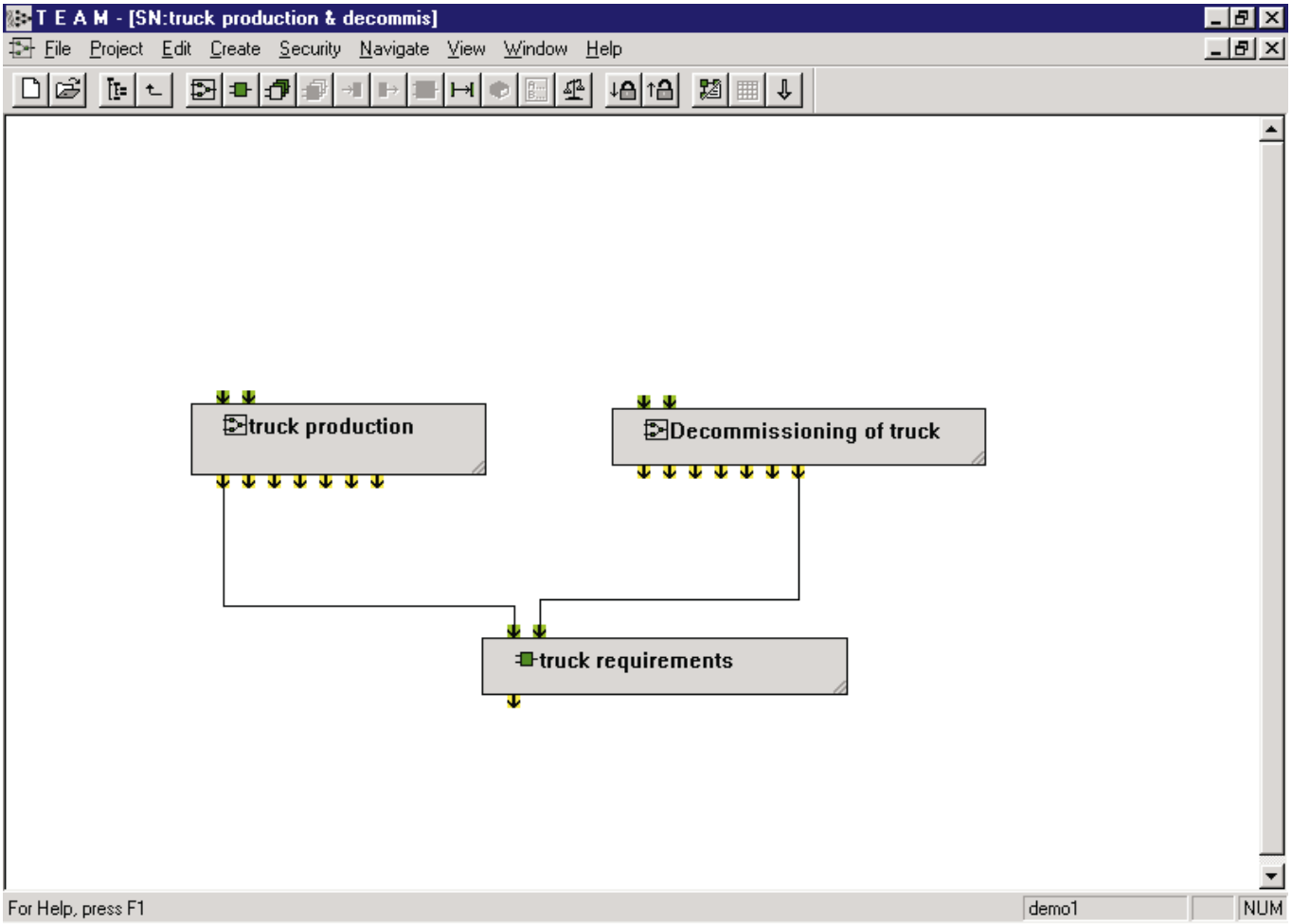

T E A M - [SN:Decommisioning of plant]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.1
I Iron Scrap: Magnetic Separation.1
steel recycling name change
Steel Production from Scrap
Steel Production from ore
Steel Production from Scrap.1
Aluminum: Landfilling
iron production
Electricity (MAPP, US, 1992): Production.2
dissassembly of plant
aluminum landfillling name & unit cl
aluminum recycling name change & unit
steel landfilling name change
Steel: Landfilling
Aluminum Production from scrap
Aluminum Production from ore
Aluminum Production from scrap.1
For Help, press F1
demo1
NUM

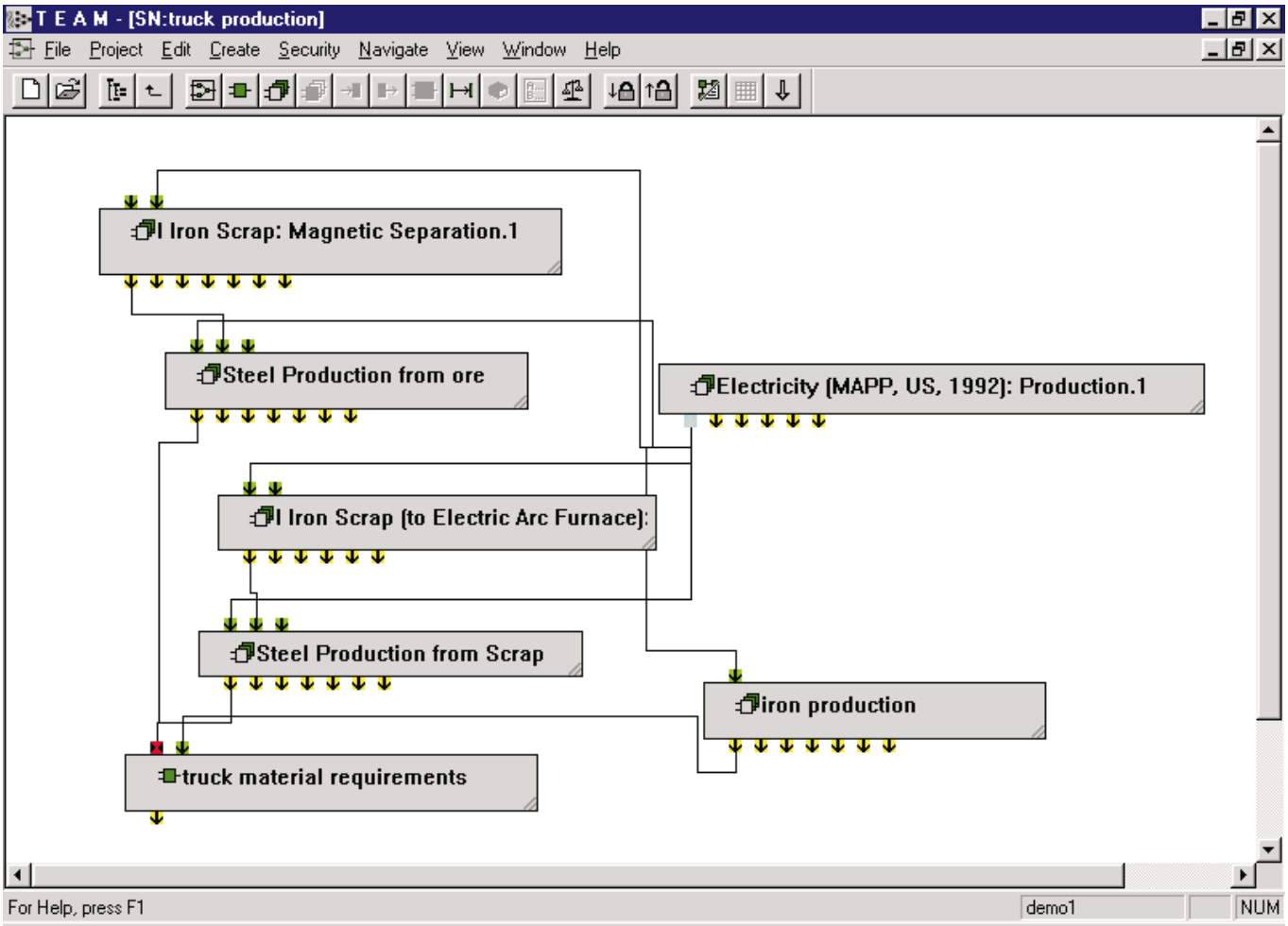

T E A M - [SN:transportation]
File Project Edit Create Security Navigate View Window Help
railcar production & decommissioning
barge production & decommissioning
truck production & decommissioning
barge use
rail car use
truck use
transportation requirements
For Help, press F1
demo1
NUM

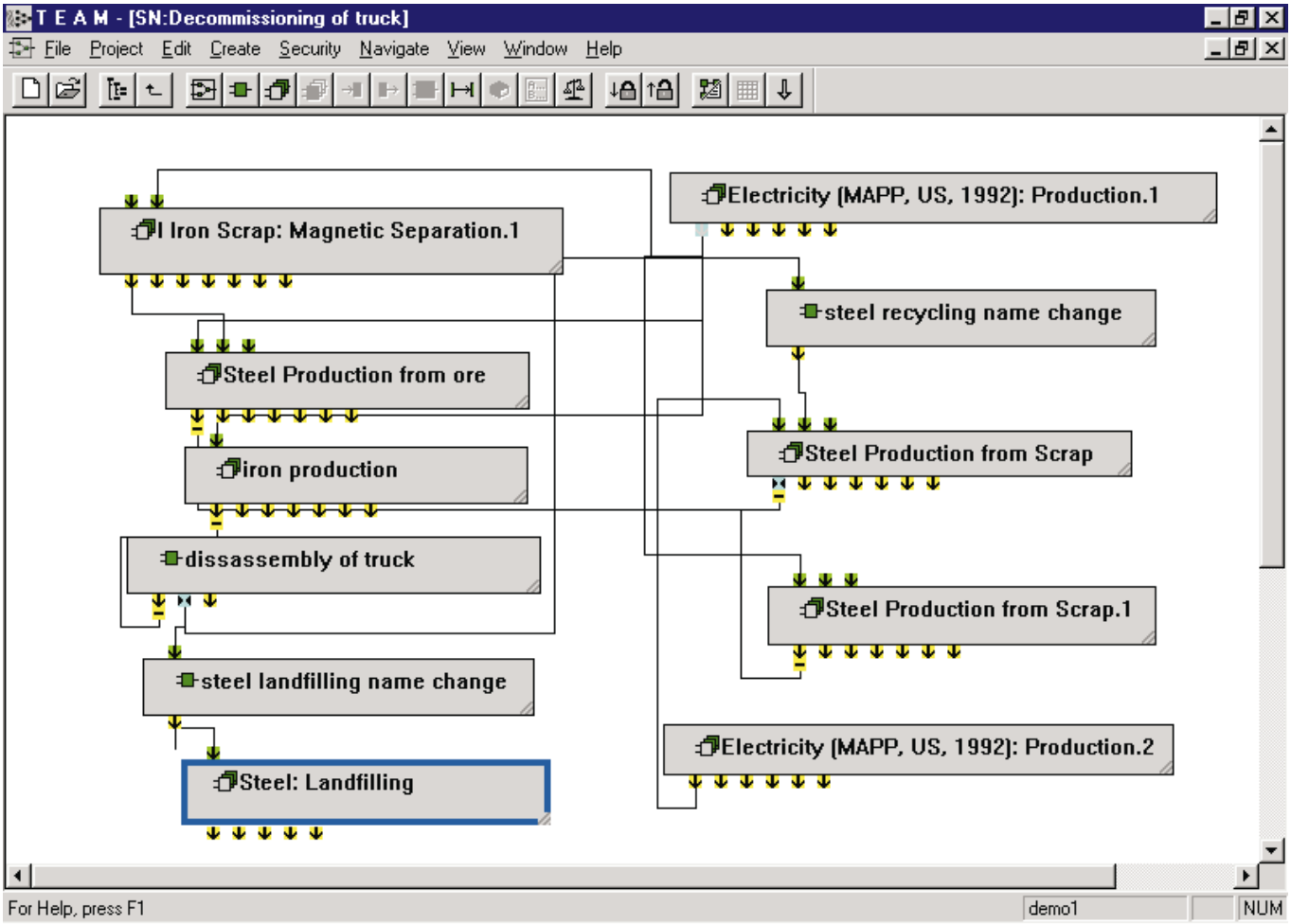

T E A M - [SN:truck use]
File Project Edit Create Security Navigate View Window Help
Diesel Oil: Production.1
S Road Transport (US, Diesel, Heavy Duty).2
coal truck transport
For Help, press F1
demo1
NUM

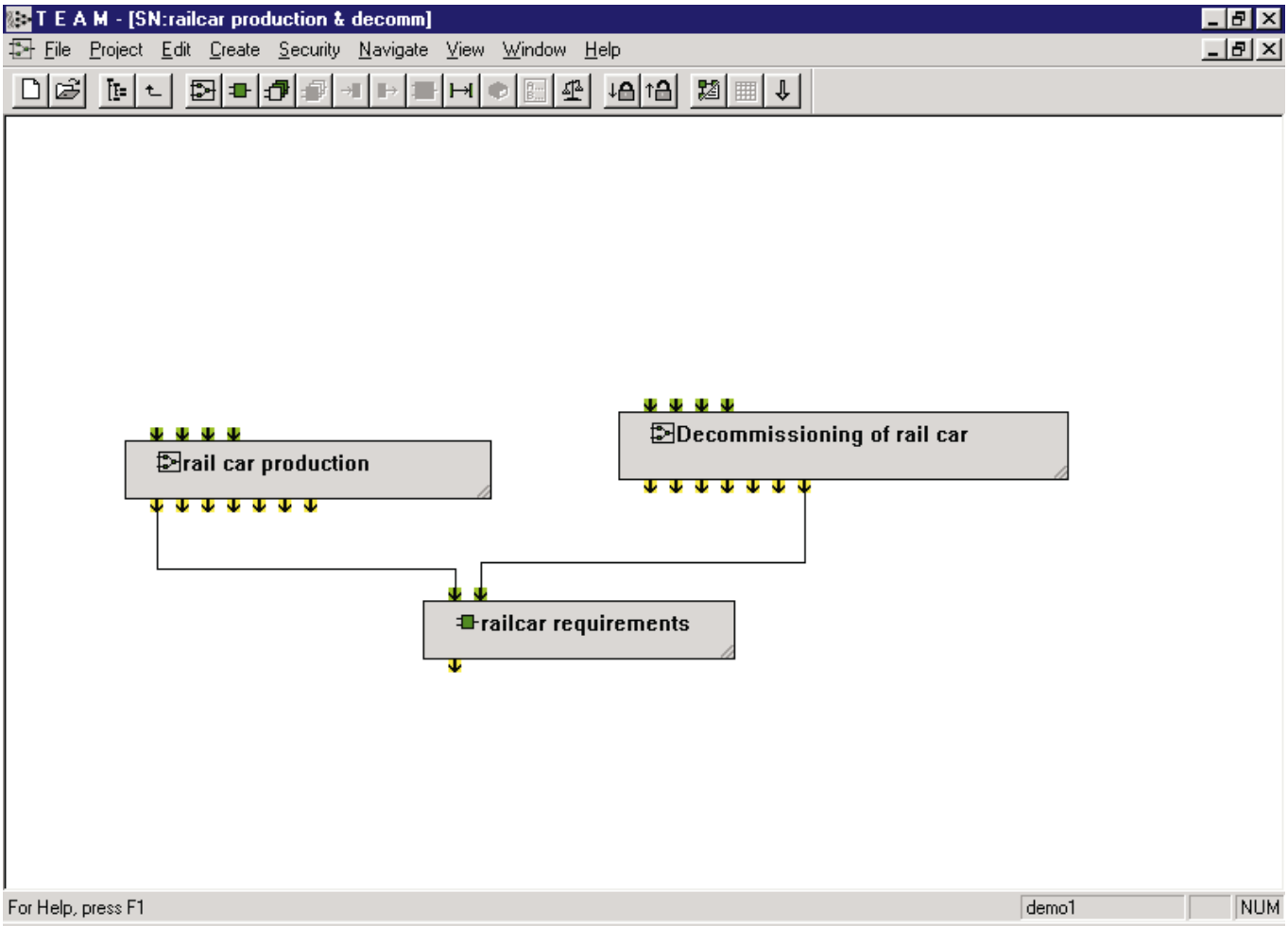

T E A M - [SN:rail car use]
File Project Edit Create Security Navigate View Window Help
Light Fuel Oil: Production.1
S Rail Transport (Diesel Oil, kg.km).1
coal rail transport
For Help, press F1
demo1
NUM

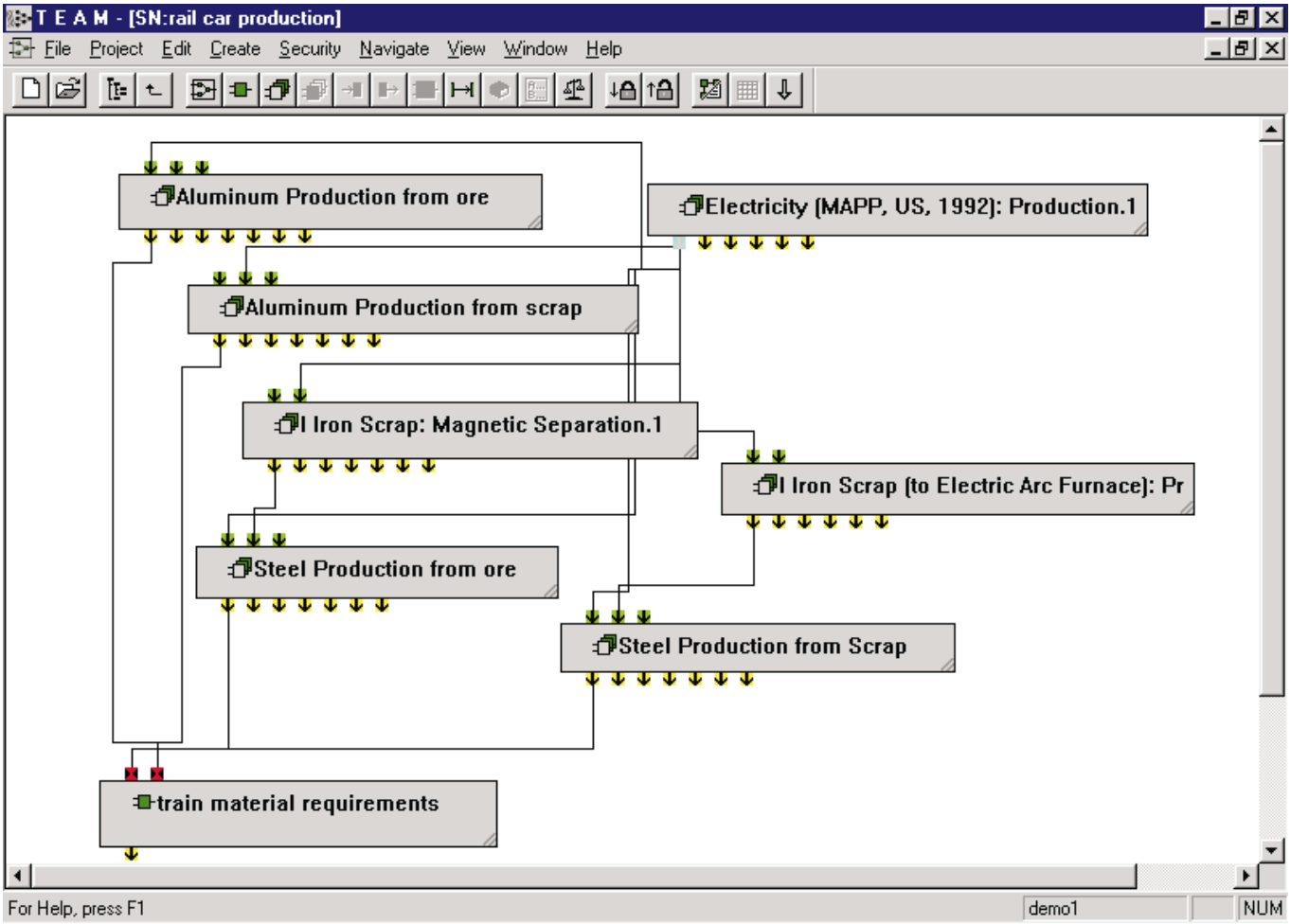

T E A M - [SN:barge use]
File Project Edit Create Security Navigate View Window Help
Heavy Fuel Oil: Production.1
S Fluvial Transport (River Barge, kg.1
coal barge transport
For Help, press F1
demo1
NUM

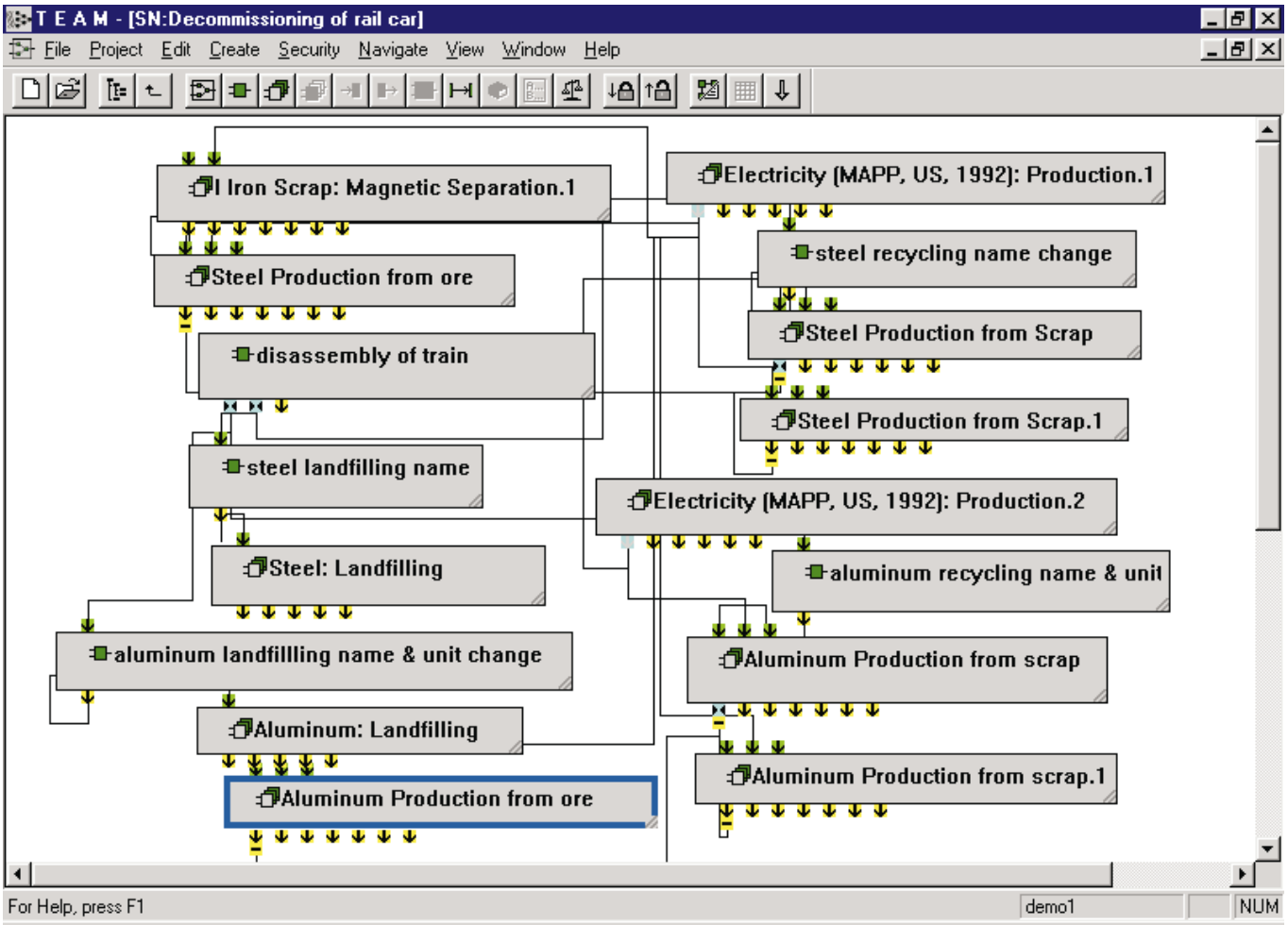

T E A M - [SN:truck production & decommis]
File Project Edit Create Security Navigate View Window Help
truck production
Decommissioning of truck
truck requirements
For Help, press F1
demo1
NUM

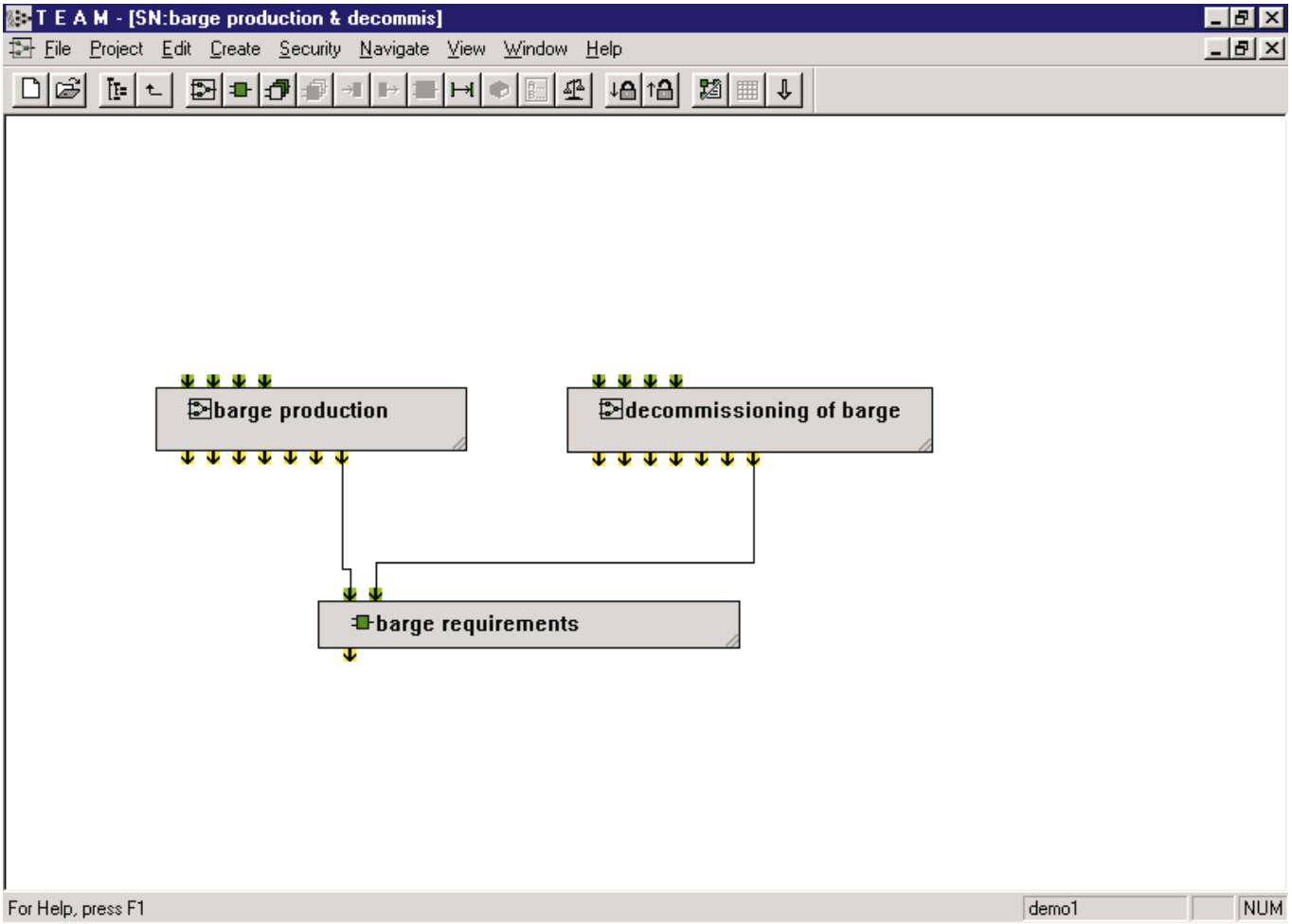

T E A M - [SN:truck production]
File Project Edit Create Security Navigate View Window Help
I Iron Scrap: Magnetic Separation.1
Steel Production from ore
Electricity (MAPP, US, 1992): Production.1
I Iron Scrap (to Electric Arc Furnace):
Steel Production from Scrap
iron production
truck material requirements
For Help, press F1
demo1
NUM

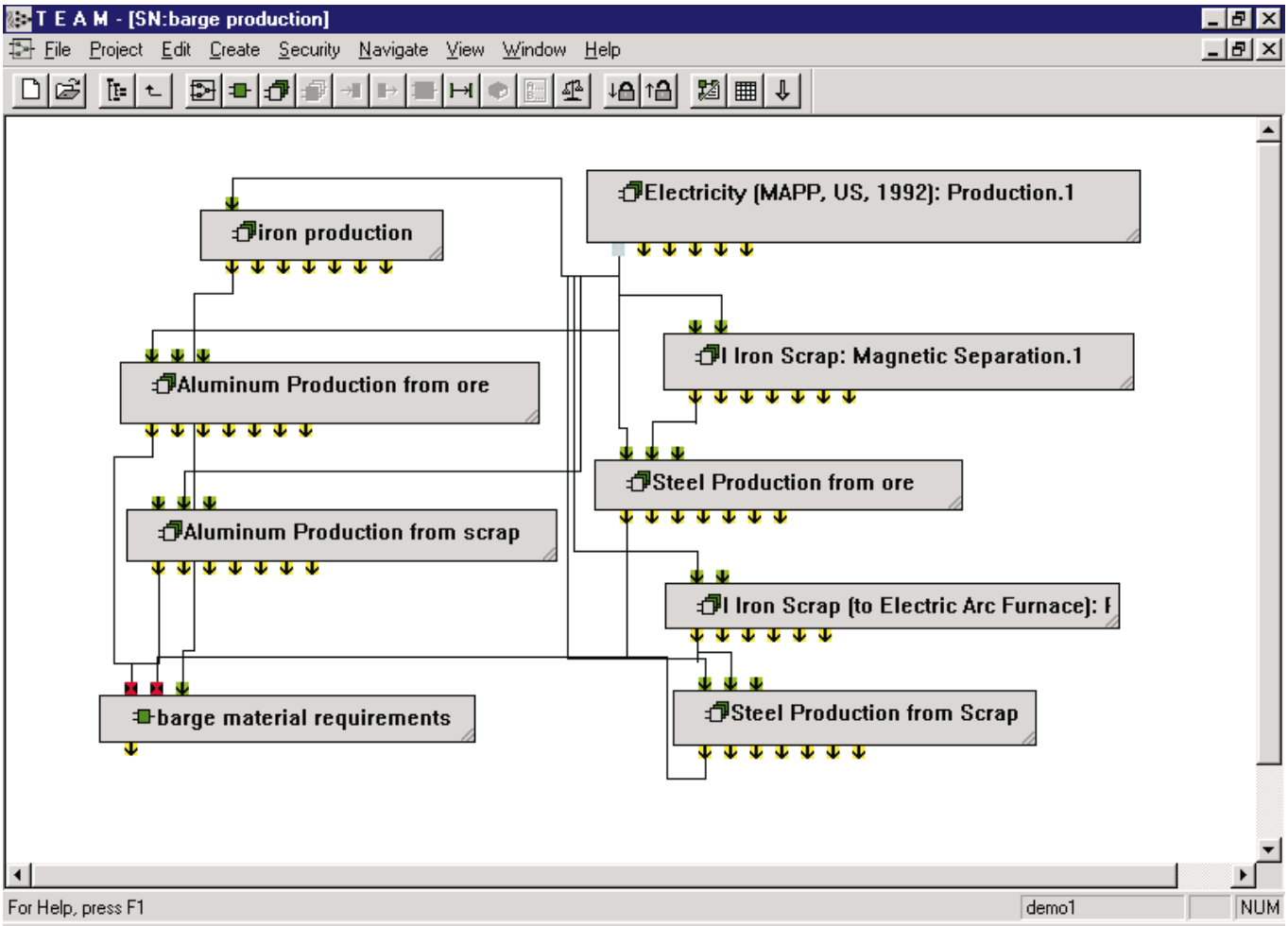

T E A M - [SN:Decommissioning of truck]
File Project Edit Create Security Navigate View Window Help
Electricity (MAPP, US, 1992): Production.1
I Iron Scrap: Magnetic Separation.1
steel recycling name change
Steel Production from ore
Steel Production from Scrap
iron production
dissassembly of truck
Steel Production from Scrap.1
steel landfilling name change
Electricity (MAPP, US, 1992): Production.2
Steel: Landfilling
For Help, press F1
demo1
NUM

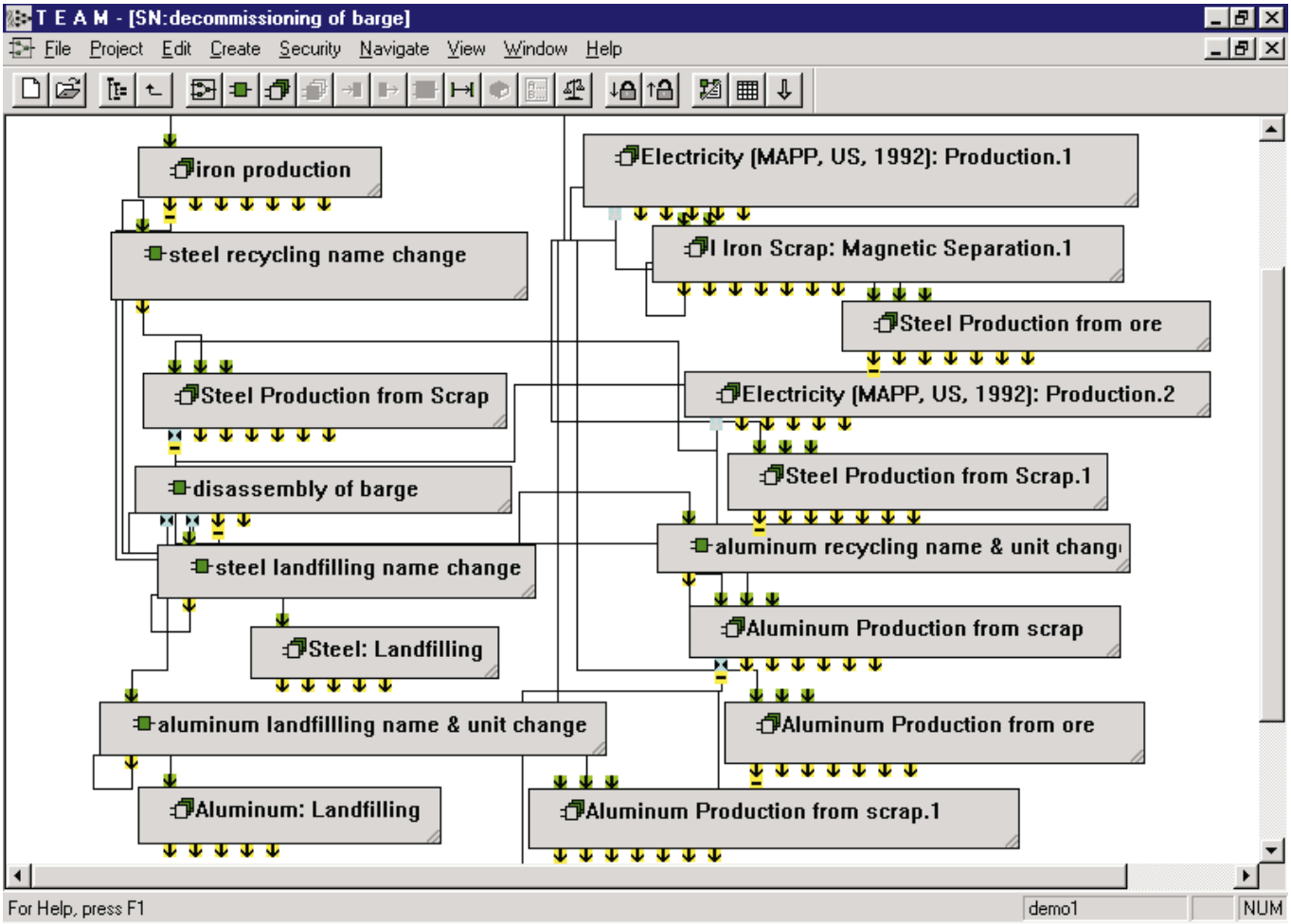

T E A M - [SN:railcar production & decomm]
File Project Edit Create Security Navigate View Window Help
rail car production
Decommissioning of rail car
railcar requirements
For Help, press F1
demo1
NUM


T E A M - [SN:rail car production]
File Project Edit Create Security Navigate View Window Help
Aluminum Production from ore
Electricity (MAPP, US, 1992): Production.1
Aluminum Production from scrap
I Iron Scrap: Magnetic Separation.1
I Iron Scrap (to Electric Arc Furnace): Pr
Steel Production from ore
Steel Production from Scrap
train material requirements
For Help, press F1
demo1
NUM


T E A M - [SN:Decommissioning of rail car]
File Project Edit Create Security Navigate View Window Help
I Iron Scrap: Magnetic Separation.1
Electricity (MAPP, US, 1992): Production.1
steel recycling name change
Steel Production from ore
Steel Production from Scrap
disassembly of train
Steel Production from Scrap.1
steel landfilling name
Electricity (MAPP, US, 1992): Production.2
Steel: Landfilling
aluminum recycling name & unit
aluminum landfillling name & unit change
Aluminum Production from scrap
Aluminum: Landfilling
Aluminum Production from scrap.1
Aluminum Production from ore
For Help, press F1
demo1
NUM


T E A M - [SN:barge production & decommis]
File Project Edit Create Security Navigate View Window Help
barge production
decommissioning of barge
barge requirements
For Help, press F1
demo1
NUM


T E A M - [SN:barge production]
File Project Edit Create Security Navigate View Window Help
iron production
Electricity (MAPP, US, 1992): Production.1
I Iron Scrap: Magnetic Separation.1
Aluminum Production from ore
Steel Production from ore
Aluminum Production from scrap
I Iron Scrap (to Electric Arc Furnace): I
barge material requirements
Steel Production from Scrap
For Help, press F1
demo1
NUM


T E A M - [SN:decommissioning of barge]
File Project Edit Create Security Navigate View Window Help
iron production
Electricity (MAPP, US, 1992): Production.1
steel recycling name change
I Iron Scrap: Magnetic Separation.1
Steel Production from ore
Steel Production from Scrap
Electricity (MAPP, US, 1992): Production.2
Steel Production from Scrap.1
disassembly of barge
aluminum recycling name & unit chang
steel landfilling name change
Aluminum Production from scrap
Steel: Landfilling
aluminum landfillling name & unit change
Aluminum Production from ore
Aluminum: Landfilling
Aluminum Production from scrap.1
For Help, press F1
demo1
NUM

Appendix B: Additional Tables

Table B1: Average Resource Consumption per kWh of Net Electricity Produced - Average System (underground mining & average user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(r) Bauxite (Al2O3, ore)	0.00%	2.54E-03	0.01%	4.90%	95.09%
(r) Clay (in ground)	0.00%	2.08E-08	11.81%	2.94%	85.25%
(r) Coal (in ground)	79.05%	4.75E+02	0.67%	0.01%	99.33%
(r) Iron (Fe, ore)	0.02%	9.62E-02	13.76%	2.61%	83.63%
(r) Limestone (CaCO3, in ground)	18.82%	1.13E+02	9.12%	0.00%	90.88%
(r) Natural Gas (in ground)	0.14%	8.53E-01	9.79%	2.53%	87.68%
(r) Oil (in ground)	1.96%	1.18E+01	5.47%	46.80%	47.73%
(r) Sand (in ground)	0.00%	2.27E-08	0.01%	4.90%	95.09%
(r) Sodium Chloride (NaCl, in ground or in sea)	0.00%	7.26E-05	0.92%	4.75%	94.33%
(r) Uranium (U, ore)	0.00%	4.02E-05	96.35%	0.10%	3.55%
Aluminum Scrap	0.00%	6.22E-04	0.01%	4.90%	95.09%
Iron Scrap	0.02%	1.02E-01	13.99%	2.58%	83.43%
Lubricant	0.00%	1.74E-03	13.77%	2.60%	83.64%
Trinitrotoluene (C6H3(NO2)3)	0.00%	4.53E-06	0.01%	4.90%	95.09%

(r) = resource

Table B2: Average Air Emissions per kWh of Net Electricity Produced - Average System (underground mining & average user by river)

	% of Total in this Table	% of Total in this Table except CO2	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(a) Aldehydes	0.00%	0.00%	4.64E-04	11.28%	43.89%	44.84%
(a) Ammonia (NH3)	0.00%	0.00%	2.22E-04	5.23%	46.03%	48.79%
(a) antimony	0.00%	0.00%	4.11E-06	0.00%	0.00%	100.00%
(a) arsenic	0.00%	0.00%	4.95E-05	0.00%	0.00%	100.00%
(a) barium	0.00%	0.00%	1.28E-05	0.00%	0.00%	100.00%
(a) beryllium	0.00%	0.00%	1.60E-06	0.00%	0.00%	100.00%
(a) boron	0.00%	0.07%	1.70E-02	0.00%	0.00%	100.00%
(a) cadmium	0.00%	0.00%	4.07E-06	0.00%	0.00%	100.00%
(a) total Carbon Dioxide (CO2)	97.83%		1.02E+03	0.85%	1.72%	97.43%
(a) Carbon Monoxide (CO)	0.02%	1.15%	2.61E-01	1.03%	38.96%	60.01%
(a) Chlorides (Cl-)	0.00%	0.00%	5.70E-07	0.01%	3.48%	96.52%
(a) chromium	0.00%	0.00%	5.92E-05	0.00%	0.00%	100.00%
(a) cobalt	0.00%	0.00%	6.87E-06	0.00%	0.00%	100.00%
(a) copper	0.00%	0.00%	2.34E-05	0.00%	0.00%	100.00%
(a) Fluorides (F-)	0.00%	0.00%	2.66E-07	17.12%	3.40%	79.48%
(a) non-methane Hydrocarbons (including VOCs)	0.02%	0.87%	1.98E-01	33.63%	29.67%	36.69%
(a) Hydrogen Chloride (HCl)	0.00%	0.00%	1.83E-06	0.14%	3.19%	96.67%
(a) Hydrogen Fluoride (HF)	0.00%	0.00%	1.65E-07	2.62%	4.47%	92.91%
(a) Hydrogen Sulfide (H2S)	0.00%	0.00%	1.04E-08	11.81%	2.94%	85.25%
(a) lead	0.00%	0.00%	3.00E-05	0.00%	0.00%	100.00%
(a) manganese	0.00%	0.00%	4.30E-05	0.00%	0.00%	100.00%
(a) mercury	0.00%	0.00%	3.66E-05	0.00%	0.00%	100.00%
(a) Metals (unspecified)	0.00%	0.00%	1.27E-09	9.69%	3.29%	87.01%
(a) Methane (CH4)	0.19%	8.82%	2.00E+00	99.53%	0.05%	0.43%
(a) molybdenum	0.00%	0.00%	3.81E-05	0.00%	0.00%	100.00%
(a) nickel	0.00%	0.00%	5.79E-05	0.00%	0.00%	100.00%
(a) Nitrogen Oxides (NOx as NO2)	0.32%	14.75%	3.34E+00	1.10%	5.53%	93.37%
(a) Nitrous Oxide (N2O)	0.00%	0.02%	4.30E-03	20.36%	5.72%	73.92%
(a) Organic Matter (unspecified)	0.00%	0.00%	6.95E-04	13.51%	43.96%	42.53%
(a) total Particulates (unspecified)	0.97%	44.72%	1.01E+01	9.22%	0.18%	90.60%
(a) selenium	0.00%	0.00%	4.06E-04	0.00%	0.00%	100.00%
(a) Sulfur Oxides (SOx as SO2)	0.64%	29.59%	6.70E+00	1.12%	1.42%	97.46%
(a) Tars (unspecified)	0.00%	0.00%	3.65E-07	11.56%	2.98%	85.46%
(a) vanadium	0.00%	0.00%	8.80E-05	0.00%	0.00%	100.00%

(a) = air emission

Table B3: Average Water Emissions per kWh of Net Electricity Produced - Average System
(underground mining & avg user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(w) Acids (H+)	0.00%	9.32E-08	7.91%	3.58%	88.37%
(w) Ammonia (NH4+)	0.00%	0.00E+00	0.00%	0.00%	0.00%
(w) Ammonia (NH4+, NH3, as N)	0.00%	3.31E-06	83.99%	0.48%	15.54%
(w) TOTAL BOD5 (Biological Oxygen Demand)	0.04%	6.52E-05	5.05%	46.90%	48.05%
(w) Chlorides (Cl-)	0.00%	3.42E-06	2.36%	4.76%	92.88%
(w) COD (Chemical Oxygen Demand)	0.12%	1.94E-04	5.00%	47.15%	47.85%
(w) Cyanides (CN-)	0.00%	7.29E-09	13.76%	2.61%	83.63%
(w) Dissolved Matter (unspecified)	98.49%	1.57E-01	5.65%	41.23%	53.12%
(w) Fluorides (F-)	0.00%	7.07E-06	84.69%	0.45%	14.85%
(w) Inorganic Dissolved Matter (unspecified)	0.00%	5.26E-07	11.68%	2.96%	85.35%
(w) Iron (Fe++, Fe3+)	0.00%	1.17E-08	96.35%	0.10%	3.55%
(w) Metals (unspecified)	0.00%	3.20E-07	11.52%	2.99%	85.49%
(w) Nitrates (NO3-)	0.00%	1.44E-06	96.35%	0.10%	3.55%
(w) Nitric acid	0.00%	0.00E+00	0.00%	0.00%	0.00%
(w) Nitrogenous Matter (unspecified, as N)	0.00%	1.04E-08	11.81%	2.94%	85.25%
(w) Oils	1.17%	1.87E-03	5.59%	44.53%	49.88%
(w) Oils (unspecified)	0.02%	2.63E-05	0.00%	0.00%	100.00%
(w) Organic Dissolved Matter (unspecified)	0.00%	2.08E-08	11.81%	2.94%	85.25%
(w) Phenol (C6H6O)	0.00%	2.29E-08	13.67%	2.62%	83.70%
(w) Sodium (Na+)	0.00%	1.46E-06	65.65%	1.63%	32.72%
(w) Sulfates (SO4--)	0.00%	1.73E-06	71.61%	1.33%	27.05%
(w) Sulfides (S--)	0.00%	1.46E-08	13.76%	2.61%	83.63%
(w) Suspended Matter (unspecified)	0.12%	1.91E-04	7.94%	16.98%	75.08%
(w) Tars (unspecified)	0.00%	5.22E-09	11.56%	2.98%	85.46%
(w) Water: Chemically Polluted	0.02%	3.11E-05	0.01%	3.79%	96.20%

(w) = water emission

Table B4: Average Energy Requirements per kWh of Net Electricity Produced - Average System
(underground mining & avg user by river)

	Total (MJ/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
Non-electric Energy Consumed by System (excluding coal energy)	0.6715	19.10%	34.51%	46.39%
Electricity Consumed by System	0.0300	98.49%	2.35%	-0.84%
Total Non-coal Energy Consumed by System	0.7015	22.49%	33.14%	44.38%
Energy in Coal to Power Plant	11.8508	N/A	N/A	N/A
Total Energy Consumed by System	12.5523	1.26%	1.85%	96.89%

Note: The electricity produced and consumed by the power plant is not included in this table.
The power plant energy and electricty requirements are from upstream processes, construction, and decommissioning.

Table B5: Average Solid Waste Generation per kWh of Net Electricity Produced - Average System
(underground mining & avg user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(s) antimony	0.00%	1.49E-05	0.00%	0.00%	100.00%
(s) arsenic	0.00%	1.30E-04	0.00%	0.00%	100.00%
(s) barium	0.00%	4.37E-04	0.00%	0.00%	100.00%
(s) beryllium	0.00%	1.41E-05	0.00%	0.00%	100.00%
(s) boron	0.00%	7.19E-04	0.00%	0.00%	100.00%
(s) cadmium	0.00%	9.83E-06	0.00%	0.00%	100.00%
(s) chromium	0.00%	2.22E-04	0.00%	0.00%	100.00%
(s) cobalt	0.00%	4.65E-05	0.00%	0.00%	100.00%
(s) copper	0.00%	1.14E-04	0.00%	0.00%	100.00%
(s) lead	0.00%	1.00E-04	0.00%	0.00%	100.00%
(s) manganese	0.00%	2.73E-04	0.00%	0.00%	100.00%
(s) mercury	0.00%	1.66E-07	0.00%	0.00%	100.00%
(s) molybdenum	0.00%	3.89E-05	0.00%	0.00%	100.00%
(s) nickel	0.00%	1.56E-04	0.00%	0.00%	100.00%
(s) selenium	0.00%	1.03E-05	0.00%	0.00%	100.00%
(s) vanadium	0.00%	3.17E-04	0.00%	0.00%	100.00%
ash - landfilled (dry)	22.92%	2.57E+01	0.00%	0.00%	100.00%
FGC waste (dry) - landfilled	57.75%	6.47E+01	0.00%	0.00%	100.00%
Waste (hazardous)	0.00%	3.31E-09	3.72%	4.29%	92.00%
Waste (municipal and industrial)	0.11%	1.24E-01	13.67%	2.44%	83.89%
Waste (unspecified)	19.21%	2.15E+01	16.29%	0.05%	83.66%

(s) = solid emission

Table B6: Average Resource Consumption per kWh of Net Electricity Produced - NSPS Case (surface mining & average user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(r) Bauxite (Al2O3, ore)	0.00%	2.53E-03	0.00%	4.50%	95.49%
(r) Clay (in ground)	0.00%	2.35E-08	21.65%	2.39%	75.97%
(r) Coal (in ground)	78.05%	4.35E+02	0.75%	0.01%	99.24%
(r) Iron (Fe, ore)	0.02%	1.11E-01	24.70%	2.07%	73.22%
(r) Limestone (CaCO3, in ground)	19.65%	1.09E+02	0.04%	0.00%	99.96%
(r) Natural Gas (in ground)	0.23%	1.26E+00	35.07%	1.57%	63.37%
(r) Oil (in ground)	2.03%	1.13E+01	2.62%	44.62%	52.76%
(r) Sand (in ground)	0.00%	2.26E-08	0.00%	4.50%	95.50%
(r) Sodium Chloride (NaCl, in ground or in sea)	0.00%	7.30E-05	1.88%	4.32%	93.80%
(r) Uranium (U, ore)	0.00%	4.22E-05	95.07%	0.09%	4.84%
Aluminum Scrap	0.00%	6.19E-04	0.00%	4.50%	95.50%
Iron Scrap	0.02%	1.18E-01	25.10%	2.05%	72.86%
Lubricant	0.00%	2.01E-03	24.75%	2.06%	73.18%
Trinitrotoluene (C6H3(NO2)3)	0.00%	4.51E-06	0.00%	4.50%	95.49%

(r) = resource

Table B7: Average Air Emissions per kWh of Net Electricity Produced - NSPS Case (surface mining & average user by river)

	% of Total in this Table	% of Total in this Table except CO2	Total (g/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(a) Aldehydes	0.00%	0.00%	4.47E-04	8.93%	41.65%	49.42%
(a) Ammonia (NH3)	0.01%	0.56%	9.04E-02	99.77%	0.10%	0.13%
(a) antimony	0.00%	0.00%	3.76E-06	0.00%	0.00%	100.00%
(a) arsenic	0.00%	0.00%	4.52E-05	0.00%	0.00%	100.00%
(a) barium	0.00%	0.00%	1.17E-05	0.00%	0.00%	100.00%
(a) beryllium	0.00%	0.00%	1.46E-06	0.00%	0.00%	100.00%
(a) boron	0.00%	0.10%	1.55E-02	0.00%	0.00%	100.00%
(a) cadmium	0.00%	0.00%	3.72E-06	0.00%	0.00%	100.00%
(a) total Carbon Dioxide (CO2)	98.32%		9.41E+02	0.93%	1.71%	97.36%
(a) Carbon Monoxide (CO)	0.03%	1.54%	2.48E-01	3.40%	37.46%	59.14%
(a) Chlorides (Cl-)	0.00%	0.00%	5.68E-07	0.00%	3.19%	96.81%
(a) chromium	0.00%	0.00%	5.41E-05	0.00%	0.00%	100.00%
(a) cobalt	0.00%	0.00%	6.28E-06	0.00%	0.00%	100.00%
(a) copper	0.00%	0.00%	2.14E-05	0.00%	0.00%	100.00%
(a) Fluorides (F-)	0.00%	0.00%	2.83E-07	22.06%	2.92%	75.02%
(a) non-methane Hydrocarbons (including VOCs)	0.02%	1.26%	2.03E-01	36.58%	26.51%	36.91%
(a) Hydrogen Chloride (HCl)	0.00%	0.00%	1.83E-06	0.28%	2.92%	96.80%
(a) Hydrogen Fluoride (HF)	0.00%	0.00%	1.69E-07	5.27%	3.99%	90.75%
(a) Hydrogen Sulfide (H2S)	0.00%	0.00%	1.17E-08	21.65%	2.39%	75.97%
(a) lead	0.00%	0.00%	2.74E-05	0.00%	0.00%	100.00%
(a) manganese	0.00%	0.00%	3.93E-05	0.00%	0.00%	100.00%
(a) mercury	0.00%	0.00%	3.35E-05	0.00%	0.00%	100.00%
(a) Metals (unspecified)	0.00%	0.00%	1.40E-09	18.15%	2.73%	79.12%
(a) Methane (CH4)	0.09%	5.21%	8.36E-01	98.81%	0.10%	1.09%
(a) molybdenum	0.00%	0.00%	3.48E-05	0.00%	0.00%	100.00%
(a) nickel	0.00%	0.00%	5.29E-05	0.00%	0.00%	100.00%
(a) Nitrogen Oxides (NOx as NO2)	0.24%	14.58%	2.34E+00	1.87%	7.22%	90.92%
(a) Nitrous Oxide (N2O)	0.00%	0.03%	4.52E-03	20.25%	4.97%	74.78%
(a) Organic Matter (unspecified)	0.00%	0.02%	2.56E-03	76.13%	10.92%	12.95%
(a) total Particulates (unspecified)	1.02%	60.96%	9.78E+00	0.12%	0.17%	99.70%
(a) selenium	0.00%	0.00%	3.71E-04	0.00%	0.00%	100.00%
(a) Sulfur Oxides (SOx as SO2)	0.26%	15.74%	2.53E+00	2.58%	3.44%	93.98%
(a) Tars (unspecified)	0.00%	0.00%	4.11E-07	21.24%	2.42%	76.33%
(a) vanadium	0.00%	0.00%	8.05E-05	0.00%	0.00%	100.00%

(a) = air emission

Table B8: Average Water Emissions per kWh of Net Electricity Produced - NSPS Case
(surface mining & average user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(w) Acids (H+)	0.01%	2.35E-05	99.63%	0.01%	0.35%
(w) Ammonia (NH4+)	12.10%	2.14E-02	100.00%	0.00%	0.00%
(w) Ammonia (NH4+, NH3, as N)	0.00%	3.52E-06	83.69%	0.41%	15.90%
(w) TOTAL BOD5 (Biological Oxygen Demand)	0.31%	5.49E-04	88.87%	5.09%	6.04%
(w) Chlorides (Cl-)	0.00%	3.42E-06	2.62%	4.36%	93.01%
(w) COD (Chemical Oxygen Demand)	0.93%	1.65E-03	88.95%	5.08%	5.98%
(w) Cyanides (CN-)	0.00%	8.38E-09	24.70%	2.07%	73.22%
(w) Dissolved Matter (unspecified)	84.76%	1.50E-01	1.74%	39.37%	58.89%
(w) Fluorides (F-)	0.00%	7.51E-06	84.34%	0.39%	15.27%
(w) Inorganic Dissolved Matter (unspecified)	0.00%	5.93E-07	21.44%	2.41%	76.15%
(w) Iron (Fe++, Fe3+)	0.00%	1.23E-08	95.07%	0.09%	4.84%
(w) Metals (unspecified)	0.00%	3.60E-07	21.17%	2.43%	76.40%
(w) Nitrates (NO3-)	0.00%	1.50E-06	95.07%	0.09%	4.84%
(w) Nitric acid	0.67%	1.19E-03	100.00%	0.00%	0.00%
(w) Nitrogenous Matter (unspecified, as N)	0.00%	1.17E-08	21.65%	2.39%	75.97%
(w) Oils	1.03%	1.82E-03	4.31%	41.74%	53.95%
(w) Oils (unspecified)	0.02%	2.80E-05	0.00%	0.00%	100.00%
(w) Organic Dissolved Matter (unspecified)	0.00%	2.35E-08	21.65%	2.39%	75.97%
(w) Phenol (C6H6O)	0.00%	2.63E-08	24.57%	2.09%	73.35%
(w) Sodium (Na+)	0.00%	1.51E-06	65.85%	1.44%	32.70%
(w) Sulfates (SO4--)	0.00%	1.79E-06	71.61%	1.18%	27.22%
(w) Sulfides (S--)	0.00%	1.68E-08	24.70%	2.07%	73.22%
(w) Suspended Matter (unspecified)	0.13%	2.29E-04	22.03%	12.93%	65.05%
(w) Tars (unspecified)	0.00%	5.87E-09	21.24%	2.42%	76.33%
(w) Water: Chemically Polluted	0.02%	3.09E-05	0.00%	3.48%	96.52%

(w) = water emission

Table B9: Average Energy Requirements per kWh of Net Electricity Produced - NSPS Case
(surface mining & average user by river)

	Total (MJ/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
Non-electric Energy Consumed by System (excluding coal energy)	0.6757	19.86%	31.36%	48.78%
Electricity Consumed by System	0.0314	97.39%	2.05%	0.56%
Total Non-coal Energy Consumed by System	0.7071	23.30%	30.06%	46.65%
Energy in Coal to Power Plant	10.8350	N/A	N/A	N/A
Total Energy Consumed by System	11.5421	1.43%	1.84%	96.73%

Note: The electricity produced and consumed by the power plant is not included in this table.
The power plant energy and electricty requirements are from upstream processes, construction, and decommissioning.

Table B10: Average Solid Waste Generation per kWh of Net Electricity Produced - NSPS Case
(surface mining & average user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(s) antimony	0.00%	1.36E-05	0.00%	0.00%	100.00%
(s) arsenic	0.00%	1.19E-04	0.00%	0.00%	100.00%
(s) barium	0.00%	4.00E-04	0.00%	0.00%	100.00%
(s) beryllium	0.00%	1.29E-05	0.00%	0.00%	100.00%
(s) boron	0.00%	6.57E-04	0.00%	0.00%	100.00%
(s) cadmium	0.00%	8.99E-06	0.00%	0.00%	100.00%
(s) chromium	0.00%	2.03E-04	0.00%	0.00%	100.00%
(s) cobalt	0.00%	4.25E-05	0.00%	0.00%	100.00%
(s) copper	0.00%	1.05E-04	0.00%	0.00%	100.00%
(s) lead	0.00%	9.15E-05	0.00%	0.00%	100.00%
(s) manganese	0.00%	2.49E-04	0.00%	0.00%	100.00%
(s) mercury	0.00%	1.52E-07	0.00%	0.00%	100.00%
(s) molybdenum	0.00%	3.56E-05	0.00%	0.00%	100.00%
(s) nickel	0.00%	1.43E-04	0.00%	0.00%	100.00%
(s) selenium	0.00%	9.40E-06	0.00%	0.00%	100.00%
(s) vanadium	0.00%	2.90E-04	0.00%	0.00%	100.00%
ash - landfilled (dry)	20.71%	2.35E+01	0.00%	0.00%	100.00%
FGC waste (dry) - landfilled	60.75%	6.89E+01	0.00%	0.00%	100.00%
Waste (hazardous)	0.00%	3.43E-09	7.40%	3.78%	88.82%
Waste (municipal and industrial)	0.12%	1.42E-01	23.66%	1.96%	74.38%
Waste (unspecified)	18.42%	2.09E+01	8.05%	0.05%	91.90%

(s) = solid emission

Table B11: Average Resource Consumption per kWh of Net Electricity Produced - NSPS Case (underground mining & average user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(r) Bauxite (Al2O3, ore)	0.00%	2.53E-03	0.01%	4.50%	95.49%
(r) Clay (in ground)	0.00%	2.06E-08	10.89%	2.71%	86.40%
(r) Coal (in ground)	76.76%	4.35E+02	0.67%	0.01%	99.33%
(r) Iron (Fe, ore)	0.02%	9.54E-02	12.69%	2.41%	84.90%
(r) Limestone (CaCO3, in ground)	21.00%	1.19E+02	7.93%	0.00%	92.07%
(r) Natural Gas (in ground)	0.16%	8.93E-01	8.55%	2.21%	89.24%
(r) Oil (in ground)	2.05%	1.16E+01	5.08%	43.49%	51.43%
(r) Sand (in ground)	0.00%	2.26E-08	0.01%	4.50%	95.49%
(r) Sodium Chloride (NaCl, in ground or in sea)	0.00%	7.23E-05	0.85%	4.37%	94.79%
(r) Uranium (U, ore)	0.00%	3.75E-05	94.46%	0.10%	5.44%
Aluminum Scrap	0.00%	6.19E-04	0.01%	4.50%	95.49%
Iron Scrap	0.02%	1.01E-01	12.90%	2.38%	84.72%
Lubricant	0.00%	1.73E-03	12.70%	2.39%	84.91%
Trinitrotoluene (C6H3(NO2)3)	0.00%	4.51E-06	0.01%	4.50%	95.49%

(r) = resource

Table B12: Average Air Emissions per kWh of Net Electricity Produced - NSPS Case (underground mining & average user by river)

	% of Total in this Table	% of Total in this Table except CO2	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(a) Aldehydes	0.00%	0.00%	4.55E-04	10.52%	40.92%	48.56%
(a) Ammonia (NH3)	0.00%	0.00%	2.18E-04	4.86%	42.73%	52.40%
(a) antimony	0.00%	0.00%	3.76E-06	0.00%	0.00%	100.00%
(a) arsenic	0.00%	0.00%	4.52E-05	0.00%	0.00%	100.00%
(a) barium	0.00%	0.00%	1.17E-05	0.00%	0.00%	100.00%
(a) beryllium	0.00%	0.00%	1.46E-06	0.00%	0.00%	100.00%
(a) boron	0.00%	0.09%	1.55E-02	0.00%	0.00%	100.00%
(a) cadmium	0.00%	0.00%	3.72E-06	0.00%	0.00%	100.00%
(a) total Carbon Dioxide (CO2)	98.14%		9.40E+02	0.85%	1.71%	97.45%
(a) Carbon Monoxide (CO)	0.03%	1.36%	2.42E-01	1.01%	38.38%	60.60%
(a) Chlorides (Cl-)	0.00%	0.00%	5.68E-07	0.01%	3.19%	96.80%
(a) chromium	0.00%	0.00%	5.41E-05	0.00%	0.00%	100.00%
(a) cobalt	0.00%	0.00%	6.28E-06	0.00%	0.00%	100.00%
(a) copper	0.00%	0.00%	2.14E-05	0.00%	0.00%	100.00%
(a) Fluorides (F-)	0.00%	0.00%	2.62E-07	15.88%	3.15%	80.97%
(a) non-methane Hydrocarbons (including VOCs)	0.02%	1.07%	1.90E-01	32.15%	28.36%	39.49%
(a) Hydrogen Chloride (HCl)	0.00%	0.00%	1.82E-06	0.13%	2.93%	96.94%
(a) Hydrogen Fluoride (HF)	0.00%	0.00%	1.64E-07	2.41%	4.11%	93.48%
(a) Hydrogen Sulfide (H2S)	0.00%	0.00%	1.03E-08	10.89%	2.71%	86.40%
(a) lead	0.00%	0.00%	2.74E-05	0.00%	0.00%	100.00%
(a) manganese	0.00%	0.00%	3.93E-05	0.00%	0.00%	100.00%
(a) mercury	0.00%	0.00%	3.35E-05	0.00%	0.00%	100.00%
(a) Metals (unspecified)	0.00%	0.00%	1.26E-09	8.93%	3.03%	88.03%
(a) Methane (CH4)	0.19%	10.29%	1.83E+00	99.46%	0.05%	0.50%
(a) molybdenum	0.00%	0.00%	3.48E-05	0.00%	0.00%	100.00%
(a) nickel	0.00%	0.00%	5.29E-05	0.00%	0.00%	100.00%
(a) Nitrogen Oxides (NOx as NO2)	0.24%	13.12%	2.33E+00	1.45%	7.25%	91.30%
(a) Nitrous Oxide (N2O)	0.00%	0.02%	4.41E-03	18.16%	5.10%	76.74%
(a) Organic Matter (unspecified)	0.00%	0.00%	6.97E-04	12.33%	40.12%	47.56%
(a) total Particulates (unspecified)	1.11%	59.81%	1.06E+01	8.04%	0.16%	91.80%
(a) selenium	0.00%	0.00%	3.71E-04	0.00%	0.00%	100.00%
(a) Sulfur Oxides (SOx as SO2)	0.26%	14.24%	2.53E+00	2.72%	3.43%	93.84%
(a) Tars (unspecified)	0.00%	0.00%	3.62E-07	10.66%	2.75%	86.59%
(a) vanadium	0.00%	0.00%	8.05E-05	0.00%	0.00%	100.00%

(a) = air emission

Table B13: Average Water Emissions per kWh of Net Electricity Produced - NSPS Case
(underground mining & avg user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(w) Acids (H+)	0.00%	9.24E-08	7.30%	3.30%	89.41%
(w) Ammonia (NH4+)	0.00%	0.00E+00	0.00%	0.00%	0.00%
(w) Ammonia (NH4+, NH3, as N)	0.00%	3.12E-06	81.57%	0.46%	17.97%
(w) TOTAL BOD5 (Biological Oxygen Demand)	0.04%	6.42E-05	4.69%	43.57%	51.73%
(w) Chlorides (Cl-)	0.00%	3.40E-06	2.17%	4.38%	93.45%
(w) COD (Chemical Oxygen Demand)	0.12%	1.91E-04	4.65%	43.80%	51.55%
(w) Cyanides (CN-)	0.00%	7.23E-09	12.69%	2.41%	84.90%
(w) Dissolved Matter (unspecified)	98.50%	1.56E-01	5.21%	37.98%	56.81%
(w) Fluorides (F-)	0.00%	6.65E-06	82.30%	0.44%	17.26%
(w) Inorganic Dissolved Matter (unspecified)	0.00%	5.22E-07	10.77%	2.73%	86.50%
(w) Iron (Fe++, Fe3+)	0.00%	1.09E-08	94.46%	0.10%	5.44%
(w) Metals (unspecified)	0.00%	3.18E-07	10.62%	2.76%	86.63%
(w) Nitrates (NO3-)	0.00%	1.34E-06	94.46%	0.10%	5.44%
(w) Nitric acid	0.00%	0.00E+00	0.00%	0.00%	0.00%
(w) Nitrogenous Matter (unspecified, as N)	0.00%	1.03E-08	10.89%	2.71%	86.40%
(w) Oils	1.17%	1.84E-03	5.19%	41.35%	53.45%
(w) Oils (unspecified)	0.02%	2.80E-05	0.00%	0.00%	100.00%
(w) Organic Dissolved Matter (unspecified)	0.00%	2.06E-08	10.89%	2.71%	86.40%
(w) Phenol (C6H6O)	0.00%	2.27E-08	12.61%	2.42%	84.97%
(w) Sodium (Na+)	0.00%	1.39E-06	63.02%	1.56%	35.42%
(w) Sulfates (SO4--)	0.00%	1.64E-06	69.02%	1.28%	29.69%
(w) Sulfides (S--)	0.00%	1.45E-08	12.69%	2.41%	84.90%
(w) Suspended Matter (unspecified)	0.12%	1.92E-04	7.20%	15.38%	77.42%
(w) Tars (unspecified)	0.00%	5.18E-09	10.66%	2.75%	86.59%
(w) Water: Chemically Polluted	0.02%	3.09E-05	0.01%	3.48%	96.51%

(w) = water emission

Table B14: Average Energy Requirements per kWh of Net Electricity Produced - NSPS Case
(underground mining & avg user by river)

	Total (MJ/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
Non-electric Energy Consumed by System (excluding coal energy)	0.6588	17.80%	32.16%	50.04%
Electricity Consumed by System	0.0278	97.05%	2.32%	0.63%
Total Non-coal Energy Consumed by System	0.6866	21.01%	30.96%	48.04%
Energy in Coal to Power Plant	10.8350	N/A	N/A	N/A
Total Energy Consumed by System	11.5216	1.25%	1.84%	96.90%

Note: The electricity produced and consumed by the power plant is not included in this table.
The power plant energy and electricty requirements are from upstream processes, construction, and decommissioning.

Table B15: Average Solid Waste Generation per kWh of Net Electricity Produced - NSPS Case
(underground mining & avg user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(s) antimony	0.00%	1.36E-05	0.00%	0.00%	100.00%
(s) arsenic	0.00%	1.19E-04	0.00%	0.00%	100.00%
(s) barium	0.00%	4.00E-04	0.00%	0.00%	100.00%
(s) beryllium	0.00%	1.29E-05	0.00%	0.00%	100.00%
(s) boron	0.00%	6.57E-04	0.00%	0.00%	100.00%
(s) cadmium	0.00%	8.99E-06	0.00%	0.00%	100.00%
(s) chromium	0.00%	2.03E-04	0.00%	0.00%	100.00%
(s) cobalt	0.00%	4.25E-05	0.00%	0.00%	100.00%
(s) copper	0.00%	1.05E-04	0.00%	0.00%	100.00%
(s) lead	0.00%	9.15E-05	0.00%	0.00%	100.00%
(s) manganese	0.00%	2.49E-04	0.00%	0.00%	100.00%
(s) mercury	0.00%	1.52E-07	0.00%	0.00%	100.00%
(s) molybdenum	0.00%	3.56E-05	0.00%	0.00%	100.00%
(s) nickel	0.00%	1.43E-04	0.00%	0.00%	100.00%
(s) selenium	0.00%	9.40E-06	0.00%	0.00%	100.00%
(s) vanadium	0.00%	2.90E-04	0.00%	0.00%	100.00%
ash - landfilled (dry)	20.44%	2.35E+01	0.00%	0.00%	100.00%
FGC waste (dry) - landfilled	59.95%	6.89E+01	0.00%	0.00%	100.00%
Waste (hazardous)	0.00%	3.29E-09	3.42%	3.94%	92.64%
Waste (municipal and industrial)	0.11%	1.24E-01	12.56%	2.24%	85.19%
Waste (unspecified)	19.50%	2.24E+01	14.31%	0.05%	85.65%

(s) = solid emission

Table B16: Average Resource Consumption per kWh of Net Electricity Produced - LEBS Case (surface mining & average user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(r) Bauxite (Al2O3, ore)	0.00%	2.50E-03	0.00%	3.69%	96.30%
(r) Clay (in ground)	0.00%	2.07E-08	19.99%	2.20%	77.81%
(r) Coal (in ground)	97.34%	3.53E+02	0.75%	0.01%	99.24%
(r) Iron (Fe, ore)	0.03%	9.54E-02	23.29%	1.96%	74.75%
(r) Limestone (CaCO3, in ground)	0.01%	3.96E-02	81.38%	0.48%	18.14%
(r) Natural Gas (in ground)	1.25%	4.53E+00	7.91%	0.35%	91.74%
(r) Oil (in ground)	1.34%	4.88E+00	4.94%	84.18%	10.88%
(r) Sand (in ground)	0.00%	2.24E-08	0.00%	3.69%	96.30%
(r) Sodium Chloride (NaCl, in ground or in sea)	0.00%	7.17E-05	1.56%	3.58%	94.86%
(r) Uranium (U, ore)	0.00%	3.23E-05	100.89%	0.09%	-0.98%
Aluminum Scrap	0.00%	6.13E-04	0.00%	3.69%	96.30%
Iron Scrap	0.03%	1.02E-01	23.65%	1.93%	74.42%
Lubricant	0.00%	1.73E-03	23.28%	1.94%	74.78%
Trinitrotoluene (C6H3(NO2)3)	0.00%	4.47E-06	0.00%	3.69%	96.30%

(r) = resource

Table B17: Average Air Emissions per kWh of Net Electricity Produced - LEBS Case (surface mining & average user by river)

	% of Total in this Table	% of Total in this Table except CO2	Total (g/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(a) Aldehydes	0.00%	0.01%	1.97E-04	16.50%	76.96%	6.54%
(a) Ammonia (NH3)	0.01%	2.87%	7.34E-02	99.88%	0.10%	0.01%
(a) antimony	0.00%	0.00%	3.06E-06	0.00%	0.00%	100.00%
(a) arsenic	0.00%	0.00%	3.68E-05	0.00%	0.00%	100.00%
(a) barium	0.00%	0.00%	9.50E-06	0.00%	0.00%	100.00%
(a) beryllium	0.00%	0.00%	1.19E-06	0.00%	0.00%	100.00%
(a) boron	0.00%	0.49%	1.26E-02	0.00%	0.00%	100.00%
(a) cadmium	0.00%	0.00%	3.02E-06	0.00%	0.00%	100.00%
(a) total Carbon Dioxide (CO2)	99.66%		7.41E+02	0.96%	1.76%	97.28%
(a) Carbon Monoxide (CO)	0.03%	7.47%	1.91E-01	3.58%	39.52%	56.89%
(a) Chlorides (Cl-)	0.00%	0.00%	5.64E-07	0.00%	2.61%	97.39%
(a) chromium	0.00%	0.00%	4.40E-05	0.00%	0.00%	100.00%
(a) cobalt	0.00%	0.00%	5.11E-06	0.00%	0.00%	100.00%
(a) copper	0.00%	0.00%	1.74E-05	0.00%	0.00%	100.00%
(a) Fluorides (F-)	0.00%	0.00%	2.57E-07	19.72%	2.61%	77.66%
(a) non-methane Hydrocarbons (including VOCs)	0.03%	7.48%	1.91E-01	31.53%	22.85%	45.62%
(a) Hydrogen Chloride (HCl)	0.00%	0.00%	1.81E-06	0.23%	2.40%	97.38%
(a) Hydrogen Fluoride (HF)	0.00%	0.00%	1.63E-07	4.44%	3.36%	92.19%
(a) Hydrogen Sulfide (H2S)	0.00%	0.00%	1.03E-08	19.99%	2.20%	77.81%
(a) lead	0.00%	0.00%	2.23E-05	0.00%	0.00%	100.00%
(a) manganese	0.00%	0.00%	3.19E-05	0.00%	0.00%	100.00%
(a) mercury	0.00%	0.00%	2.72E-05	0.00%	0.00%	100.00%
(a) Metals (unspecified)	0.00%	0.00%	1.26E-09	16.43%	2.47%	81.10%
(a) Methane (CH4)	0.10%	27.91%	7.14E-01	94.07%	0.10%	5.84%
(a) molybdenum	0.00%	0.00%	2.83E-05	0.00%	0.00%	100.00%
(a) nickel	0.00%	0.00%	4.30E-05	0.00%	0.00%	100.00%
(a) Nitrogen Oxides (NOx as NO2)	0.07%	21.27%	5.44E-01	6.53%	25.24%	68.23%
(a) Nitrous Oxide (N2O)	0.00%	0.05%	1.19E-03	62.34%	15.29%	22.38%
(a) Organic Matter (unspecified)	0.00%	0.07%	1.86E-03	85.13%	12.21%	2.65%
(a) total Particulates (unspecified)	0.02%	4.39%	1.12E-01	8.66%	12.24%	79.11%
(a) selenium	0.00%	0.01%	3.01E-04	0.00%	0.00%	100.00%
(a) Sulfur Oxides (SOx as SO2)	0.10%	27.97%	7.15E-01	7.41%	9.86%	82.72%
(a) Tars (unspecified)	0.00%	0.00%	3.63E-07	19.57%	2.23%	78.19%
(a) vanadium	0.00%	0.00%	6.54E-05	0.00%	0.00%	100.00%

(a) = air emission

Table B18: Average Water Emissions per kWh of Net Electricity Produced - LEBS Case
(surface mining & average user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(w) Acids (H+)	0.03%	2.31E-05	82.11%	0.01%	17.88%
(w) Ammonia (NH4+)	22.72%	1.74E-02	100.00%	0.00%	0.00%
(w) Ammonia (NH4+, NH3, as N)	0.01%	5.51E-06	43.53%	0.21%	56.26%
(w) TOTAL BOD5 (Biological Oxygen Demand)	0.66%	5.07E-04	78.36%	4.49%	17.15%
(w) Chlorides (Cl-)	0.00%	3.36E-06	2.17%	3.61%	94.23%
(w) COD (Chemical Oxygen Demand)	1.98%	1.52E-03	78.41%	4.48%	17.11%
(w) Cyanides (CN-)	0.00%	7.22E-09	23.29%	1.96%	74.75%
(w) Dissolved Matter (unspecified)	71.46%	5.48E-02	3.87%	87.68%	8.45%
(w) Fluorides (F-)	0.01%	5.87E-06	87.81%	0.41%	11.78%
(w) Inorganic Dissolved Matter (unspecified)	0.00%	5.22E-07	19.78%	2.22%	78.01%
(w) Iron (Fe++, Fe3+)	0.00%	9.43E-09	100.89%	0.09%	-0.98%
(w) Metals (unspecified)	0.00%	3.18E-07	19.50%	2.24%	78.26%
(w) Nitrates (NO3-)	0.00%	1.15E-06	100.89%	0.09%	-0.98%
(w) Nitric acid	1.26%	9.68E-04	100.00%	0.00%	0.00%
(w) Nitrogenous Matter (unspecified, as N)	0.00%	1.03E-08	19.99%	2.20%	77.81%
(w) Oils	1.26%	9.63E-04	6.63%	64.29%	29.07%
(w) Oils (unspecified)	0.00%	0.00E+00	0.00%	0.00%	0.00%
(w) Organic Dissolved Matter (unspecified)	0.00%	2.07E-08	19.99%	2.20%	77.81%
(w) Phenol (C6H6O)	0.00%	2.27E-08	23.14%	1.97%	74.89%
(w) Sodium (Na+)	0.00%	1.26E-06	64.10%	1.41%	34.50%
(w) Sulfates (SO4--)	0.00%	1.47E-06	70.85%	1.17%	27.98%
(w) Sulfides (S--)	0.00%	1.44E-08	23.29%	1.96%	74.75%
(w) Suspended Matter (unspecified)	0.56%	4.33E-04	9.47%	5.56%	84.98%
(w) Tars (unspecified)	0.00%	5.18E-09	19.57%	2.23%	78.19%
(w) Water: Chemically Polluted	0.04%	3.07E-05	0.00%	2.85%	97.15%

(w) = water emission

Table B19: Average Energy Requirements per kWh of Net Electricity Produced - LEBS Case
(surface mining & average user by river)

	Total (MJ/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
Non-electric Energy Consumed by System (excluding coal energy)	0.5109	21.35%	33.71%	44.94%
Electricity Consumed by System	0.0250	99.23%	2.09%	-1.32%
Total Non-coal Energy Consumed by System	0.5359	24.98%	32.24%	42.78%
Energy in Coal to Power Plant	8.8075	N/A	N/A	N/A
Total Energy Consumed by System	9.3434	1.43%	1.85%	96.72%

Note: The electricity produced and consumed by the power plant is not included in this table.
The power plant energy and electricty requirements are from upstream processes, construction, and decommissioning.

Table B20: Average Solid Waste Generation per kWh of Net Electricity Produced - LEBS Case
(surface mining & average user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Surface Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(s) antimony	0.00%	1.11E-05	0.00%	0.00%	100.00%
(s) arsenic	0.00%	9.68E-05	0.00%	0.00%	100.00%
(s) barium	0.00%	3.25E-04	0.00%	0.00%	100.00%
(s) beryllium	0.00%	1.05E-05	0.00%	0.00%	100.00%
(s) boron	0.00%	5.34E-04	0.00%	0.00%	100.00%
(s) cadmium	0.00%	7.31E-06	0.00%	0.00%	100.00%
(s) chromium	0.00%	1.65E-04	0.00%	0.00%	100.00%
(s) cobalt	0.00%	3.46E-05	0.00%	0.00%	100.00%
(s) copper	0.00%	8.50E-05	0.00%	0.00%	100.00%
(s) lead	0.00%	7.43E-05	0.00%	0.00%	100.00%
(s) manganese	0.00%	2.03E-04	0.00%	0.00%	100.00%
(s) mercury	0.00%	1.23E-07	0.00%	0.00%	100.00%
(s) molybdenum	0.00%	2.89E-05	0.00%	0.00%	100.00%
(s) nickel	0.00%	1.16E-04	0.00%	0.00%	100.00%
(s) selenium	0.00%	7.64E-06	0.00%	0.00%	100.00%
(s) vanadium	0.00%	2.36E-04	0.00%	0.00%	100.00%
ash - landfilled (dry)	92.57%	1.91E+01	0.00%	0.00%	100.00%
FGC waste (dry) - landfilled	0.00%	0.00E+00	0.00%	0.00%	0.00%
Waste (hazardous)	0.00%	3.27E-09	6.31%	3.22%	90.47%
Waste (municipal and industrial)	0.56%	1.16E-01	23.50%	1.95%	74.55%
Waste (unspecified)	6.86%	1.42E+00	96.48%	0.58%	2.94%

(s) = solid emission

Table B21: Average Resource Consumption per kWh of Net Electricity Produced - LEBS Case (underground mining & average user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(r) Bauxite (Al2O3, ore)	0.00%	2.50E-03	0.01%	3.69%	96.30%
(r) Clay (in ground)	0.00%	1.84E-08	9.95%	2.48%	87.57%
(r) Coal (in ground)	95.36%	3.53E+02	0.67%	0.01%	99.33%
(r) Iron (Fe, ore)	0.02%	8.30E-02	11.86%	2.25%	85.89%
(r) Limestone (CaCO3, in ground)	2.07%	7.67E+00	99.90%	0.00%	0.09%
(r) Natural Gas (in ground)	1.14%	4.24E+00	1.47%	0.38%	98.16%
(r) Oil (in ground)	1.38%	5.11E+00	9.38%	80.25%	10.37%
(r) Sand (in ground)	0.00%	2.24E-08	0.01%	3.69%	96.30%
(r) Sodium Chloride (NaCl, in ground or in sea)	0.00%	7.10E-05	0.70%	3.61%	95.69%
(r) Uranium (U, ore)	0.00%	2.85E-05	101.01%	0.11%	-1.11%
Aluminum Scrap	0.00%	6.13E-04	0.01%	3.69%	96.30%
Iron Scrap	0.02%	8.83E-02	12.04%	2.22%	85.73%
Lubricant	0.00%	1.51E-03	11.83%	2.23%	85.94%
Trinitrotoluene (C6H3(NO2)3)	0.00%	4.47E-06	0.01%	3.69%	96.30%

(r) = resource

Table B22: Average Air Emissions per kWh of Net Electricity Produced - LEBS Case (underground mining & average user by river)

	% of Total in this Table	% of Total in this Table except CO2	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(a) Aldehydes	0.00%	0.01%	2.03E-04	19.15%	74.52%	6.33%
(a) Ammonia (NH3)	0.00%	0.00%	9.52E-05	9.06%	79.68%	11.27%
(a) antimony	0.00%	0.00%	3.06E-06	0.00%	0.00%	100.00%
(a) arsenic	0.00%	0.00%	3.68E-05	0.00%	0.00%	100.00%
(a) barium	0.00%	0.00%	9.50E-06	0.00%	0.00%	100.00%
(a) beryllium	0.00%	0.00%	1.19E-06	0.00%	0.00%	100.00%
(a) boron	0.00%	0.32%	1.26E-02	0.00%	0.00%	100.00%
(a) cadmium	0.00%	0.00%	3.02E-06	0.00%	0.00%	100.00%
(a) total Carbon Dioxide (CO2)	99.47%		7.41E+02	0.87%	1.76%	97.37%
(a) Carbon Monoxide (CO)	0.02%	4.71%	1.86E-01	1.07%	40.55%	58.38%
(a) Chlorides (Cl-)	0.00%	0.00%	5.64E-07	0.01%	2.61%	97.38%
(a) chromium	0.00%	0.00%	4.40E-05	0.00%	0.00%	100.00%
(a) cobalt	0.00%	0.00%	5.11E-06	0.00%	0.00%	100.00%
(a) copper	0.00%	0.00%	1.74E-05	0.00%	0.00%	100.00%
(a) Fluorides (F-)	0.00%	0.00%	2.40E-07	14.08%	2.80%	83.12%
(a) non-methane Hydrocarbons (including VOCs)	0.02%	4.57%	1.80E-01	27.45%	24.21%	48.34%
(a) Hydrogen Chloride (HCl)	0.00%	0.00%	1.81E-06	0.11%	2.40%	97.50%
(a) Hydrogen Fluoride (HF)	0.00%	0.00%	1.59E-07	2.02%	3.45%	94.53%
(a) Hydrogen Sulfide (H2S)	0.00%	0.00%	9.18E-09	9.95%	2.48%	87.57%
(a) lead	0.00%	0.00%	2.23E-05	0.00%	0.00%	100.00%
(a) manganese	0.00%	0.00%	3.19E-05	0.00%	0.00%	100.00%
(a) mercury	0.00%	0.00%	2.72E-05	0.00%	0.00%	100.00%
(a) Metals (unspecified)	0.00%	0.00%	1.14E-09	8.00%	2.72%	89.28%
(a) Methane (CH4)	0.20%	38.47%	1.52E+00	97.21%	0.05%	2.74%
(a) molybdenum	0.00%	0.00%	2.83E-05	0.00%	0.00%	100.00%
(a) nickel	0.00%	0.00%	4.30E-05	0.00%	0.00%	100.00%
(a) Nitrogen Oxides (NOx as NO2)	0.07%	13.56%	5.36E-01	5.12%	25.62%	69.26%
(a) Nitrous Oxide (N2O)	0.00%	0.03%	1.10E-03	59.12%	16.59%	24.29%
(a) Organic Matter (unspecified)	0.00%	0.01%	3.46E-04	20.16%	65.59%	14.25%
(a) total Particulates (unspecified)	0.11%	20.16%	7.97E-01	87.12%	1.73%	11.16%
(a) selenium	0.00%	0.01%	3.01E-04	0.00%	0.00%	100.00%
(a) Sulfur Oxides (SOx as SO2)	0.10%	18.17%	7.18E-01	7.79%	9.82%	82.38%
(a) Tars (unspecified)	0.00%	0.00%	3.23E-07	9.71%	2.51%	87.78%
(a) vanadium	0.00%	0.00%	6.54E-05	0.00%	0.00%	100.00%

(a) = air emission

Table B23: Average Water Emissions per kWh of Net Electricity Produced - LEBS Case
(underground mining & avg user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(w) Acids (H+)	0.01%	4.15E-06	0.13%	0.06%	99.81%
(w) Ammonia (NH4+)	0.00%	0.00E+00	0.00%	0.00%	0.00%
(w) Ammonia (NH4+, NH3, as N)	0.01%	5.18E-06	39.93%	0.23%	59.84%
(w) TOTAL BOD5 (Biological Oxygen Demand)	0.18%	1.12E-04	2.19%	20.28%	77.54%
(w) Chlorides (Cl-)	0.01%	3.35E-06	1.79%	3.62%	94.59%
(w) COD (Chemical Oxygen Demand)	0.55%	3.36E-04	2.15%	20.29%	77.56%
(w) Cyanides (CN-)	0.00%	6.29E-09	11.86%	2.25%	85.89%
(w) Dissolved Matter (unspecified)	96.93%	5.93E-02	11.11%	81.07%	7.81%
(w) Fluorides (F-)	0.01%	5.16E-06	86.15%	0.46%	13.39%
(w) Inorganic Dissolved Matter (unspecified)	0.00%	4.65E-07	9.83%	2.49%	87.68%
(w) Iron (Fe++, Fe3+)	0.00%	8.32E-09	101.01%	0.11%	-1.11%
(w) Metals (unspecified)	0.00%	2.83E-07	9.67%	2.51%	87.81%
(w) Nitrates (NO3-)	0.00%	1.02E-06	101.01%	0.11%	-1.11%
(w) Nitric acid	0.00%	0.00E+00	0.00%	0.00%	0.00%
(w) Nitrogenous Matter (unspecified, as N)	0.00%	9.18E-09	9.95%	2.48%	87.57%
(w) Oils	1.60%	9.77E-04	7.96%	63.38%	28.66%
(w) Oils (unspecified)	0.00%	0.00E+00	0.00%	0.00%	0.00%
(w) Organic Dissolved Matter (unspecified)	0.00%	1.84E-08	9.95%	2.48%	87.57%
(w) Phenol (C6H6O)	0.00%	1.98E-08	11.77%	2.26%	85.97%
(w) Sodium (Na+)	0.00%	1.17E-06	61.20%	1.52%	37.28%
(w) Sulfates (SO4--)	0.00%	1.35E-06	68.23%	1.27%	30.50%
(w) Sulfides (S--)	0.00%	1.26E-08	11.86%	2.25%	85.89%
(w) Suspended Matter (unspecified)	0.66%	4.03E-04	2.79%	5.97%	91.24%
(w) Tars (unspecified)	0.00%	4.62E-09	9.71%	2.51%	87.78%
(w) Water: Chemically Polluted	0.05%	3.07E-05	0.01%	2.85%	97.15%

(w) = water emission

Table B24: Average Energy Requirements per kWh of Net Electricity Produced - LEBS Case
(underground mining & avg user by river)

	Total (MJ/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
Non-electric Energy Consumed by System (excluding coal energy)	0.4971	19.17%	34.65%	46.18%
Electricity Consumed by System	0.0221	99.13%	2.36%	-1.50%
Total Non-coal Energy Consumed by System	0.5193	22.58%	33.27%	44.15%
Energy in Coal to Power Plant	8.8075	N/A	N/A	N/A
Total Energy Consumed by System	9.3268	1.26%	1.85%	96.89%

Note: The electricity produced and consumed by the power plant is not included in this table.
The power plant energy and electricty requirements are from upstream processes, construction, and decommissioning.

Table B25: Average Solid Waste Generation per kWh of Net Electricity Produced - LEBS Case
(underground mining & avg user by river)

	% of Total in this Table	Total (g/kWh)	% of Total from Underground Coal Mining	% of Total from Transportation	% of Total from Electricity Generation
(s) antimony	0.00%	1.11E-05	0.00%	0.00%	100.00%
(s) arsenic	0.00%	9.68E-05	0.00%	0.00%	100.00%
(s) barium	0.00%	3.25E-04	0.00%	0.00%	100.00%
(s) beryllium	0.00%	1.05E-05	0.00%	0.00%	100.00%
(s) boron	0.00%	5.34E-04	0.00%	0.00%	100.00%
(s) cadmium	0.00%	7.31E-06	0.00%	0.00%	100.00%
(s) chromium	0.00%	1.65E-04	0.00%	0.00%	100.00%
(s) cobalt	0.00%	3.46E-05	0.00%	0.00%	100.00%
(s) copper	0.00%	8.50E-05	0.00%	0.00%	100.00%
(s) lead	0.00%	7.43E-05	0.00%	0.00%	100.00%
(s) manganese	0.00%	2.03E-04	0.00%	0.00%	100.00%
(s) mercury	0.00%	1.23E-07	0.00%	0.00%	100.00%
(s) molybdenum	0.00%	2.89E-05	0.00%	0.00%	100.00%
(s) nickel	0.00%	1.16E-04	0.00%	0.00%	100.00%
(s) selenium	0.00%	7.64E-06	0.00%	0.00%	100.00%
(s) vanadium	0.00%	2.36E-04	0.00%	0.00%	100.00%
ash - landfilled (dry)	87.39%	1.91E+01	0.00%	0.00%	100.00%
FGC waste (dry) - landfilled	0.00%	0.00E+00	0.00%	0.00%	0.00%
Waste (hazardous)	0.00%	3.16E-09	2.90%	3.34%	93.76%
Waste (municipal and industrial)	0.46%	1.01E-01	12.47%	2.23%	85.31%
Waste (unspecified)	12.13%	2.66E+00	98.12%	0.31%	1.57%

(s) = solid emission

Table B26: Sensitivity Analysis Condensed Results - Average System (underground mining)
% change from the base case on a per unit of energy produced (i.e., MWh) basis

	A	B	C	D	E	F	G	H	I	J
	underground	underground	underground	underground	underground	underground	underground	underground	underground	underground
(r) Coal (in ground) (including losses)	-13.51%	18.52%	0.00%	-0.05%	0.00%	-0.01%	0.00%	0.03%	0.08%	-0.10%
(r) Limestone (CaCO3, in ground)	-13.51%	18.52%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
(r) Natural Gas (in ground)	-13.51%	18.52%	-0.05%	-0.90%	0.00%	-2.51%	0.05%	8.29%	1.06%	-1.46%
(r) Oil (in ground)	-13.51%	18.52%	-0.91%	-2.61%	0.00%	-46.57%	1.17%	154.76%	0.16%	-0.08%
(a) total Carbon Dioxide (CO2)	-13.51%	18.52%	-0.04%	-0.42%	0.00%	-1.71%	0.04%	5.68%	0.47%	-0.64%
(a) Carbon Monoxide (CO)	-13.51%	18.52%	-0.75%	-3.15%	0.00%	-38.84%	1.60%	130.75%	1.12%	-1.43%
(a) total Hydrocarbons (except CH4, including VOCs)	-13.51%	18.52%	-0.79%	-3.89%	0.00%	-29.55%	0.91%	98.59%	3.68%	-4.96%
(a) Methane (CH4)	-13.51%	18.52%	0.00%	0.00%	117.34%	-0.05%	0.00%	0.15%	0.00%	0.00%
(a) Nitrogen Oxides (NOx as NO2)	-13.51%	18.52%	-0.15%	-0.59%	0.00%	-5.50%	0.24%	18.58%	0.47%	-0.63%
(a) total Particlulates (unspecified)	-13.51%	18.52%	0.00%	-0.11%	0.00%	-0.18%	0.01%	0.62%	0.01%	-0.02%
(a) Sulfur Oxides (SOx as SO2)	-13.51%	18.52%	-0.01%	-0.20%	0.00%	-1.41%	0.05%	4.73%	0.26%	-0.35%
Electricity	-13.51%	18.52%	-0.05%	-2.88%	0.00%	-2.32%	-0.02%	7.42%	11.22%	-15.48%
total Non-Coal Energy	-13.51%	18.52%	-0.66%	-2.99%	0.00%	-32.96%	1.80%	112.53%	2.23%	-2.98%
ash - landfilled (dry)	-13.51%	18.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	38.89%	0.00%
ash - total (dry)	-13.51%	18.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FGC waste (dry) - landfilled	-13.51%	18.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FGD waste (dry) - total	-13.51%	18.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	-13.51%	18.52%	-0.06%	-38.08%	0.00%	-4.16%	-3.41%	0.00%	0.01%	0.00%
Waste (municipal and industrial)	-13.51%	18.52%	-0.21%	-66.67%	0.00%	-2.01%	-1.66%	0.00%	0.02%	0.00%
Waste (unspecified)	-13.51%	18.52%	0.00%	-0.58%	0.00%	-0.05%	-0.01%	0.12%	0.85%	-1.17%
Waste (total)	-13.51%	18.52%	0.00%	-0.19%	0.00%	-0.01%	0.00%	0.02%	9.08%	-0.23%

	K	L	M	N	O	P	Q	R	S	T
	underground	underground	underground	underground	underground	underground	underground	underground	underground	underground
(r) Coal (in ground) (including losses)	-0.06%	-0.25%	-0.01%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
(r) Limestone (CaCO3, in ground)	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
(r) Natural Gas (in ground)	-0.83%	-3.44%	-0.28%	0.05%	-0.05%	0.12%	0.01%	0.00%	-0.01%	-0.01%
(r) Oil (in ground)	-0.13%	-0.28%	-0.81%	0.01%	-0.01%	0.00%	0.21%	0.00%	-0.22%	-0.22%
(a) total Carbon Dioxide (CO2)	-0.37%	-1.52%	-0.13%	0.00%	0.00%	0.01%	0.01%	-0.03%	-0.01%	-0.08%
(a) Carbon Monoxide (CO)	-0.88%	-3.44%	-0.97%	0.02%	-0.02%	0.00%	0.21%	-0.47%	-0.22%	-1.18%
(a) total Hydrocarbons (except CH4, including VOCs)	-2.89%	-11.75%	-1.21%	0.13%	-0.13%	0.33%	0.21%	-0.27%	-0.21%	-0.76%
(a) Methane (CH4)	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.01%	0.00%	-0.01%
(a) Nitrogen Oxides (NOx as NO2)	-0.37%	-1.49%	-0.18%	0.00%	0.00%	0.00%	0.04%	-0.02%	-0.04%	-0.08%
(a) total Particlulates (unspecified)	-0.01%	-0.04%	-0.04%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	-0.01%
(a) Sulfur Oxides (SOx as SO2)	-0.20%	-0.84%	-0.06%	0.00%	0.00%	0.00%	0.00%	-0.01%	0.00%	-0.03%
Electricity	-8.81%	-36.45%	-0.91%	0.25%	-0.25%	-0.10%	0.01%	0.00%	-0.01%	-0.01%
total Non-Coal Energy	-1.75%	-7.08%	-0.93%	0.07%	-0.07%	0.12%	0.16%	0.00%	-0.16%	-0.16%
ash - landfilled (dry)	-30.56%	-30.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ash - total (dry)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FGC waste (dry) - landfilled	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	32.80%	0.00%	-33.60%	-33.60%
FGD waste (dry) - total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	-0.01%	-0.01%	-26.30%	1.73%	-1.73%	37.51%	0.01%	0.00%	-0.01%	-0.01%
Waste (municipal and industrial)	-0.02%	-0.02%	-20.44%	6.06%	-6.06%	93.06%	0.05%	0.00%	-0.05%	-0.05%
Waste (unspecified)	-0.67%	-2.76%	-0.18%	0.03%	-0.03%	0.08%	0.00%	0.00%	0.00%	0.00%
Waste (total)	-7.13%	-7.54%	-0.06%	0.01%	-0.01%	0.12%	18.94%	0.00%	-19.40%	-19.40%

SENSITIVITY CASE	CASE LETTER
Increase plant efficiency by 5 points	A
Decrease plant efficiency by 5 points	B
Pond versus landfilling of ash from power plant	C
Construction materials low case	D
Mining methane emissions using EIA average U.S. numbers	E
Mine mouth	F
Average user by land	G
Farthest user	H
No ash recovery - 100% of plant ash is landfilled	I
100% of recovered ash is used in cement	J

SENSITIVITY CASE	CASE LETTER
50% of plant ash is recovered & percent used in cement remains constant @ 42%	K
50% of plant ash is recovered & 100% of this is used in cement	L
Plant operating capacity factor = 85%	M
Increase mining equipment materials by 50%	N
Decrease mining equipment materials by 50%	O
Decrease in recycle of materials by 1/3	P
No FGC recovery - 100% is landfilled	Q
100% of recovered FGC is used in asphalt	R
50% of plant FCG is recovered & percent used in asphalt remains constant @ 7.2%	S
50% of plant FCG is recovered & 100% of this is used in asphalt	T

Table B27: Sensitivity Analysis Condensed Results - NSPS System (surface mining)
% change from the base case on a per unit of energy produced (i.e., MWh) basis

	A	B	C	D	E	F	G	H	I	J
	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
(r) Coal (in ground) (including losses)	-12.50%	16.67%	0.00%	-0.05%	0.00%	-0.01%	0.00%	0.03%	0.08%	-0.10%
(r) Limestone (CaCO3, in ground)	-12.50%	16.67%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
(r) Natural Gas (in ground)	-12.50%	16.67%	-0.03%	-0.61%	0.00%	-1.56%	0.03%	5.14%	0.66%	-0.90%
(r) Oil (in ground)	-12.50%	16.67%	-0.97%	-2.72%	0.00%	-44.39%	1.11%	147.53%	0.15%	-0.08%
(a) total Carbon Dioxide (CO2)	-12.50%	16.67%	-0.04%	-0.46%	0.00%	-1.70%	0.04%	5.63%	0.47%	-0.64%
(a) Carbon Monoxide (CO)	-12.50%	16.67%	-0.81%	-3.31%	0.00%	-37.34%	1.53%	125.70%	1.08%	-1.38%
(a) total Hydrocarbons (except CH4, including VOCs)	-12.50%	16.67%	-0.79%	-3.80%	0.00%	-26.40%	0.82%	88.08%	3.29%	-4.43%
(a) Methane (CH4)	-12.50%	16.67%	-0.01%	-0.01%	-55.01%	-0.10%	0.00%	0.33%	0.01%	-0.01%
(a) Nitrogen Oxides (NOx as NO2)	-12.50%	16.67%	-0.22%	-0.85%	0.00%	-7.18%	0.31%	24.26%	0.61%	-0.82%
(a) total Particlulates (unspecified)	-12.50%	16.67%	0.00%	-0.12%	0.00%	-0.17%	0.01%	0.58%	0.01%	-0.02%
(a) Sulfur Oxides (SOx as SO2)	-12.50%	16.67%	-0.03%	-0.54%	0.00%	-3.43%	0.13%	11.49%	0.63%	-0.86%
Electricity	-12.50%	16.67%	-0.05%	-2.75%	0.00%	-2.03%	-0.02%	6.48%	9.79%	-13.52%
total Non-Coal Energy	-12.50%	16.67%	-0.67%	-2.96%	0.00%	-29.90%	1.63%	102.07%	2.03%	-2.71%
ash - landfilled (dry)	-12.50%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	38.89%	0.00%
ash - total (dry)	-12.50%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FGC waste (dry) - landfilled	-12.50%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FGD waste (dry) - total	-12.50%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	-12.50%	16.67%	-0.06%	-36.66%	0.00%	-3.67%	-3.01%	0.00%	0.01%	0.00%
Waste (municipal and industrial)	-12.50%	16.67%	-0.18%	-58.46%	0.00%	-1.61%	-1.33%	0.00%	0.02%	0.00%
Waste (unspecified)	-12.50%	16.67%	0.00%	-0.60%	0.00%	-0.05%	-0.01%	0.11%	0.80%	-1.11%
Waste (total)	-12.50%	16.67%	0.00%	-0.18%	0.00%	-0.01%	0.00%	0.02%	8.20%	-0.20%

	K	L	N	O	P	Q	R	S	T	U
	surface	surface	surface	surface	surface	surface	surface	surface	surface	surface
(r) Coal (in ground) (including losses)	-0.06%	-0.25%	-0.02%	0.01%	-0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
(r) Limestone (CaCO3, in ground)	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
(r) Natural Gas (in ground)	-0.52%	-2.13%	-0.19%	0.07%	-0.07%	0.09%	0.01%	0.00%	-0.01%	-0.01%
(r) Oil (in ground)	-0.12%	-0.27%	-0.85%	0.03%	-0.03%	0.01%	0.24%	0.00%	-0.24%	-0.24%
(a) total Carbon Dioxide (CO2)	-0.37%	-1.51%	-0.14%	0.01%	-0.01%	0.01%	0.01%	-0.04%	-0.01%	-0.09%
(a) Carbon Monoxide (CO)	-0.85%	-3.31%	-1.02%	0.04%	-0.04%	0.00%	0.24%	-0.53%	-0.24%	-1.32%
(a) total Hydrocarbons (except CH4, including VOCs)	-2.58%	-10.50%	-1.18%	0.29%	-0.29%	0.37%	0.21%	-0.28%	-0.22%	-0.79%
(a) Methane (CH4)	-0.01%	-0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.02%	0.00%	-0.04%
(a) Nitrogen Oxides (NOx as NO2)	-0.48%	-1.94%	-0.26%	0.01%	-0.01%	0.00%	0.06%	-0.03%	-0.06%	-0.13%
(a) total Particlulates (unspecified)	-0.01%	-0.04%	-0.04%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	-0.01%
(a) Sulfur Oxides (SOx as SO2)	-0.49%	-2.03%	-0.17%	0.02%	-0.02%	0.00%	0.01%	-0.03%	-0.01%	-0.07%
Electricity	-7.70%	-31.83%	-0.87%	0.52%	-0.52%	-0.12%	0.01%	0.00%	-0.01%	-0.01%
total Non-Coal Energy	-1.59%	-6.42%	-0.92%	0.16%	-0.16%	0.13%	0.16%	0.00%	-0.17%	-0.17%
ash - landfilled (dry)	-30.56%	-30.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ash - total (dry)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FGC waste (dry) - landfilled	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	32.80%	0.00%	-33.60%	-33.60%
FGD waste (dry) - total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	0.00%	0.00%	-25.35%	3.65%	-3.65%	35.60%	0.01%	0.00%	-0.01%	-0.01%
Waste (municipal and industrial)	-0.01%	-0.01%	-17.92%	11.66%	-11.66%	94.06%	0.05%	0.00%	-0.05%	-0.05%
Waste (unspecified)	-0.63%	-2.60%	-0.19%	0.08%	-0.08%	0.09%	0.00%	0.00%	0.00%	0.00%
Waste (total)	-6.44%	-6.81%	-0.06%	0.03%	-0.03%	0.13%	19.93%	0.00%	-20.41%	-20.41%

SENSITIVITY CASE	CASE LETTER
Increase plant efficiency by 5 points	A
Decrease plant efficiency by 5 points	B
Pond versus landfilling of ash from power plant	C
Construction materials low case	D
Mining methane emissions using EIA average U.S. numbers	E
Mine mouth	F
Average user by land	G
Farthest user	H
No ash recovery - 100% of plant ash is landfilled	I
100% of recovered ash is used in cement	J

SENSITIVITY CASE	CASE LETTER
50% of plant ash is recovered & percent used in cement remains constant @ 42%	K
50% of plant ash is recovered & 100% of this is used in cement	L
Plant operating capacity factor = 85%	M
Increase mining equipment materials by 50%	N
Decrease mining equipment materials by 50%	O
Decrease in recycle of materials by 1/3	P
No FGC recovery - 100% is landfilled	Q
100% of recovered FGC is used in asphalt	R
50% of plant FCG is recovered & percent used in asphalt remains constant @ 7.2%	S
50% of plant FCG is recovered & 100% of this is used in asphalt	T

Table B28: Sensitivity Analysis Condensed Results - NSPS System (underground mining)
% change from the base case on a per unit of energy produced (i.e., MWh) basis

	A	B	C	D	E	F	G	H	I	J
	underground	underground	underground	underground	underground	underground	underground	underground	underground	underground
(r) Coal (in ground) (including losses)	-12.50%	16.67%	0.00%	-0.05%	0.00%	-0.01%	0.00%	0.03%	0.08%	-0.10%
(r) Limestone (CaCO3, in ground)	-12.50%	16.67%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
(r) Natural Gas (in ground)	-12.50%	16.67%	-0.05%	-0.86%	0.00%	-2.19%	0.04%	7.24%	0.93%	-1.27%
(r) Oil (in ground)	-12.50%	16.67%	-0.94%	-2.65%	0.00%	-43.27%	1.08%	143.79%	0.15%	-0.08%
(a) total Carbon Dioxide (CO2)	-12.50%	16.67%	-0.04%	-0.46%	0.00%	-1.70%	0.04%	5.64%	0.47%	-0.64%
(a) Carbon Monoxide (CO)	-12.50%	16.67%	-0.83%	-3.39%	0.00%	-38.26%	1.57%	128.80%	1.10%	-1.41%
(a) total Hydrocarbons (except CH4, including VOCs)	-12.50%	16.67%	-0.84%	-4.06%	0.00%	-28.24%	0.87%	94.23%	3.52%	-4.74%
(a) Methane (CH4)	-12.50%	16.67%	0.00%	-0.01%	117.25%	-0.05%	0.00%	0.15%	0.00%	0.00%
(a) Nitrogen Oxides (NOx as NO2)	-12.50%	16.67%	-0.22%	-0.85%	0.00%	-7.21%	0.31%	24.36%	0.62%	-0.82%
(a) total Particlulates (unspecified)	-12.50%	16.67%	0.00%	-0.11%	0.00%	-0.16%	0.01%	0.54%	0.01%	-0.01%
(a) Sulfur Oxides (SOx as SO2)	-12.50%	16.67%	-0.03%	-0.54%	0.00%	-3.43%	0.13%	11.48%	0.63%	-0.86%
Electricity	-12.50%	16.67%	-0.06%	-3.10%	0.00%	-2.29%	-0.02%	7.31%	11.05%	-15.25%
total Non-Coal Energy	-12.50%	16.67%	-0.69%	-3.05%	0.00%	-30.79%	1.68%	105.12%	2.09%	-2.79%
ash - landfilled (dry)	-12.50%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	38.89%	0.00%
ash - total (dry)	-12.50%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FGC waste (dry) - landfilled	-12.50%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FGD waste (dry) - total	-12.50%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	-12.50%	16.67%	-0.06%	-38.24%	0.00%	-3.83%	-3.14%	0.00%	0.01%	0.00%
Waste (municipal and industrial)	-12.50%	16.67%	-0.21%	-66.96%	0.00%	-1.85%	-1.52%	0.00%	0.02%	0.00%
Waste (unspecified)	-12.50%	16.67%	0.00%	-0.56%	0.00%	-0.04%	-0.01%	0.11%	0.75%	-1.03%
Waste (total)	-12.50%	16.67%	0.00%	-0.18%	0.00%	-0.01%	0.00%	0.02%	8.09%	-0.20%

	K	L	M	N	O	P	Q	R	S	T
	underground	underground	underground	underground	underground	underground	underground	underground	underground	underground
(r) Coal (in ground) (including losses)	-0.06%	-0.25%	-0.02%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
(r) Limestone (CaCO3, in ground)	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
(r) Natural Gas (in ground)	-0.73%	-3.00%	-0.27%	0.04%	-0.04%	0.12%	0.01%	0.00%	-0.01%	-0.01%
(r) Oil (in ground)	-0.12%	-0.26%	-0.82%	0.01%	-0.01%	0.00%	0.23%	0.00%	-0.24%	-0.24%
(a) total Carbon Dioxide (CO2)	-0.37%	-1.51%	-0.14%	0.00%	0.00%	0.01%	0.01%	-0.04%	-0.01%	-0.09%
(a) Carbon Monoxide (CO)	-0.87%	-3.39%	-1.05%	0.02%	-0.02%	0.00%	0.24%	-0.54%	-0.25%	-1.35%
(a) total Hydrocarbons (except CH4, including VOCs)	-2.76%	-11.23%	-1.26%	0.13%	-0.13%	0.34%	0.23%	-0.30%	-0.23%	-0.85%
(a) Methane (CH4)	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.01%	0.00%	-0.02%
(a) Nitrogen Oxides (NOx as NO2)	-0.48%	-1.95%	-0.26%	0.00%	0.00%	0.00%	0.06%	-0.03%	-0.06%	-0.13%
(a) total Particlulates (unspecified)	-0.01%	-0.03%	-0.03%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	-0.01%
(a) Sulfur Oxides (SOx as SO2)	-0.49%	-2.03%	-0.17%	0.01%	-0.01%	0.00%	0.01%	-0.03%	-0.01%	-0.07%
Electricity	-8.68%	-35.92%	-0.98%	0.24%	-0.25%	-0.11%	0.01%	0.00%	-0.01%	-0.01%
total Non-Coal Energy	-1.64%	-6.61%	-0.95%	0.07%	-0.07%	0.12%	0.17%	0.00%	-0.17%	-0.17%
ash - landfilled (dry)	-30.56%	-30.56%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ash - total (dry)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FGC waste (dry) - landfilled	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	32.80%	0.00%	-33.60%	-33.60%
FGD waste (dry) - total	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	0.00%	0.00%	-26.44%	1.59%	-1.59%	37.70%	0.01%	0.00%	-0.02%	-0.02%
Waste (municipal and industrial)	-0.02%	-0.02%	-20.53%	5.57%	-5.57%	92.73%	0.05%	0.00%	-0.05%	-0.05%
Waste (unspecified)	-0.59%	-2.43%	-0.17%	0.03%	-0.03%	0.07%	0.00%	0.00%	0.00%	0.00%
Waste (total)	-6.36%	-6.72%	-0.06%	0.01%	-0.01%	0.11%	19.67%	0.00%	-20.14%	-20.14%

SENSITIVITY CASE	CASE LETTER
Increase plant efficiency by 5 points	A
Decrease plant efficiency by 5 points	B
Pond versus landfilling of ash from power plant	C
Construction materials low case	D
Mining methane emissions using EIA average U.S. numbers	E
Mine mouth	F
Average user by land	G
Farthest user	H
No ash recovery - 100% of plant ash is landfilled	I
100% of recovered ash is used in cement	J

SENSITIVITY CASE	CASE LETTER
50% of plant ash is recovered & percent used in cement remains constant @ 42%	K
50% of plant ash is recovered & 100% of this is used in cement	L
Plant operating capacity factor = 85%	M
Increase mining equipment materials by 50%	N
Decrease mining equipment materials by 50%	O
Decrease in recycle of materials by 1/3	P
No FGC recovery - 100% is landfilled	Q
100% of recovered FGC is used in asphalt	R
50% of plant FCG is recovered & percent used in asphalt remains constant @ 7.2%	S
50% of plant FCG is recovered & 100% of this is used in asphalt	T

Table B29: Sensitivity Analysis Condensed Results - LEBS System (surface mining)
% change from the base case on a per unit of energy produced (i.e., MWh) basis

	A	B	C	D	E	F	G	H
	surface	surface	surface	surface	surface	surface	surface	surface
(r) Coal (in ground) (including losses)	-10.64%	13.51%	0.00%	-0.06%	0.00%	-0.01%	0.00%	0.03%
(r) Limestone (CaCO3, in ground)	-10.65%	13.49%	-0.04%	-17.11%	0.00%	-0.41%	-0.33%	0.00%
(r) Natural Gas (in ground)	-10.64%	13.51%	0.00%	-0.17%	0.00%	-0.35%	0.01%	1.16%
(r) Oil (in ground)	-10.64%	13.51%	-0.47%	-6.32%	0.00%	-83.75%	2.10%	278.34%
(a) total Carbon Dioxide (CO2)	-10.64%	13.51%	-0.01%	-0.58%	0.00%	-1.75%	0.04%	5.81%
(a) Carbon Monoxide (CO)	-10.64%	13.51%	-0.22%	-4.30%	0.00%	-39.40%	1.62%	132.62%
(a) total Hydrocarbons (except CH4, including VOCs)	-10.64%	13.51%	-0.17%	-4.03%	0.00%	-22.75%	0.70%	75.93%
(a) Methane (CH4)	-10.64%	13.51%	0.00%	-0.01%	-52.37%	-0.10%	0.00%	0.32%
(a) Nitrogen Oxides (NOx as NO2)	-10.64%	13.51%	-0.20%	-3.64%	0.00%	-25.12%	1.08%	84.84%
(a) total Particlulates (unspecified)	-10.64%	13.51%	-0.08%	-10.32%	0.00%	-12.16%	0.61%	41.36%
(a) Sulfur Oxides (SOx as SO2)	-10.64%	13.51%	-0.02%	-1.91%	0.00%	-9.85%	0.37%	32.98%
Electricity	-10.64%	13.51%	-0.01%	-3.45%	0.00%	-2.06%	-0.02%	6.60%
total Non-Coal Energy	-10.64%	13.51%	-0.18%	-3.91%	0.00%	-32.07%	1.75%	109.47%
ash - landfilled (dry)	-10.64%	13.51%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ash - total (dry)	-10.64%	13.51%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	-10.64%	13.51%	-0.01%	-38.48%	0.00%	-3.13%	-2.57%	0.00%
Waste (municipal and industrial)	-10.64%	13.51%	-0.05%	-71.46%	0.00%	-1.60%	-1.32%	0.00%
Waste (unspecified)	-10.64%	13.51%	-0.01%	-8.87%	0.00%	-0.55%	-0.10%	1.38%
Waste (total)	-10.64%	13.51%	0.00%	-1.01%	0.00%	-0.05%	-0.01%	0.09%

	I	J	K	L	M	N	O	P
	surface	surface	surface	surface	surface	surface	surface	surface
(r) Coal (in ground) (including losses)	0.08%	0.00%	-0.06%	-0.25%	-0.02%	0.01%	-0.01%	0.01%
(r) Limestone (CaCO3, in ground)	0.00%	0.00%	0.00%	0.00%	-5.34%	2.75%	-2.80%	15.73%
(r) Natural Gas (in ground)	0.15%	0.00%	-0.12%	-0.48%	-0.05%	0.02%	-0.02%	0.02%
(r) Oil (in ground)	0.29%	0.00%	-0.23%	-0.50%	-1.96%	0.05%	-0.05%	0.01%
(a) total Carbon Dioxide (CO2)	0.48%	0.00%	-0.38%	-1.56%	-0.18%	0.01%	-0.01%	0.01%
(a) Carbon Monoxide (CO)	1.14%	0.00%	-0.90%	-3.50%	-1.33%	0.04%	-0.04%	0.00%
(a) total Hydrocarbons (except CH4, including VOCs)	2.84%	0.00%	-2.23%	-9.07%	-1.25%	0.25%	-0.25%	0.34%
(a) Methane (CH4)	0.00%	0.00%	0.00%	-0.02%	0.00%	0.00%	0.00%	0.00%
(a) Nitrogen Oxides (NOx as NO2)	2.15%	0.00%	-1.69%	-6.81%	-1.13%	0.03%	-0.03%	0.00%
(a) total Particlulates (unspecified)	0.82%	0.00%	-0.64%	-2.59%	-3.18%	0.18%	-0.18%	0.85%
(a) Sulfur Oxides (SOx as SO2)	1.80%	0.00%	-1.42%	-5.84%	-0.59%	0.05%	-0.05%	0.01%
Electricity	10.00%	0.00%	-7.86%	-32.51%	-1.09%	0.53%	-0.53%	-0.12%
total Non-Coal Energy	2.18%	0.00%	-1.71%	-6.90%	-1.22%	0.17%	-0.17%	0.15%
ash - landfilled (dry)	38.89%	0.00%	-30.56%	-30.56%	0.00%	0.00%	0.00%	0.00%
ash - total (dry)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	0.00%	0.00%	0.00%	0.00%	-26.60%	3.11%	-3.11%	37.82%
Waste (municipal and industrial)	0.02%	0.00%	-0.01%	-0.01%	-21.91%	11.59%	-11.59%	99.23%
Waste (unspecified)	9.61%	0.00%	-7.55%	-31.25%	-2.76%	0.93%	-0.93%	1.18%
Waste (total)	36.66%	0.00%	-28.81%	-30.43%	-0.31%	0.13%	-0.13%	0.64%

SENSITIVITY CASE	CASE LETTER
Increase plant efficiency by 5 points	A
Decrease plant efficiency by 5 points	B
Pond versus landfilling of ash from power plant	C
Construction materials low case	D
Mining methane emissions using EIA average U.S. numbers	E
Mine mouth	F
Average user by land	G
Farthest user	H

SENSITIVITY CASE	CASE LETTER
No ash recovery - 100% of plant ash is landfilled	I
100% of recovered ash is used in cement	J
50% of plant ash is recovered & percent used in cement remains constant @ 42%	K
50% of plant ash is recovered & 100% of this is used in cement	L
Plant operating capacity factor = 85%	M
Increase mining equipment materials by 50%	N
Decrease mining equipment materials by 50%	O
Decrease in recycle of materials by 1/3	P

Table B30: Sensitivity Analysis Condensed Results - LEBS System (underground mining)
% change from the base case on a per unit of energy produced (i.e., MWh) basis

	A	B	C	D	E	F	G	H
	underground	underground	underground	underground	underground	underground	underground	underground
(r) Coal (in ground) (including losses)	-10.64%	13.51%	0.00%	-0.06%	0.00%	-0.01%	0.00%	0.03%
(r) Limestone (CaCO3, in ground)	-10.64%	13.51%	0.00%	-0.09%	0.00%	0.00%	0.00%	0.00%
(r) Natural Gas (in ground)	-10.64%	13.51%	0.00%	-0.18%	0.00%	-0.38%	0.01%	1.24%
(r) Oil (in ground)	-10.64%	13.51%	-0.44%	-6.02%	0.00%	-79.84%	2.00%	265.35%
(a) total Carbon Dioxide (CO2)	-10.64%	13.51%	-0.01%	-0.58%	0.00%	-1.75%	0.04%	5.81%
(a) Carbon Monoxide (CO)	-10.64%	13.51%	-0.22%	-4.41%	0.00%	-40.43%	1.66%	136.08%
(a) total Hydrocarbons (except CH4, including VOCs)	-10.64%	13.51%	-0.18%	-4.27%	0.00%	-24.11%	0.75%	80.45%
(a) Methane (CH4)	-10.64%	13.51%	0.00%	-0.01%	114.61%	-0.05%	0.00%	0.15%
(a) Nitrogen Oxides (NOx as NO2)	-10.64%	13.51%	-0.20%	-3.69%	0.00%	-25.50%	1.09%	86.11%
(a) total Particlulates (unspecified)	-10.64%	13.51%	-0.01%	-1.46%	0.00%	-1.71%	0.09%	5.83%
(a) Sulfur Oxides (SOx as SO2)	-10.64%	13.51%	-0.02%	-1.91%	0.00%	-9.81%	0.37%	32.85%
Electricity	-10.64%	13.51%	-0.01%	-3.90%	0.00%	-2.34%	-0.02%	7.46%
total Non-Coal Energy	-10.64%	13.51%	-0.19%	-4.04%	0.00%	-33.09%	1.81%	112.98%
ash - landfilled (dry)	-10.64%	13.51%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ash - total (dry)	-10.64%	13.51%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	-10.64%	13.51%	-0.01%	-39.88%	0.00%	-3.25%	-2.66%	0.00%
Waste (municipal and industrial)	-10.64%	13.51%	-0.05%	-81.76%	0.00%	-1.83%	-1.51%	0.00%
Waste (unspecified)	-10.64%	13.51%	0.00%	-4.73%	0.00%	-0.29%	-0.05%	0.73%
Waste (total)	-10.64%	13.51%	0.00%	-0.95%	0.00%	-0.04%	-0.01%	0.09%

	I	J	K	L	M	N	O	P
	underground	underground	underground	underground	underground	underground	underground	underground
(r) Coal (in ground) (including losses)	0.08%	0.00%	-0.06%	-0.25%	-0.02%	0.00%	0.00%	0.01%
(r) Limestone (CaCO3, in ground)	0.00%	0.00%	0.00%	0.00%	-0.03%	0.01%	-0.01%	0.07%
(r) Natural Gas (in ground)	0.16%	0.00%	-0.13%	-0.52%	-0.06%	0.01%	-0.01%	0.02%
(r) Oil (in ground)	0.28%	0.00%	-0.22%	-0.48%	-1.87%	0.02%	-0.02%	0.01%
(a) total Carbon Dioxide (CO2)	0.48%	0.00%	-0.38%	-1.56%	-0.18%	0.00%	0.00%	0.01%
(a) Carbon Monoxide (CO)	1.17%	0.00%	-0.92%	-3.59%	-1.36%	0.02%	-0.02%	0.00%
(a) total Hydrocarbons (except CH4, including VOCs)	3.01%	0.00%	-2.36%	-9.61%	-1.33%	0.11%	-0.11%	0.31%
(a) Methane (CH4)	0.00%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
(a) Nitrogen Oxides (NOx as NO2)	2.18%	0.00%	-1.72%	-6.91%	-1.14%	0.01%	-0.01%	0.00%
(a) total Particlulates (unspecified)	0.12%	0.00%	-0.09%	-0.37%	-0.45%	0.01%	-0.01%	0.10%
(a) Sulfur Oxides (SOx as SO2)	1.79%	0.00%	-1.41%	-5.81%	-0.59%	0.02%	-0.02%	0.01%
Electricity	11.31%	0.00%	-8.89%	-36.77%	-1.23%	0.25%	-0.25%	-0.11%
total Non-Coal Energy	2.25%	0.00%	-1.77%	-7.13%	-1.26%	0.07%	-0.07%	0.14%
ash - landfilled (dry)	38.89%	0.00%	-30.56%	-30.56%	0.00%	0.00%	0.00%	0.00%
ash - total (dry)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Waste (hazardous)	0.01%	0.00%	0.00%	0.00%	-27.57%	1.34%	-1.34%	39.68%
Waste (municipal and industrial)	0.02%	0.00%	-0.02%	-0.02%	-25.07%	5.53%	-5.53%	98.66%
Waste (unspecified)	5.13%	0.00%	-4.03%	-16.67%	-1.47%	0.21%	-0.21%	0.55%
Waste (total)	34.61%	0.00%	-27.20%	-28.73%	-0.29%	0.05%	-0.05%	0.52%

SENSITIVITY CASE	CASE LETTER
Increase plant efficiency by 5 points	A
Decrease plant efficiency by 5 points	B
Pond versus landfilling of ash from power plant	C
Construction materials low case	D
Mining methane emissions using EIA average U.S. numbers	E
Mine mouth	F
Average user by land	G
Farthest user	H

SENSITIVITY CASE	CASE LETTER
No ash recovery - 100% of plant ash is landfilled	I
100% of recovered ash is used in cement	J
50% of plant ash is recovered & percent used in cement remains constant @ 42%	K
50% of plant ash is recovered & 100% of this is used in cement	L
Plant operating capacity factor = 85%	M
Increase mining equipment materials by 50%	N
Decrease mining equipment materials by 50%	O
Decrease in recycle of materials by 1/3	P

Table B31: Sensitivity Analysis Efficiencies and Energy Ratios - NSPS System

	nsps - base case	A	B	C	D	E	F	G	H	I	J
power plant efficiency	35%	40%	30%	35%	35%	35%	35%	35%	35%	35%	35%
life cycle efficiency - surface mining	-73.2%	-68.5%	-78.0%	-73.2%	-73.0%	-73.2%	-71.3%	-73.3%	-79.9%	-73.3%	-73.0%
external energy efficiency - surface mining	26.8%	31.5%	22.0%	26.8%	27.0%	26.8%	28.7%	26.7%	20.1%	26.7%	27.0%
net energy ratio - surface mining	0.31	0.36	0.27	0.31	0.31	0.31	0.32	0.31	0.29	0.31	0.31
external net energy ratio - surface mining	5.09	5.82	4.36	5.13	5.25	5.09	7.26	5.01	2.52	4.99	5.23
life cycle efficiency - underground mining	-73.0%	-68.3%	-77.8%	-73.0%	-72.8%	-73.0%	-71.1%	-73.1%	-79.7%	-73.2%	-72.8%
external energy efficiency - underground mining	27.0%	31.7%	22.2%	27.0%	27.2%	27.0%	28.9%	26.9%	20.3%	26.8%	27.2%
net energy ratio - underground mining	0.31	0.36	0.27	0.31	0.31	0.31	0.32	0.31	0.29	0.31	0.31
external net energy ratio - underground mining	5.24	5.99	4.49	5.28	5.41	5.24	7.58	5.16	2.56	5.14	5.39

	nsps - base case	K	L	M	N	O	P	Q	R	S	T
power plant efficiency	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
life cycle efficiency - surface mining	-73.2%	-73.1%	-72.8%	-73.2%	-73.2%	-73.2%	-73.2%	-73.2%	-73.2%	-73.2%	-73.2%
external energy efficiency - surface mining	26.8%	26.9%	27.2%	26.8%	26.8%	26.8%	26.8%	26.8%	26.8%	26.8%	26.8%
net energy ratio - surface mining	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
external net energy ratio - surface mining	5.09	5.17	5.44	5.14	5.08	5.10	5.08	5.08	5.09	5.10	5.10
life cycle efficiency - underground mining	-73.0%	-72.9%	-72.6%	-73.0%	-73.0%	-73.0%	-73.0%	-73.0%	-73.0%	-73.0%	-73.0%
external energy efficiency - underground mining	27.0%	27.1%	27.4%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%	27.0%
net energy ratio - underground mining	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
external net energy ratio - underground mining	5.24	5.33	5.61	5.29	5.24	5.25	5.24	5.23	5.24	5.25	5.25

CASE LETTER	SENSITIVITY CASE
A	Increase plant efficiency by 5 points
B	Decrease plant efficiency by 5 points
C	Pond versus landfilling of ash from power plant
D	Construction materials low case
E	Mining methane emissions using EIA average U.S. numbers
F	Mine mouth
G	Average user by land
H	Farthest user
I	No ash recovery - 100% of plant ash is landfilled
J	100% of recovered ash is used in cement
K	50% of plant ash is recovered & percent used in cement remains constant @ 42%
L	50% of plant ash is recovered & 100% of this is used in cement
M	Plant operating capacity factor = 85%
N	Increase mining equipment materials by 50%
O	Decrease mining equipment materials by 50%
P	Decrease in recycle of materials by 1/3
Q	No FGC recovery - 100% is landfilled
R	100% of recovered FGC is used in asphalt
S	50% of plant FCG is recovered & percent used in asphalt remains constant @ 7.2%
T	50% of plant FCG is recovered & 100% of this is used in asphalt

Table B32: Sensitivity Analysis Efficiencies and Energy Ratios - LEBS System

	lebs - base case	A	B	C	D	E	F	G	H
power plant efficiency	42%	47%	37%	42%	42%	42%	42%	42%	42%
life cycle efficiency - surface mining	-65.9%	-61.1%	-70.7%	-65.9%	-65.7%	-65.9%	-64.0%	-66.0%	-72.4%
external energy efficiency - surface mining	34.1%	38.9%	29.3%	34.1%	34.3%	34.1%	36.0%	34.0%	27.6%
net energy ratio - surface mining	0.38	0.42	0.33	0.38	0.38	0.38	0.38	0.38	0.36
external net energy ratio - surface mining	6.72	7.52	5.92	6.73	6.99	6.72	9.89	6.60	3.21
life cycle efficiency - underground mining	-65.7%	-61.0%	-70.5%	-65.7%	-65.5%	-65.7%	-63.8%	-65.8%	-72.3%
external energy efficiency - underground mining	34.3%	39.0%	29.5%	34.3%	34.5%	34.3%	36.2%	34.2%	27.7%
net energy ratio - underground mining	0.38	0.42	0.33	0.38	0.38	0.38	0.39	0.38	0.36
external net energy ratio - underground mining	6.93	7.76	6.11	6.95	7.22	6.93	10.36	6.81	3.25

	lebs - base case	I	J	K	L	M	N	O	P
power plant efficiency	42%	42%	42%	42%	42%	42%	42%	42%	42%
life cycle efficiency - surface mining	-65.9%	-66.0%	-65.9%	-65.8%	-65.5%	-65.8%	-65.9%	-65.9%	-65.9%
external energy efficiency - surface mining	34.1%	34.0%	34.1%	34.2%	34.5%	34.2%	34.1%	34.1%	34.1%
net energy ratio - surface mining	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
external net energy ratio - surface mining	6.72	6.57	6.72	6.83	7.22	6.80	6.71	6.73	6.71
life cycle efficiency - underground mining	-65.7%	-65.9%	-65.7%	-65.6%	-65.3%	-65.7%	-65.7%	-65.7%	-65.7%
external energy efficiency - underground mining	34.3%	34.1%	34.3%	34.4%	34.7%	34.3%	34.3%	34.3%	34.3%
net energy ratio - underground mining	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
external net energy ratio - underground mining	6.93	6.78	6.93	7.06	7.46	7.02	6.93	6.94	6.92

CASE LETTER	SENSITIVITY CASE
A	Increase plant efficiency by 5 points
B	Decrease plant efficiency by 5 points
C	Pond versus landfilling of ash from power plant
D	Construction materials low case
E	Mining methane emissions using EIA average U.S. numbers
F	Mine mouth
G	Average user by land
H	Farthest user
I	No ash recovery - 100% of plant ash is landfilled
J	100% of recovered ash is used in cement
K	50% of plant ash is recovered & percent used in cement remains constant @ 42%
L	50% of plant ash is recovered & 100% of this is used in cement
M	Plant operating capacity factor = 85%
N	Increase mining equipment materials by 50%
O	Decrease mining equipment materials by 50%
P	Decrease in recycle of materials by 1/3

Appendix C: Additional Figures

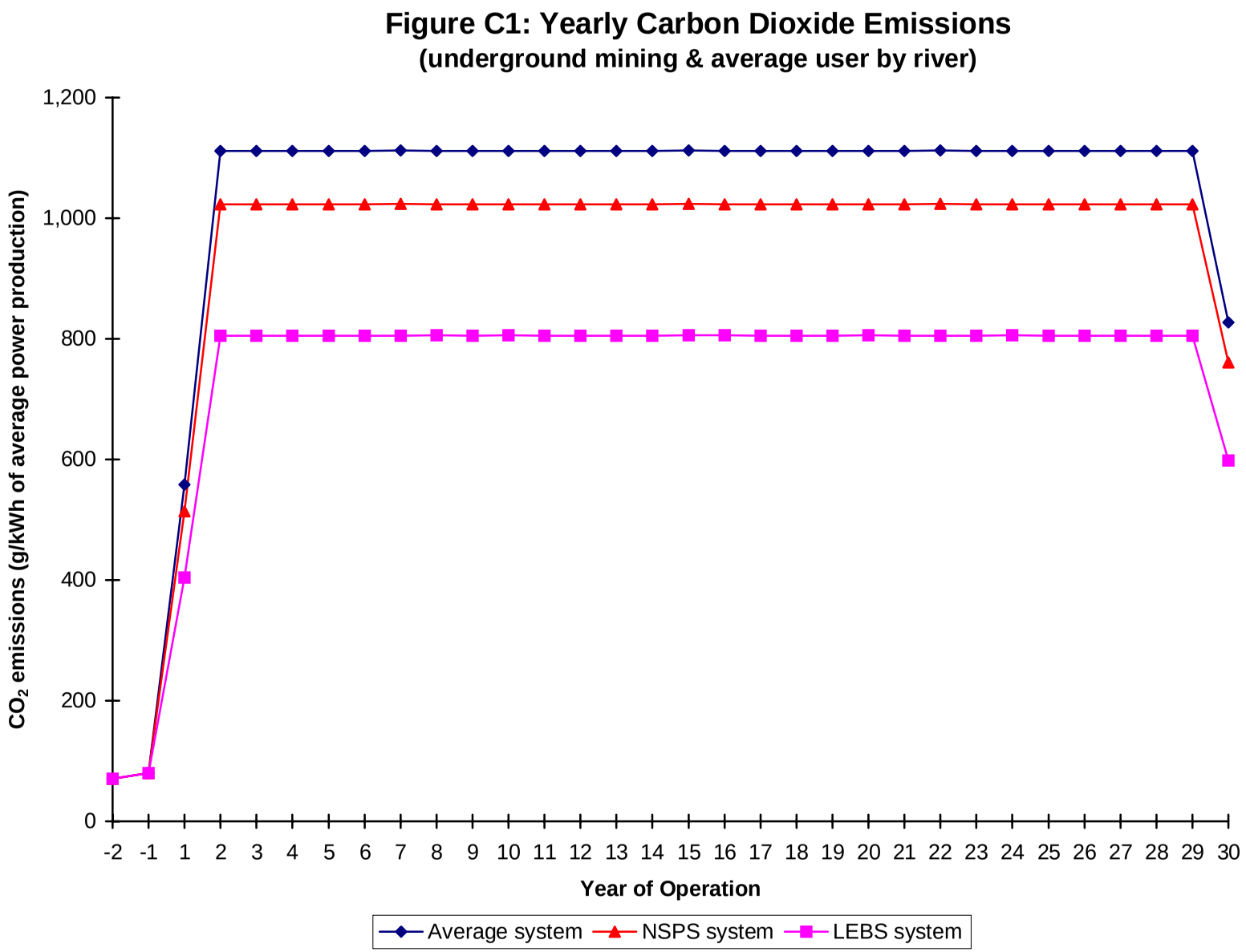


Figure C1: Yearly Carbon Dioxide Emissions
(underground mining & average user by river)
CO2 emissions (g/kWh of average power production)
1,200
1,000
800
600
400
200
0
-2 -1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Year of Operation
Average system
NSPS system
LEBS system

Figure C2: Yearly Sulfur Oxide Emissions (SO_x as SO_2)
(underground mining & average user by river)

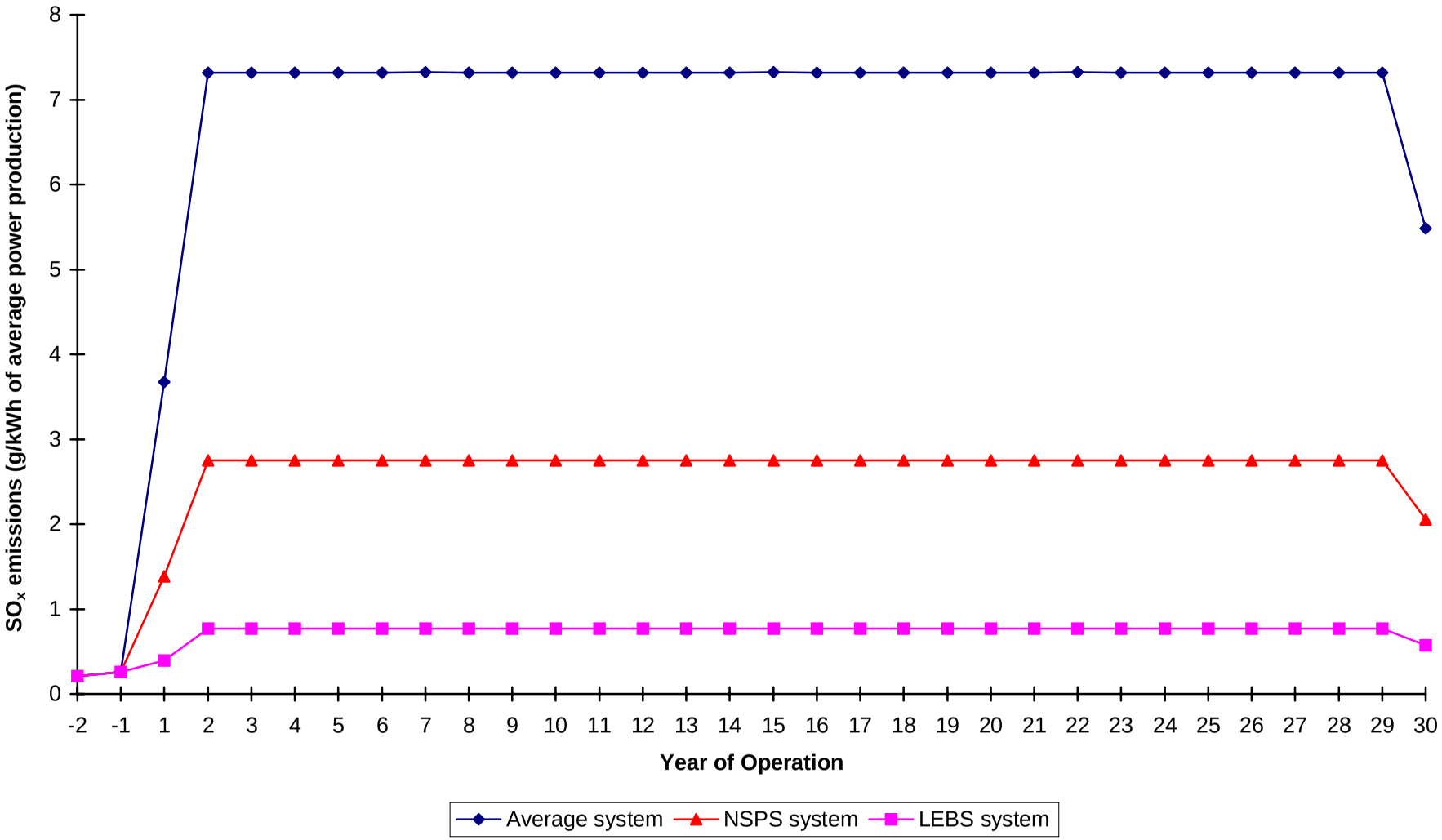


Figure C3: Yearly Nitrogen Oxide Emissions (NO_x as NO_2)
(underground mining & average user by river)

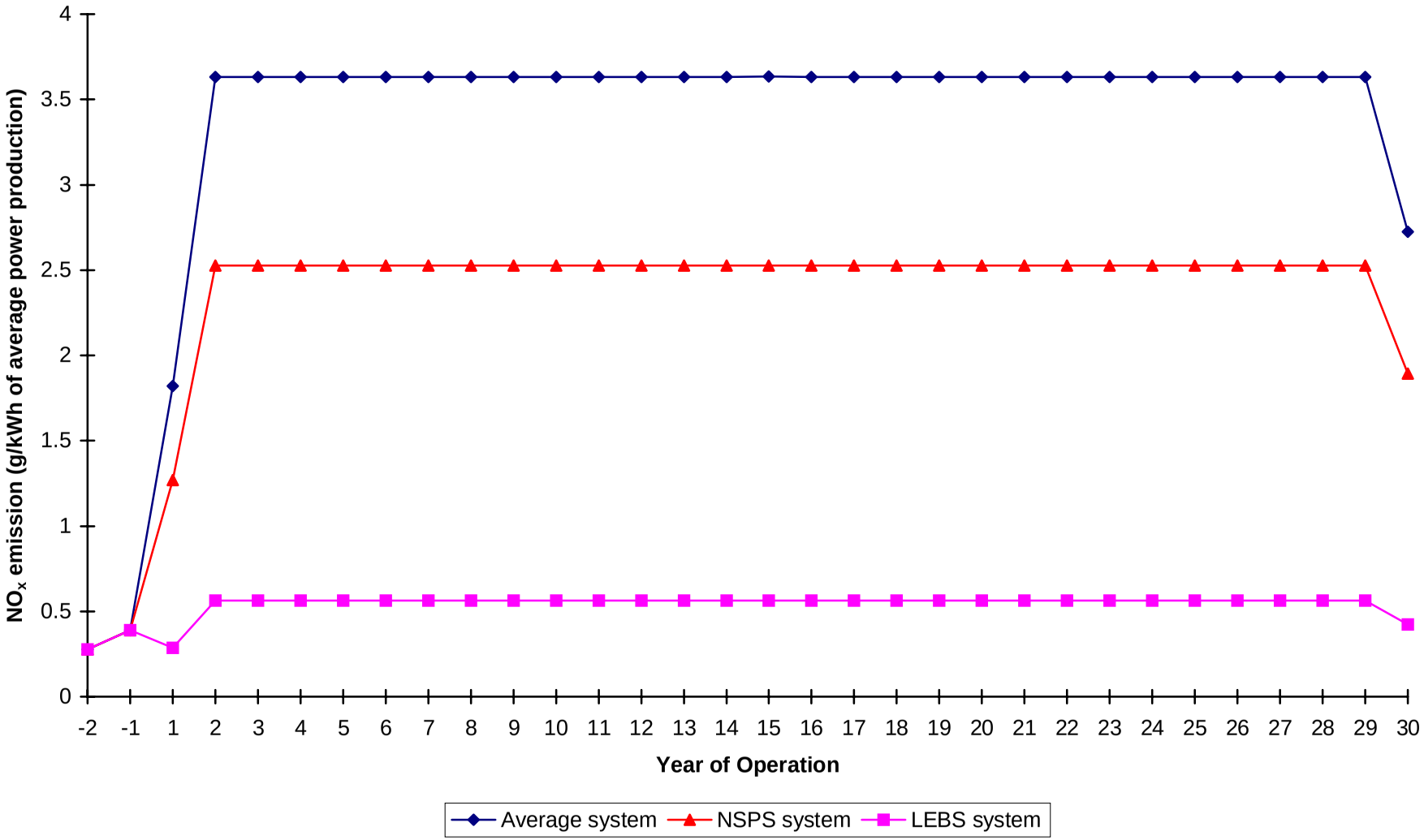


Figure C4: Yearly Methane Emissions
(underground mining & average user by river)

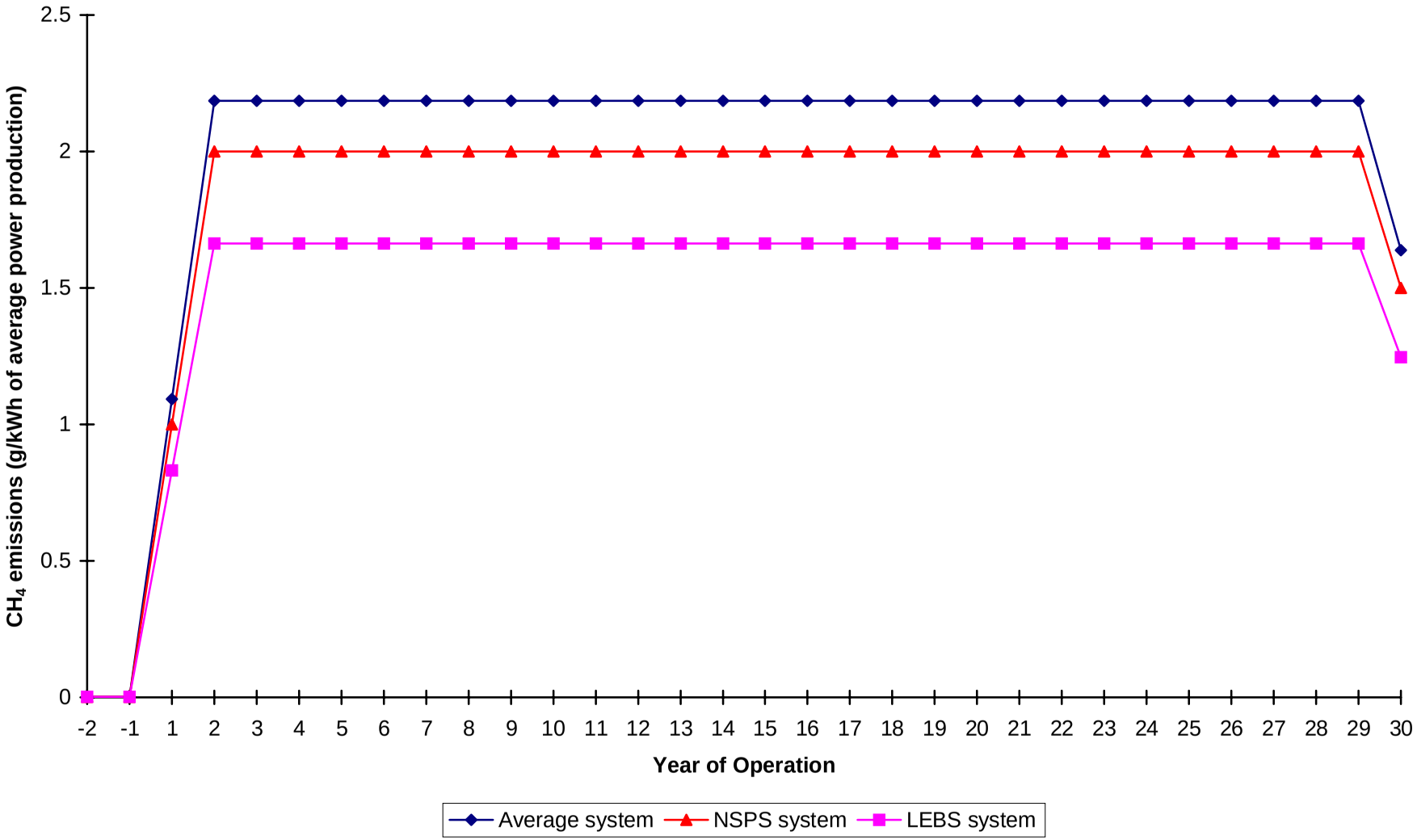
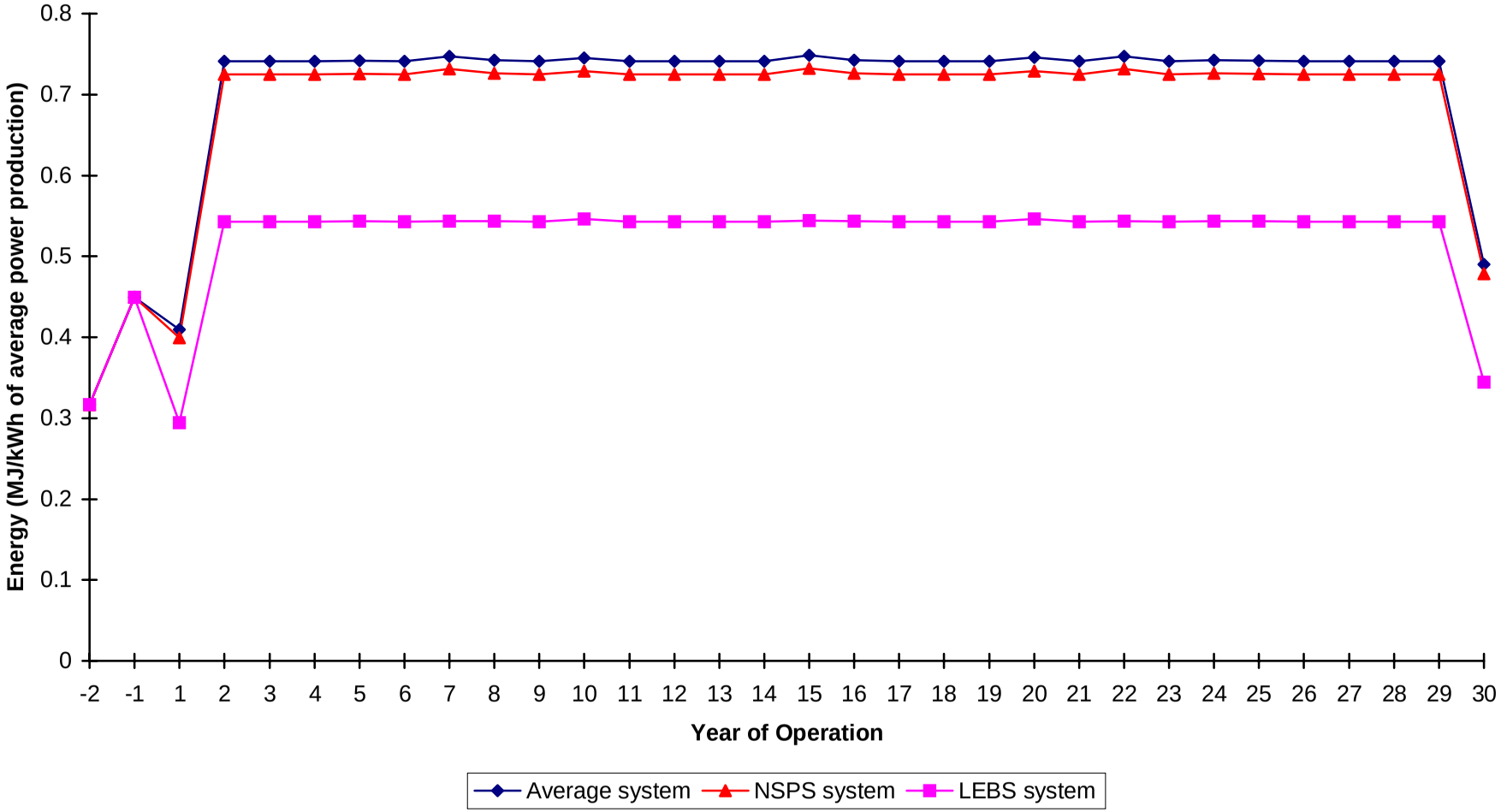


Figure C5: Yearly Total Non-Coal Energy Consumption

(underground mining & average user by river)

(Note: Electricity produced and consumed by the power plant not included)

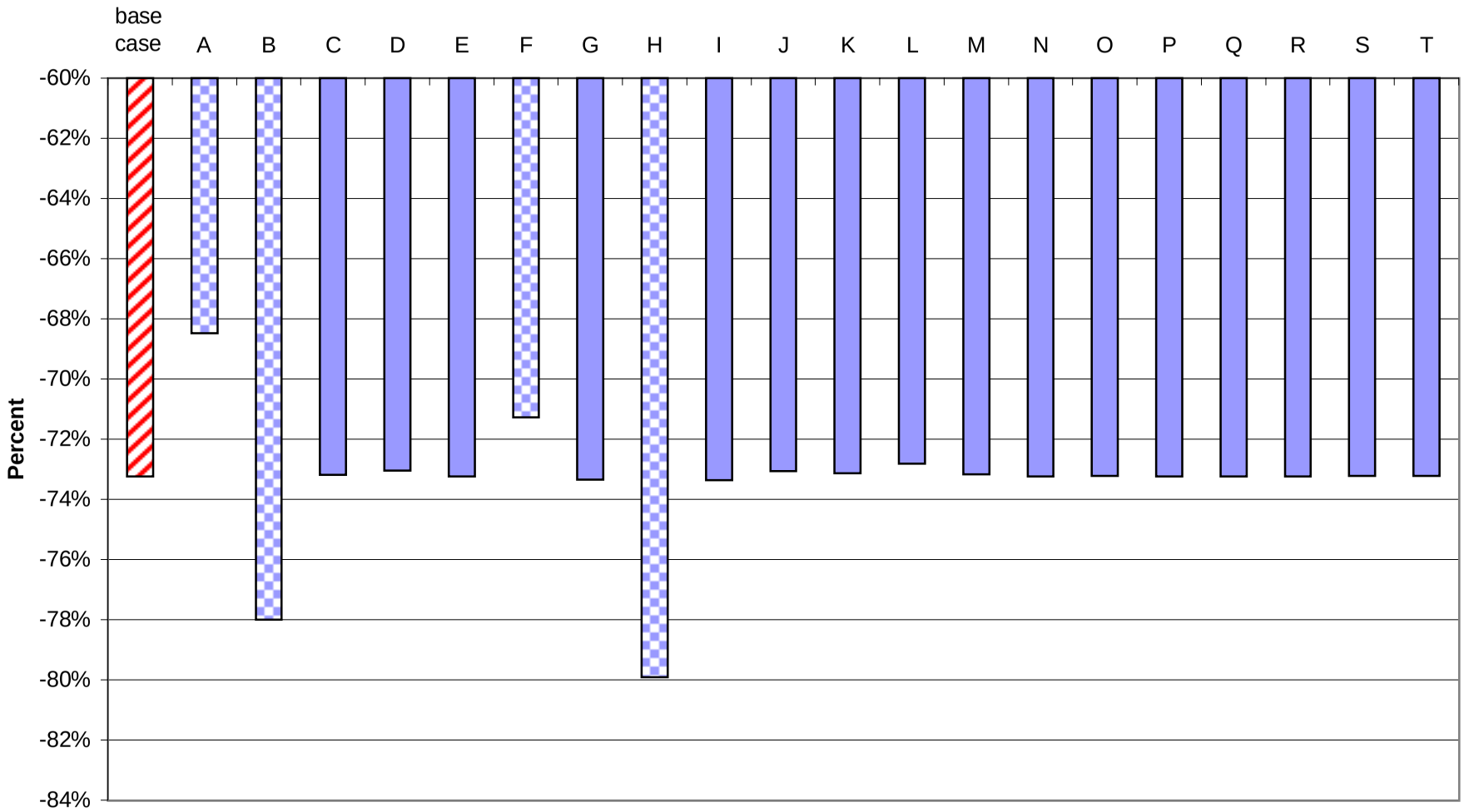


Key for Sensitivity Cases

Case Letter	Sensitivity Case
A	Increase plant efficiency by 5 points
B	Decrease plant efficiency by 5 points
C	Pond versus landfilling of ash from power plant
D	Construction materials low case
E	Mining methane emissions using EIA average U.S. numbers
F	Mine mouth
G	Average user by land
H	Farthest user
I	No ash recover - 100% of plant ash is landfilled
J	100% of recovered ash is used in cement

Case Letter	Sensitivity Case
K	50% of plant ash is recovered & percent used in cement remains constant @ 42%
L	50% of plant ash is recvovered & 100% of this is used in cement
M	Plant operating capacity factor = 85%
N	Increase mining equipment materials by 50%
O	Decrease mining equipment materials by 50%
P	Decrease in recycle of materials by 1/3
Q	No FGC recovery - 100% is landfilled
R	100% of recovered FGC is used in asphalt
S	50% of plant FGC is recovered & percent used in asphalt remains constant @ 7.2%
T	50% of plant FGC is recovered & 100% of this is used in asphalt

Figure C6: Sensitivity results for Life Cycle Efficiency - NSPS System, Surface Mining Case



Sensitivity Case
(Refer to the key located before Figure C6)

Figure C7: Sensitivity Results for External Energy Efficiency - NSPS System, Surface Mining Case

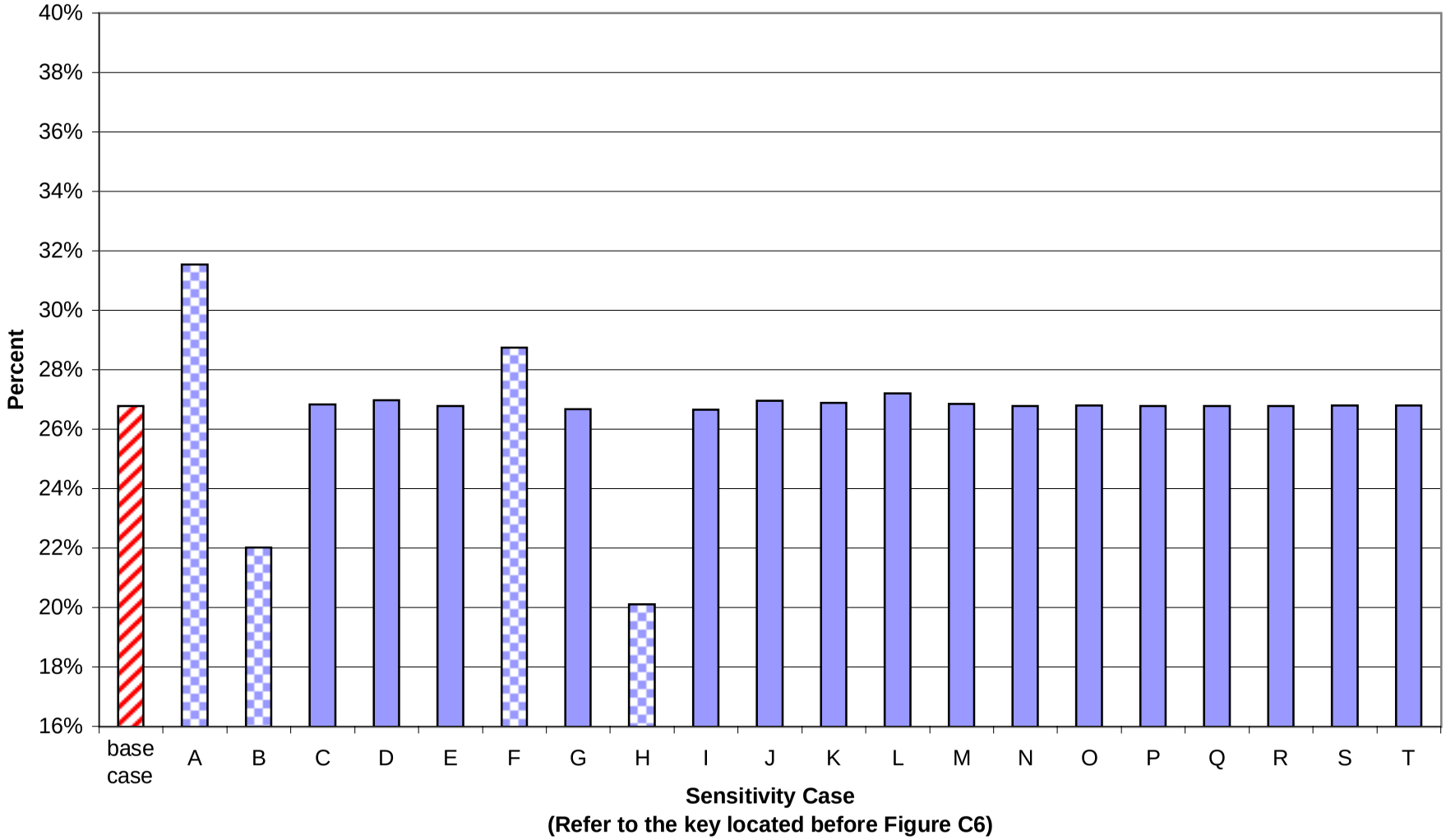
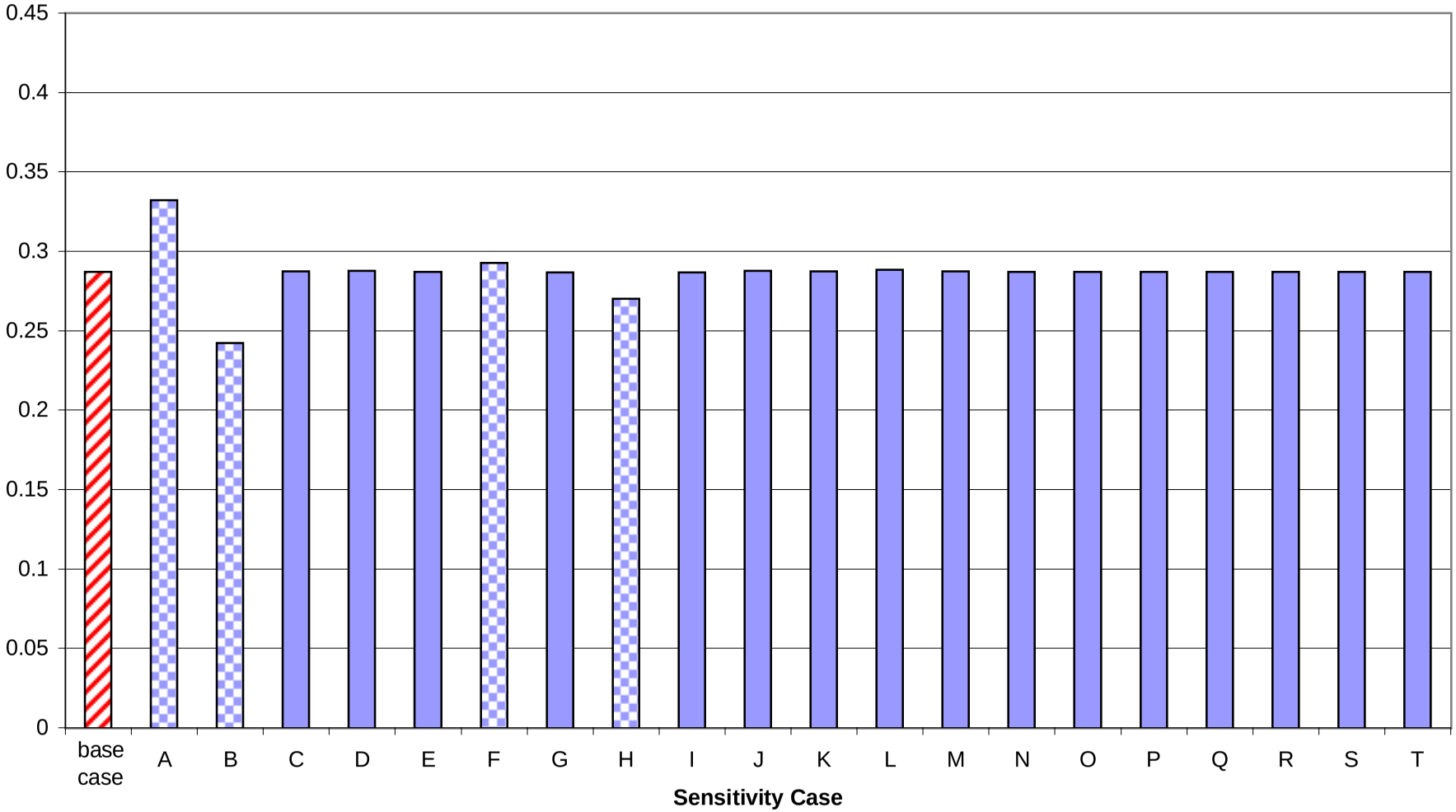


Figure C8: Sensitivity Results for Net Energy Ratio - NSPS System, Surface Mining Case



Sensitivity Case
(Refer to the key located before Figure C6)

Figure C9: Sensitivity Results for External Net Energy Ratio - NSPS System, Surface Mining Case

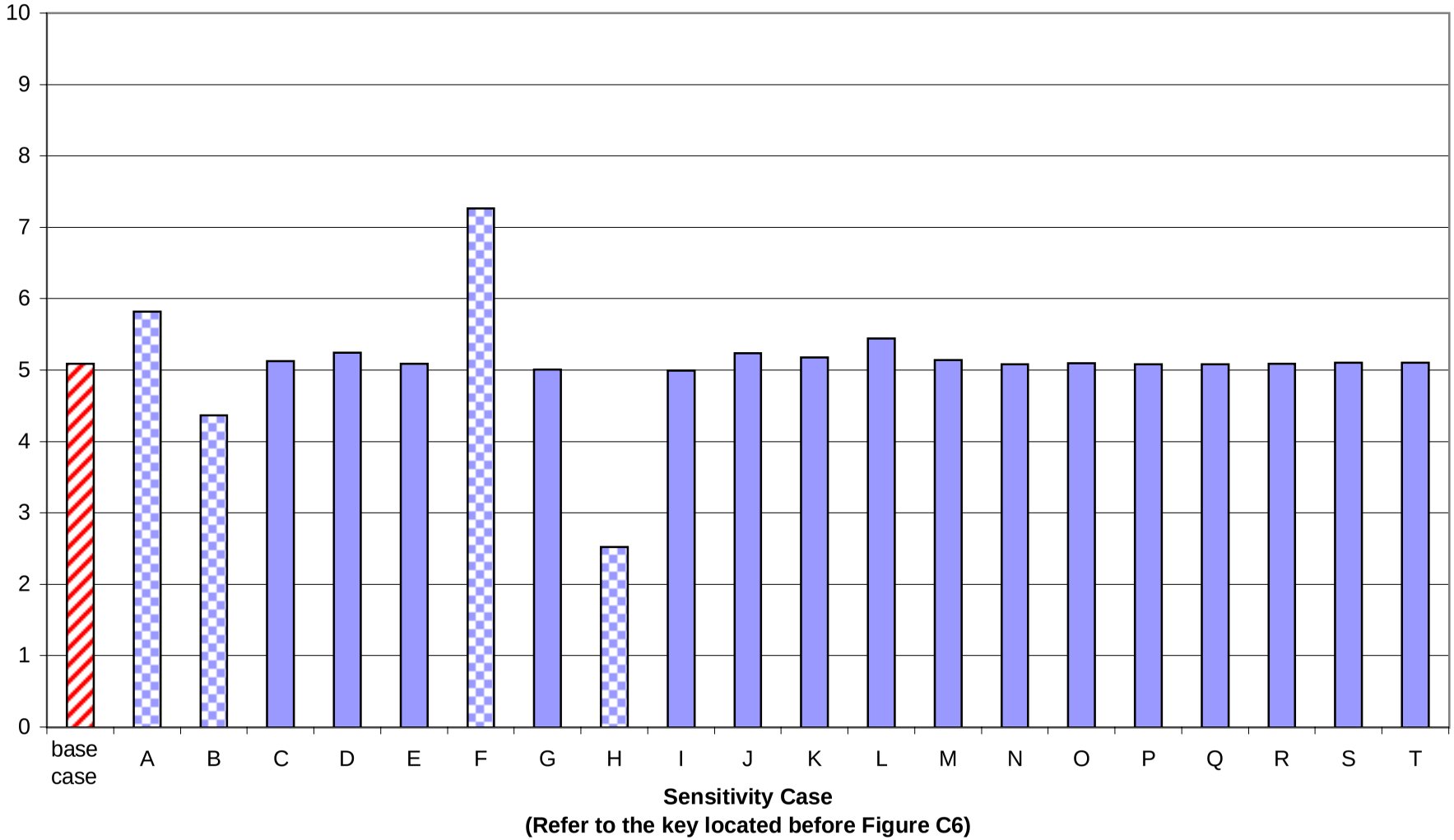
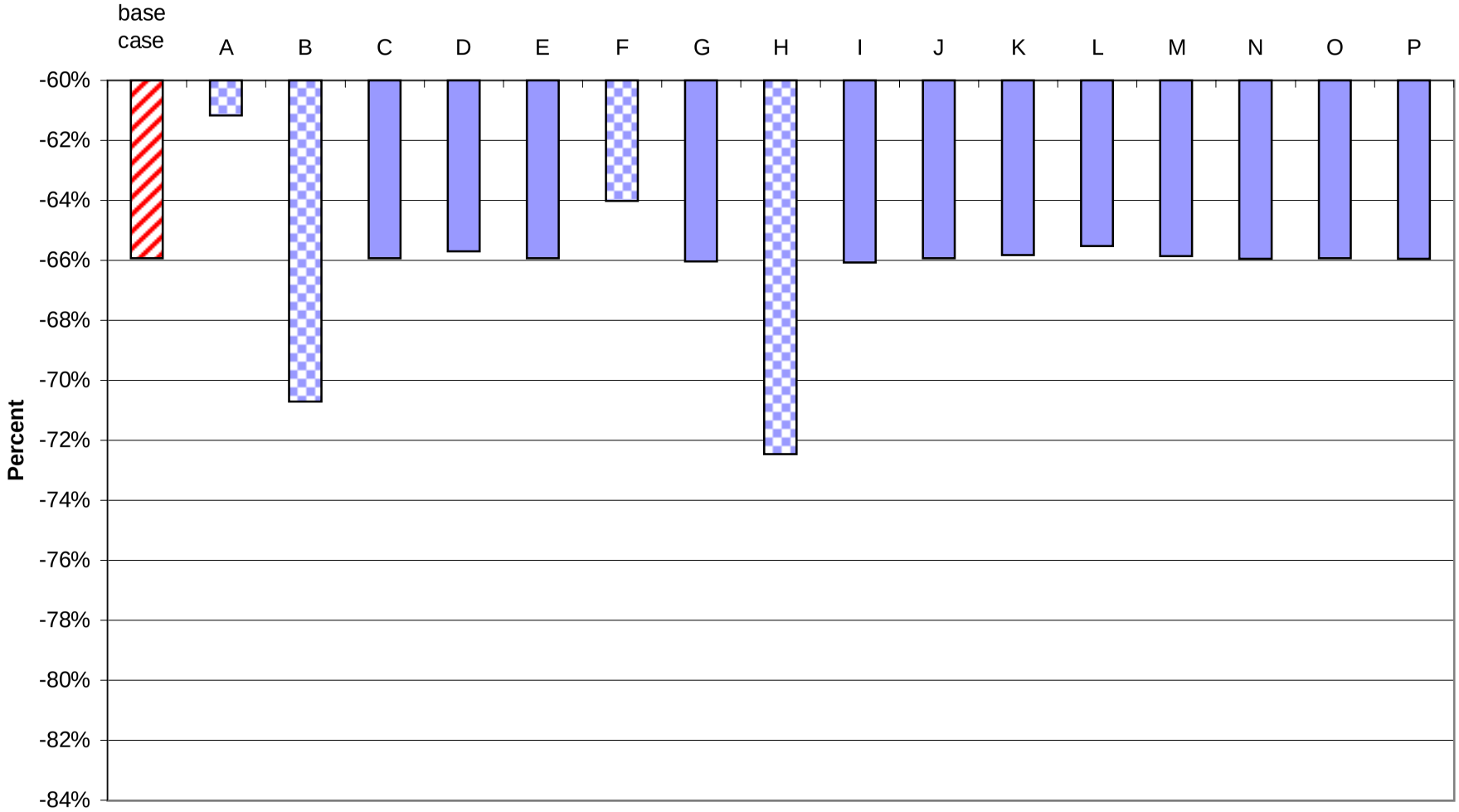


Figure C10: Sensitivity Results for Life Cycle Efficiency - LEBS System, Surface Mining Case



Sensitivity Case
(Refer to the key located before Figure C6)

Figure C11: Sensitivity Results for External Energy Efficiency - LEBS Stystem, Surface Mining Case

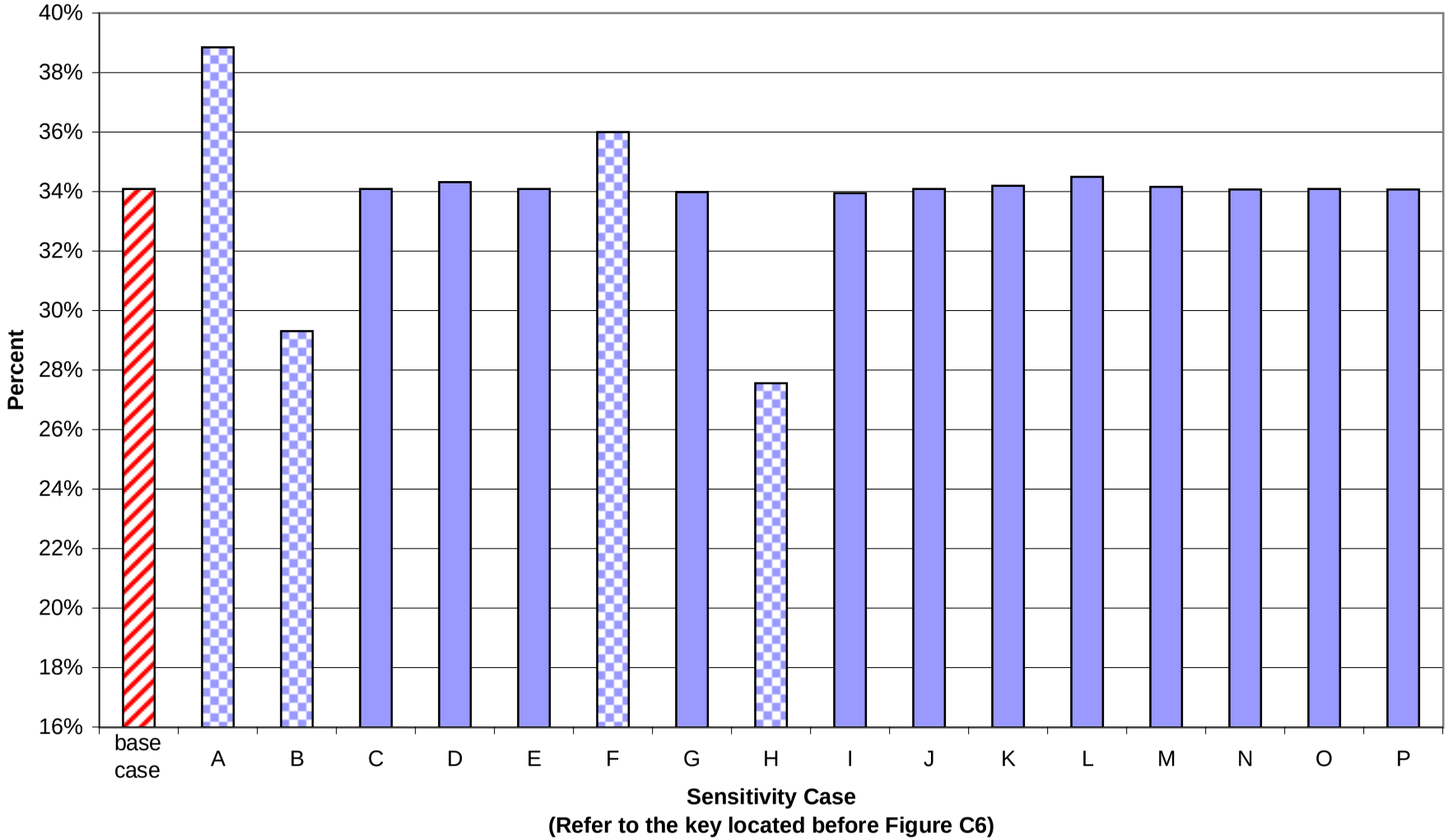
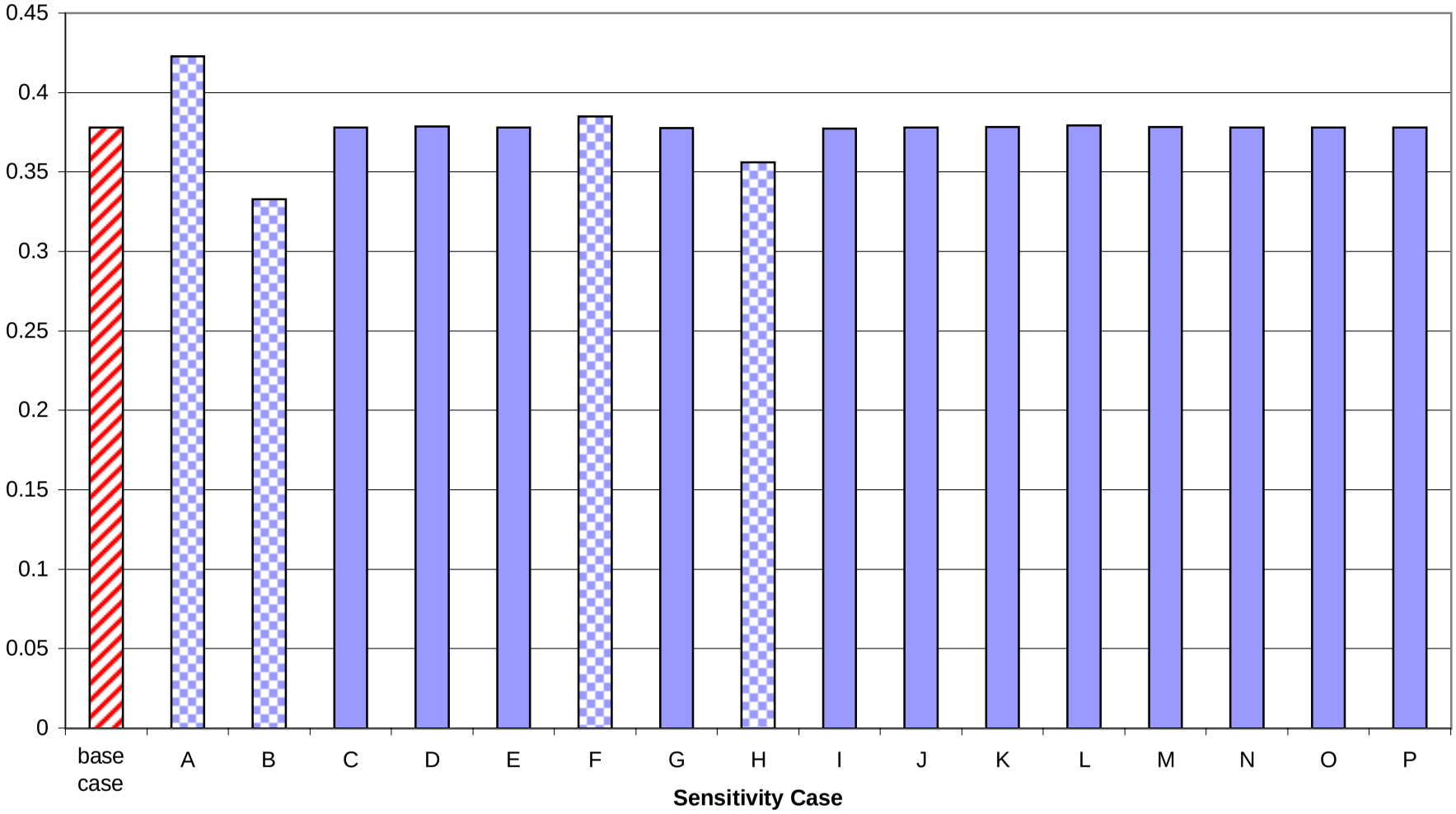
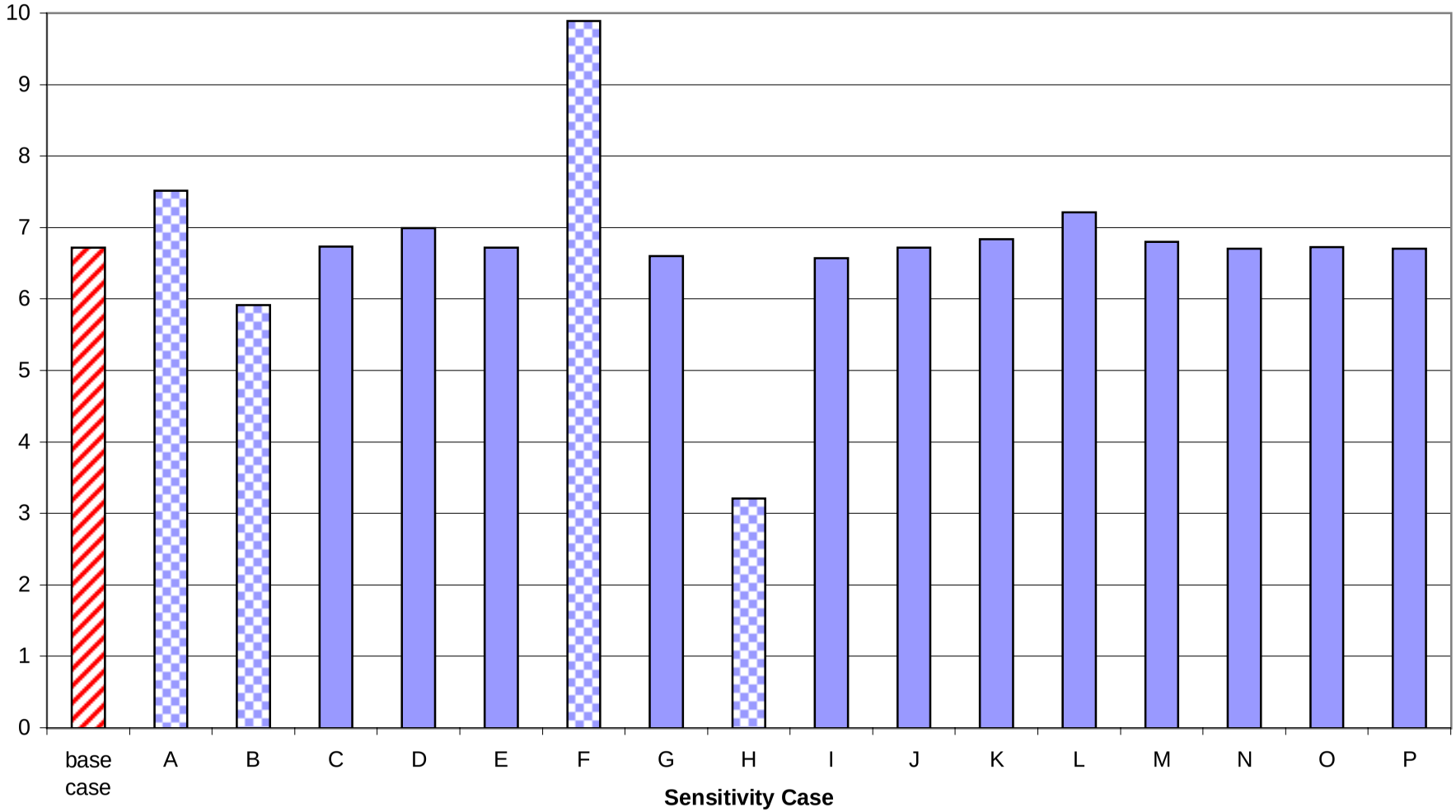


Figure C12: Sensitivity Results for Net Energy Ratio - LEBS System, Surface Mining Case



Sensitivity Case
(Refer to the key located before Figure C6)

Figure C13: Sensitivity Results for External Net Energy Ratio - LEBS System, Surface Mining Case



Sensitivity Case
(Refer to the key located before Figure C6)

REPORT DOCUMENTATION PAGE

Form Approved
OMB NO. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	June 1999	1998-1999

4. TITLE AND SUBTITLE	5. FUNDING NUMBERS
Life Cycle Assessment of Coal-fired Power Production	BP91.1030
6. AUTHOR(S) Pamela L. Spath, Margaret K. Mann, Dawn R. Kerr	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) National Renewable Energy Laboratory 1617 Cole Blvd. Golden, CO 80401-3393	10. SPONSORING/MONITORING AGENCY REPORT NUMBER TP-570-25119

11. SUPPLEMENTARY NOTES

NREL Technical Monitor:

12a. DISTRIBUTION/AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
National Technical Information Service U.S. Department of Commerce 5285 Port Royal Road Springfield, VA 22161	

13. ABSTRACT *(Maximum 200 words)*

Coal has the largest share of utility power generation in the United States, accounting for approximately 56% of all utility-produced electricity (U.S. DOE, 1998). Therefore, understanding the environmental implications of producing electricity from coal is an important component of any plan to reduce total emissions and resource consumption. A life cycle assessment (LCA) on the production of electricity from coal was performed in order to examine the environmental aspects of current and future pulverized coal boiler systems. Three systems were examined: 1) a plant that represents the average emissions and efficiency of currently operating coal-fired power plants in the U.S. (this tells us about the status quo), 2) a new coal-fired power plant that meets the New Source Performance Standards (NSPS), and 3) a highly advanced coal-fired power plant utilizing a low emission boiler system (LEBS).

14. SUBJECT TERMS	14. NUMBER OF PAGES 169
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT