APPENDIX H
WATER RESOURCES - SUPPLEMENTAL INFORMATION

This appendix provides supporting information for Section 3.4 (Water Resources). Sections 1 to 3 discuss potential exposure pathways. Sections 4 describes the affected environment and Section 5 describes environmental consequences.

1. Exposure Pathways for the No Action and Unrestricted Release Alternatives

The affected environment for the No Action and Unrestricted Release Alternatives includes all waters which come into contact with the materials released from a licensed site during the generation and handling of the materials on the licensed facility site; processing at a recycling facility; handling and disposal of byproducts and waste products from those processing activities; and the handling and utilization of end use products.

These waters potentially lead to direct exposure to the wastewater, runoff or leachate, or represent potential paths for contaminants to enter ground water or surface water from leachate or runoff during processing or in connection with end use products such as concrete roadbed material. Runoff includes waters which come in contact with the subject material or its residue and traverses over the ground, along natural or manmade drainage channels, or collects in natural or manmade catchment areas. Leachate includes waters which come in contact with the subject material and percolate to a containment barrier and which may be removed, processed, or otherwise managed by facility personnel. Both runoff and leachate may eventually reach surface water bodies or ground-water aquifers and escape beyond the limits of the delineated work area, i.e., the operational or physical limits bounding Non-Licensed Facility Worker exposures.

1.1 Concrete

Potential exposure pathways for the No Action and Unrestricted Release Alternatives for concrete are based on crushing, screening, and recycling the processed concrete as aggregate for a variety of end uses, e.g. general fill, road base material, new concrete and asphalt mixes. Crushing and screening of the concrete is also anticipated to occur under the EPA/State-Regulated Disposal, LLW Disposal, and Limited Dispositions Alternatives, and the affected environment and potential water quality impacts associated with these activities are common to all of the Alternatives. The following sections describe the affected environment for potential Non-Licensed Facility Workers, General Public, and non-radiological ecological exposures.

Non-Licensed Facility Worker Exposure

Potential exposure pathways for concrete for Non-Licensed Facility Workers include activities associated with the handling of concrete at the licensee facility site or at offsite satellite facilities; recycling of the concrete into aggregate and subsequent reuse; and disposal of concrete dust generated from concrete recycling.

Ingestion of drinking water from onsite ground-water wells or surface water sources has not been included as a Non-Licensed Facility Worker exposure pathway. Non-radiological water-related

potential Non-Licensed Facility Worker exposures are limited to skin irritation through direct skin contact with highly alkaline water. The pH of cement falls between 12 and 13, which is highly caustic. Runoff and leachate from crushed concrete would have lower pH values. NPDES permits typically limit the maximum pH of discharges to 9.0, but higher values could exist prior to the discharge point.

End uses of recycled concrete aggregate such as road bed construction material, general fill, or other applications with a high specific surface area may continue to generate leachate or runoff with elevated pH. End uses which bind the recycled concrete aggregate in cement or asphalt would not produce such leachate or runoff from the aggregate itself.

General Public Exposure

Potential General Public exposure pathways include the use of ground water, or surface water fed by ground-water flow, as a drinking water supply from a source located near the site of activities associated with handling of concrete at the licensee facility site or at offsite satellite facilities; recycling of the concrete as aggregate; end use of recycled concrete aggregate; and disposal of concrete dust generated from concrete recycling.

Potential non-radiological, General Public exposures include ingestion of water with high pH, and perhaps elevated levels of calcium, aluminum, or iron. Standard monitoring of public drinking water supplies limits the risk of exposure to elevated levels of these constituents. Since significant exposure by direct runoff flows into surface waters would be precluded by NPDES controls, the remaining pathway is ground-water flow to a surface water body. Private ground water wells or private surface water supplies fed from a ground water source remain potential exposure pathways for ingestion.

Ecological Exposure

Potential non-radiological ecological exposure pathways include the existence of aquatic or riparian animals living in or along surface water bodies at or near the site of activities associated with handling of concrete at the licensee facility site or at offsite satellite facilities; recycling of the concrete as aggregate; end use of recycled concrete aggregate; and disposal of concrete dust generated from concrete recycling.

Aquatic and riparian animals face potential exposure to water containing high pH, and perhaps elevated levels of calcium, aluminum, or iron. Since significant exposure by direct runoff flows into surface waters is precluded by NPDES controls, the remaining pathway is ground-water flow to a surface water body.

1.2 Ferrous Metal

Potential exposure pathways for the No Action and Unrestricted Release Alternatives for ferrous metal are based on the anticipated end uses for recycled ferrous metal and the anticipated processes that would be used in recycling ferrous metals. The following sections describe the

affected environment for potential Non-Licensed Facility Worker, General Public, and ecological exposures.

Non-Licensed Facility Worker Exposure

Potential Non-Licensed Facility Worker exposure pathways for ferrous metal include activities associated with the handling of scrap ferrous metal at the licensed facility site; recycling of the scrap into finished recycled ferrous metal; processing into end use products (e.g., automobiles, home appliances, building materials); installation of end use products (e.g., building materials); processing and use of byproducts (e.g., furnace slag, electric arc furnace (EAF) baghouse dust) generated by recycling processes; and disposal of wastes (e.g., EAF baghouse dust) generated by recycling processes.

Locations used for materials handling at the licensee facility or laydown areas for scrap stockpiling, segregation, loading, unloading, or other handling at the recycling facility have the potential to generate both leachate and surface water runoff. The total volume of runoff plus leachate will depend on natural precipitation and water used for dust suppression. The division between runoff and leachate will depend on the drainage systems and details in the laydown areas. All outdoor ferrous metal recycling activities have the potential to contaminate ground water or surface water, either by the escape of leachate past the barrier systems, if any, or by runoff which escapes the delineated work area.

Several processes in metal recovery and recycling involve process water for cooling or dust control. Wet cleaning systems remove basic oxygen furnace (BOF) dust in a slurry form. Ferrous metal mills may use water or water based fluids for pickling or cooling. End use manufacturing processes often use water for cleaning or cooling.

Byproduct materials from ferrous metal production also require substantial quantities of water for processing. Ground granulated blast-furnace slag (GGBFS) production requires rapid water quenching to control slag crystal growth and particle size. By contrast, air-cooled blast furnace slag (ACBFS) production mechanically crushes and screens the larger slag skulls resulting from the slower cooling process. Water is used to suppress dust in the crushing operation. Slag piles are intentionally exposed to precipitation to hydrate residual lime and therefore reduce potential future volumetric instability in construction applications. Uses of slag in portland cement concrete products include road base courses and structural building concrete, including residential slabs and foundations. Slag asphalt is also used as a pavement alternative to standard hot mix asphalt.

Ingestion of drinking water from onsite ground-water wells or surface water sources has not been included as a Non-Licensed Facility Worker exposure pathway. Potential Non-Licensed Facility Worker exposures from runoff or leachate generated by contact with ferrous metal scrap are expected to be limited to oils and greases on non-structural components such as pumps and other machinery. Potential Non-Licensed Facility Worker process water exposures are limited to dermal exposure through direct skin contact.

General Public Exposure

Potential General Public exposure pathways include the use of ground water or surface water as a drinking water supply from a source located near the site of activities associated with handling of scrap ferrous metal at the licensee facility site; recycling of the scrap into finished recycled ferrous metal; processing of the finished ferrous metal into end use products; processing and use of byproducts generated by recycling processes; and disposal of wastes generated by recycling processes.

Potential non-radiological General Public exposures from ferrous metal include ingestion of water containing contamination from oils and grease, and containing elevated levels of iron, manganese, or other metals. Standard monitoring of public drinking water supplies limits the risk of exposure to elevated levels of these constituents. Since significant exposure by direct runoff flows into surface waters is precluded by NPDES controls, the remaining pathway involves ground-water flow to a surface water body. Private ground water wells or private surface water supplies fed from a ground water source remain potential exposure pathways for ingestion.

Ecological Exposure

Potential ecological exposure pathways for ferrous metal include the existence of aquatic or riparian animals living in or along surface water bodies at or near the site of activities associated with handling of scrap ferrous metal at the licensee facility site; recycling of the scrap into finished recycled ferrous metal; processing of the finished ferrous metal into end use products; processing and use of byproducts generated by recycling processes; and disposal of wastes generated by recycling processes.

Aquatic and riparian animals face potential non radiological exposure to water containing elevated levels of metals, such as manganese and chromium. Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway is ground-water flow to a surface water body.

1.3 Aluminum

Potential exposure pathways for the No Action and Unrestricted Release Alternatives for aluminum are based on the anticipated end uses for recycled aluminum and the anticipated processes that would be used in recycling aluminum. The following sections describe the affected environment for potential Non-Licensed Facility Worker, General Public, and ecological exposures in the secondary aluminum industry.

Non-Licensed Facility Worker Exposure

Potential Non-Licensed Facility Worker exposure pathways include activities associated with handling of scrap aluminum at the licensee facility site; recycling of the scrap into finished recycled aluminum; processing of the finished aluminum into end use products (e.g., automobiles, home appliances, building materials); installation of end use products (e.g., building

materials); processing of byproducts (e.g., furnace dross) generated by recycling processes; and disposal of wastes (e.g., baghouse dust) generated by recycling processes.

Locations used for material handling at the licensee facility or laydown areas for scrap stockpiling, segregation, loading, unloading, or other handling at the recycling facility have the potential to generate both leachate and surface water runoff. Secondary aluminum processing includes scrap shredding; scrap drying, delacquering, or decoating; thermal chip drying, furnace operations, in-line fluxing; and dross cooling.

General Public Exposure

Potential General Public exposure pathways include the use of ground water or surface water as a drinking water supply from a source located near the site of activities associated with the handling of scrap aluminum at the licensee facility site; recycling of the scrap into finished recycled aluminum; processing of the finished aluminum into end use products; installation of end use products; processing of byproducts generated by recycling processes; and disposal of wastes generated by recycling processes.

Potential non-radiological General Public exposures include ingestion of leachate-contaminated water containing elevated levels of lead, copper, cadmium, and other metals. Standard monitoring of public drinking water supplies limits the risk of exposure to elevated levels of these constituents. Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway involves ground-water flow. Private ground water wells or private surface water supplies fed from a ground water source remain potential exposure pathways for ingestion.

Ecological Exposure

Potential ecological exposure pathways for aluminum include the existence of aquatic or riparian animals living in or along surface water bodies at or near the site of activities associated with the handling of scrap aluminum at the licensee facility site; recycling of the scrap into finished recycled aluminum; processing of the finished aluminum into end use products; installation of end use products; processing of byproducts generated by recycling processes; and disposal of wastes generated by recycling processes. Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway is ground-water flow to a surface water body.

1.4 Copper

Potential exposure pathways for the No Action and Unrestricted Release Alternatives for copper are based on the anticipated end uses for recycled copper and the anticipated processes that would be used in recycling copper. The following sections describe the affected environment for potential Non-Licensed Facility Worker, General Public, and ecological exposures.

Non-Licensed Facility Worker Exposure

Potential Non-Licensed Facility Worker exposure pathways for copper include activities associated with the handling of scrap copper at the licensee facility site; recycling of the scrap into finished recycled copper; processing of the finished copper into end use products (e.g., water pipes); processing of byproducts (e.g., furnace slag) generated by recycling processes; and disposal of wastes (e.g., baghouse dust) generated by recycling processes.

Non-radiological water-related potential Non-Licensed Facility Worker exposures from copper scrap are limited to dermal exposure.

General Public Exposure

Potential General Public exposure pathways for copper include the use of ground water or surface water as a drinking water supply from a source located near the site of activities associated with the handling of scrap copper at the licensee facility site; recycling of the scrap into finished recycled copper; processing of the finished copper into end use products; processing of byproducts generated by recycling processes; and disposal of wastes generated by recycling processes. Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway involves ground-water flow. Private ground-water wells or private surface water supplies fed from a ground water source remain potential exposure pathways for ingestion.

Ecological Exposure

Potential ecological exposure pathways for copper include the existence of aquatic or riparian animals living in or along surface water bodies at or near the site of activities associated with the handling of scrap copper at the licensee facility site; recycling of the scrap into finished recycled copper; processing of the finished copper into end use products; processing of byproducts generated by recycling processes; and disposal of wastes generated by recycling processes. Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway is ground-water flow to a surface water body.

1.5 Trash

This analysis assumes that the disposition of trash under all alternatives would be limited to disposal, and that there are no other anticipated end uses for trash. Specifically, recycling options have been excluded from this analysis because it is unlikely that trash from operations would be recycled. Therefore, there are no potential exposure pathways under the No Action and Unrestricted Release Alternatives other than those described for the EPA/State-Regulated Disposal Alternative in Section 2.

2. Exposure Pathways for the EPA/State-Regulated Disposal Alternative

The affected environment for the EPA/State-Regulated Disposal Alternative includes all waters which come into contact with the materials released from a licensed site during the release and

handling of the materials on the site; transportation of the materials to a disposal facility; processing or placement of the materials at the disposal facility; and subsequent operation of the disposal facility. The analysis begins at the point that the material has been released. The disposal facilities considered under the EPA/State-Regulated Disposal Alternative are limited to EPA/State-regulated Subtitle D solid waste landfills, and EPA/State-regulated solid waste incinerators for trash.

2.1 Subtitle D Landfill Disposal

Disposal in EPA/State-regulated Subtitle D landfills presents similar potential non-radiological exposure pathways for concrete, ferrous metal, aluminum, copper, and trash; however, the nature of the potential exposures depends on the contaminants present in each material. This section describes the affected environment for potential Non-Licensed Facility Worker, General Public, and ecological exposures.

Potential pathways for disposal in an EPA/State-regulated Subtitle D landfill include runoff or leachate from material piles at the licensee facility during sorting, stockpiling, handling, and loading activities; leachate collected at the material disposal facility; and collected leachate escaping and contaminating surface waters. Landfill leachate escaping an engineered landfill barrier system and entering ground water is not considered a significant pathway.

The above pathways present potential exposures risks from leachate or runoff during processing or in connection with disposal. Both runoff and leachate may eventually reach surface water bodies and escape beyond the limits of the delineated work area, i.e. the operational or physical limits bounding Non-Licensed Facility Worker exposures.

Subtitle D of the Resource Conservation and Recovery Act (RCRA) of 1976 (42 USC 82, Subchapter IV) authorized regulation of State or regional solid waste plans. RCRA Subtitle D covers solid wastes, including hazardous wastes specifically excluded from RCRA Subtitle C. The promulgated solid waste regulations appear in 40 CFR Part 190 to 282, with Part 257 (Criteria For Classification Of Solid Waste Disposal Facilities And Practices) and Part 258 (Criteria For Municipal Solid Waste Landfills) specifying the siting, design, operational, monitoring, and closure requirements. Subtitle D landfills that receive or have received any industrial waste from facilities requiring an NPDES discharge permit are themselves required to have an NPDES discharge permit. Subtitle D landfills have additional restrictions on run-on and run-off control, discharges to surface water bodies, and contamination of ground water.

Non-Licensed Facility Worker Exposure

For disposal in an EPA/State-regulated Subtitle D landfill, potential Non-Licensed Facility Worker non-radiological exposure pathways involving water resources for concrete, ferrous metal, aluminum, copper, and trash result from activities associated with release and disposal of these materials. These include activities associated with the handling of the materials at the licensee facility site, and placement and storage of the materials at an EPA/State-regulated Subtitle D landfill. Potential exposure pathways involving the transportation of materials are not considered significant.

Non-radiological water-related potential Non-Licensed Facility Worker exposures are limited to dermal exposure to leachate or runoff water. Leachate or runoff from aluminum or copper is not expected to cause skin irritation. Leachate or runoff from concrete may have elevated pH and cause irritation or rashes due to its caustic nature. Leachate or runoff from ferrous metal may contain oils or greases which can cause skin irritation following prolonged exposure. The precise characteristics of the leachate or runoff from trash will depend on the components of the trash, but may be similar to leachate from municipal solid waste. Since the contact time is hours or days, instead of months or years, the contaminant concentrations would be much lower. Leachate and runoff from trash piles is apt to contain more biological pathogens.

Municipal solid waste landfill leachates characteristically exhibit slight acidity (pH>4.5), and contain elevated levels of ammonia, chlorides, zinc, copper, cadmium, lead, nickel, chromium, and mercury. Organic compounds detected in Subtitle D landfill leachate include organic acids, ketones, aromatic compounds, chlorinated aromatic compounds, ethers, phthalates, halogenated aliphatic compounds, alcohols, amino-aromatic compounds, nitro-aromatic compounds, phenols, heterocyclic compounds, pesticides, sulfur substituted aromatic compounds, polyaromatic hydrocarbons, polychlorinated biphenyls, and organophosphates (Reinhart et al. 1998). In sufficient concentration, several of these can cause an acute skin reaction. In lower concentrations, compounds such as PCBs, pesticides, and organophosphates can cause serious chronic health problems.

General Public Exposure

For disposal in an EPA/State-regulated Subtitle D landfill, potential General Public non-radiological exposure pathways involving water resources for concrete, ferrous metal, aluminum, copper, and trash are based on the activities associated with release of these materials at the licensee facility, and disposal of these materials in an EPA/State-regulated Subtitle D landfill. These pathways include the use of ground water or surface water as a drinking water supply from a source located near the site of activities associated with the handling of the materials at the licensee facility site, and placement and storage of the materials at the landfill/disposal facility. Ingestion of drinking water from ground-water wells or surface water sources along transportation routes has not been included as a General Public pathway.

Potential non-radiological, water-related, General Public exposures from concrete material piles include ingestion of water with high pH, and perhaps elevated levels of calcium, aluminum, or iron. Exposures from ferrous metal material piles include ingestion of water containing contamination from oils and grease, and containing elevated levels of iron, manganese, or other metals. The aluminum and copper scrap is not anticipated to be contaminated with oils, grease, or other hazardous substances. The composition of runoff or leachate from trash is unknown, but can be expected to contain harmful contaminants. Leachate from landfills may contain concentrated metals, and hazardous organic and inorganic compounds. Standard monitoring of public drinking water supplies limits the risk of exposure to elevated levels of harmful constituents. Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway involves ground water. Private ground water wells or private surface water supplies fed from a ground water source remain potential exposure pathways for ingestion.

Ecological Exposure

For disposal in an EPA/State-regulated Subtitle D landfill, potential ecological non-radiological exposure pathways involving water resources for concrete, ferrous metal, aluminum, copper, and trash are based on the activities associated with release of these materials at the licensee facility, and disposal of these materials in an EPA/State-regulated Subtitle D landfill. The potential pathways include exposure of aquatic or riparian animals living in or along surface water bodies at or near the site of activities associated with the handling of the materials at the licensee facility site, and placement and storage of the materials at the landfill/disposal facility. Exposure along transportation routes has not been included as an ecological pathway.

Aquatic and riparian animals face potential non-radiological exposure to runoff or leachate from material piles containing high pH from concrete, oils and greases from ferrous metal, and various organic and inorganic compounds from trash. Aluminum and copper scrap is not anticipated to be contaminated with oils, grease, or other hazardous substances. Leachate from landfills may contain concentrated metals, and hazardous organic and inorganic compounds. Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway is ground-water flow to a surface water body. Potential ecological exposures to ground water extracted from a well and used for irrigation are not considered significant.

2.2 EPA-Regulated Incineration of Trash

Potential exposure pathways for trash are based on the anticipated processes that would be used in disposing of trash in an EPA/State-regulated incineration facility. This section describes the affected environment related to incineration of trash for potential Non-Licensed Facility Worker, General Public, and ecological exposures involving water resources.

The EPA regulations pertaining to incineration, 40 CFR Part 60 - Standards of Performance for New Stationary Sources, deal primarily with air emissions. 40 CFR Part 240 - Guidelines for the Thermal Processing of Solid Wastes, Section 240.204-1 additionally requires that all waters discharged by a solid waste thermal processing facility "shall be sufficiently treated to meet the most stringent of applicable water quality standards, established in accordance with or effective under the provisions of the Federal Water Pollution Control Act, as amended."

Solid waste combustion facilities typically generate process wastewater from the tipping floor runoff system, pollution control systems, and ash quenching. These process wastewaters can often be recycled for ash quenching. Typical facilities use a few gallons per ton of waste burned (EPA 1995).

Non-Licensed Facility Worker Exposure

Potential Non-Licensed Facility Worker exposure pathways for EPA/State-regulated incineration of trash include activities associated with release and combustion of the trash. Incinerator ash would subsequently be disposed in an ash landfill.

Runoff and leachate from trash could contain many of the same contaminants as Subtitle D landfill leachate, but since the contact time is hours or days, instead of months or years, the contaminant concentrations are much lower. Leachate and runoff from trash piles is apt to contain more biological pathogens.

General Public Exposure

Potential General Public exposure pathways for EPA/State-Regulated Incinerator disposal of trash include activities associated with release and combustion of trash in an incinerator. Incinerator ash would subsequently be disposed in an ash landfill.

Standard monitoring of public drinking water supplies limits the risk of exposure to elevated levels of harmful constituents. Private ground water wells or private surface water supplies fed from a ground water source remain potential exposure pathways for ingestion.

Ecological Exposure

Potential non radiological ecological exposure pathways involving water resources for trash incineration include the exposure of aquatic or riparian animals living in or along surface water bodies at or near the site of activities associated with release, combustion of trash in an incinerator, and subsequent disposal of the incinerator ash in an ash landfill.

Leachate or runoff from trash piles at the licensee facility may pick up harmful contaminants. Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway involves ground water. Ground-water contamination at incineration sites has proved rare.

3. Exposure Pathways for the LLW Disposal Alternative

The affected environment for the LLW Disposal Alternative includes all waters which come into contact with materials released from licensed facilities, including release and handling of the materials on the site; transportation of the materials to a LLW disposal facility; and placement of the materials at the disposal facility. The analysis begins at the point that the material has been released. LLW disposal facility regulations appear in 10 CFR Part 61.

The LLW Disposal Alternative presents non-radiological exposure pathways similar to those discussed for EPA/State-regulated Subtitle D landfills, but the performance of the leakage barriers, the leachate management system, and the operational practices may differ. Potential exposure pathways include runoff or leachate from material piles at the licensee facility during sorting, stockpiling, handling, and loading activities; leachate collected at the disposal facility; and collected leachate escaping and contaminating surface waters.

Potential non-radiological exposure pathways for the EPA/State-Regulated Disposal Alternative and LLW Disposal Alternative for concrete, ferrous metal, aluminum, copper, and trash are similar; but the nature of the potential exposures depends on the contaminants present in each

material. This section describes the affected environment for potential Non-Licensed Facility Worker, General Public, and ecological exposures.

Non-Licensed Facility Worker Exposure

Potential Non-Licensed Facility Worker (i.e., truck drivers) non-radiological exposure pathways involving water resources for the LLW Disposal Alternative for concrete, ferrous metal, aluminum, copper, and trash are based on the activities associated with the disposal of these materials in an LLW disposal facility. This includes activities associated with the handling, placement, and storage of the materials at the licensed disposal facility. Potential water-related Non-Licensed Facility Worker exposure pathways involving the transportation of materials are not considered significant.

Non-radiological water-related potential Non-Licensed Facility Worker exposures are limited to contact with leachate or runoff water. However, truck drivers would not be assumed to to be exposed to either leachate or runoff water. Leachate or runoff from aluminum or copper is not expected to cause skin irritation.

General Public Exposure

Potential General Public non-radiological exposure pathways involving water resources for concrete, ferrous metal, aluminum, copper, and trash are based on the activities associated with release, and disposal of these materials in LLW disposal facility. These pathways include the use of ground water or surface water as a drinking water supply from a source located near the site of activities associated with the handling of the materials at the licensee facility site, and placement and storage of the materials at the landfill/disposal facility. Ingestion of drinking water from ground-water wells or surface water sources along transportation routes has not been included as a General Public pathway.

Potential non-radiological, water-related, General Public exposures from concrete material piles include ingestion of water with high pH, and perhaps elevated levels of calcium, aluminum, or iron. Exposures from ferrous metal material piles include ingestion of water containing contamination from oils and grease, and containing elevated levels of iron, manganese, or other metals. The aluminum and copper scrap is not anticipated to be contaminated with oils, grease, or other hazardous substances. The composition of runoff or leachate from trash is unknown, but can be expected to contain harmful contaminants. Leachate from landfills may contain concentrated metals, and hazardous organic and inorganic compounds. Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway is ground-water flow to a surface water body. Standard monitoring of public drinking water supplies limits the risk of exposure to elevated levels of harmful constituents. Private ground water wells or private surface water supplies fed from a ground water source remain potential exposure pathways for ingestion.

Ecological Exposure

For disposal in LLW disposal facility, potential ecological non-radiological exposure pathways involving water resources for concrete, ferrous metal, aluminum, copper, and trash are based on the activities associated with release of these materials at the licensee facility, and disposal of these materials in a LLW disposal facility. The potential pathways include exposure of aquatic or riparian animals living in or along surface water bodies at or near the site of activities associated with the handling of the materials at the licensee facility site, and placement and storage of the materials at the landfill/disposal facility. Exposure along transportation routes has not been included as an ecological pathway.

Aquatic and riparian animals face potential non-radiological exposure to runoff or leachate from material piles containing high pH from concrete, oils and greases from ferrous metal, and various organic and inorganic compounds from trash. Aluminum and copper scrap is not anticipated to be contaminated with oils, grease, or other hazardous substances. Leachate from landfills may contain concentrated metals, and hazardous organic and inorganic compounds.

NRC regulations for disposal facility performance objectives (10 CFR 61.41) address only radiological discharge restrictions. However, 10 CFR 51.10 states "In accordance with section 511(c)(2) of the Federal Water Pollution Control Act (86 Stat. 893, 33 U.S.C 1371(c)(2)) the NRC recognizes that responsibility for Federal regulation of nonradiological pollutant discharges into receiving waters rests by statute with the Environmental Protection Agency." Since significant exposure by direct runoff flows into surface waters is excluded by NPDES controls, the remaining pathway is ground-water flow to a surface water body. Potential ecological exposures to ground water extracted from a well and used for irrigation are not considered significant.

4.0 Affected Environment

This section describes the affected environment under all the Alternatives. In addition to workers and the general public, ecological receptors are also addressed.

Surface Water

The affected environment for surface water includes Licensed and Non-Licensed Facility Workers potentially exposed to wastewater, runoff, or collected leachate either created by direct contact with the materials released from a licensed site during the generation, handling, processing, usage, or disposal of the released materials; or created by direct contact with any byproducts, end use products, or waste products derived from the released materials. Activities which may generate wastewater, runoff, or leachate include material handling and stockpiling at licensed facilities; material handling and stockpiling at recycling facilities; recycling processing at manufacturing facilities; end use of recycled concrete aggregate or ferrous metal slag; disposal in an EPA/State-regulated Subtitle D landfill; disposal of ash from an EPA/State-regulated incinerator; and disposal in a LLW disposal facility.

For the purposes of this discussion, wastewater, runoff, and leachate include flows that are generated and handled in engineered environments, effectively separate from the natural environment, and are considered to be controlled flows. In general, these industrial discharges require NPDES permits under 40 CFR Part 122. Wastewater refers to water or water-based fluids directly used in the material processing (e.g. cooling or wash water) and either reused or discharged. Runoff refers to water which comes into contact with the materials (e.g. via precipitation or dust control spray) and is later collected in the facility stormwater system and handled as storm water discharge associated with industrial activity as defined by 40 CFR 122.26(b)14. Leachate refers to water which comes into contact with and percolates through the materials, and which may be retained by an engineered barrier system (e.g. landfill liner), collected, processed and discharged. These wastewater, runoff, and collected leachate discharges may be treated onsite, sent to a Publicly Owned Treatment Facility (POTW) or other offsite treatment facility, or discharged directly into surface waters in accordance with each facility's point source discharge permits. Any potential non-radiological exposures following treatment and post-treatment discharge are considered insignificant.

The affected environment for surface water also includes the General Public and Ecological Receptors potentially exposed to surface water bodies into which wastewater, runoff, or collected leachate flows or is discharged, either directly or through a ground-water pathway. Natural or manmade surface water bodies may be either offsite or onsite but lie outside the area of industrial activity. NPDES stormwater restrictions preclude contaminated discharges proceeding directly into surface waters in sufficient volume, frequency, or concentration to significantly impact such waters, therefore the only remaining exposure pathway is ground-water flow to a surface water body. A surface water body fed by impacted ground water is unlikely to cause non-drinking water impacts to the General Public due to dilution or, in its absence, due to the limited expected exposure from a stagnant water body. The affected environment for surface water includes aquatic or riparian animals or vegetation living in or along ground-water fed surface water bodies at or near the site of activities associated with the release, handling, processing, usage, or disposal of the released materials.

Concrete

All Alternatives generate potential surface water exposure pathways from concrete handling, stockpiling, and loading at the licensee facility and disposal of all or part of the concrete in LLW disposal facilities. All Alternatives except the LLW Disposal Alternative generate additional potential surface water exposure pathways from concrete disposal in an EPA/State-regulated landfill. The No Action, Unrestricted Release, and Limited Dispositions Alternatives generate additional potential surface water exposure pathways from concrete handling and stockpiling at recycling facilities, recycling processing, and concrete end use activities.

All outdoor locations used for concrete handling at the licensee facility or laydown areas for concrete stockpiling, segregation, loading, unloading, or other handling at the recycling facility, have the potential to generate both leachate and surface water runoff. The total volume of runoff and leachate will depend on natural precipitation and water used for dust suppression. The division between runoff and leachate will depend on the drainage systems and details in the laydown areas.

Under the No Action, Unrestricted Release, and Limited Dispositions Alternatives, activities may include crushing, screening, and recycling of the concrete into aggregate and subsequent reuse, and disposal of concrete dust generated from concrete recycling. Potential uses for recycled concrete aggregate include general fill, road base material, aggregate for new concrete and asphalt mixes. Crushing of the concrete is also anticipated to occur under the EPA-Regulated Disposal Alternative and the LLW Disposal Alternative, but only to the extent required to facilitate transportation.

Ferrous Metal

All Alternatives generate potential surface water exposure pathways from ferrous metal handling, stockpiling, and loading at the licensee facility and disposal of all or part of the ferrous metal in LLW disposal facilities. All Alternatives except the LLW Disposal Alternative generate additional potential surface water exposure pathways from ferrous metal disposal in an EPA/State-regulated landfill. The No Action and Unrestricted Release Alternatives generate additional potential surface water exposure pathways from ferrous metal handling and stockpiling at recycling facilities, recycling processing, and ferrous metal end use activities.

Potential surface water exposure pathways for Licensed and Non-Licensed Facility Workers include exposure to runoff and collected leachate during scrap ferrous metal handling and stockpiling activities. These activities may occur at the licensed facility site or off-site. All outdoor locations used for material handling at the licensee facility or off-site; or laydown areas for scrap stockpiling, segregation, loading, unloading, or other handling at the recycling facility have the potential to generate both leachate and surface water runoff. The total volume of runoff plus leachate will depend on natural precipitation. The division between runoff and leachate will depend on the drainage systems and details in the laydown areas.

Potential surface water exposure pathways for Workers at Non Licensed Facilities also include activities associated with recycling of scrap into finished recycled ferrous metal; processing of the finished ferrous metal into end use products (e.g., automobiles, home appliances, building materials); installation of end use products (e.g., building materials); processing and use of byproducts (e.g., furnace slag, EAF baghouse dust) generated by recycling processes; and disposal of wastes (e.g., EAF baghouse dust) generated by recycling processes.

Several processes in ferrous metal recovery and recycling involve process water for cooling or dust control. Wet cleaning systems remove BOF or EAF dust in a slurry form. Ferrous metal mills may use water or water based fluids for pickling or cooling. End use manufacturing processes often use water for cleaning or cooling.

Byproduct materials from ferrous metal production also require substantial quantities of water for processing. Ground granulated blast-furnace slag production requires rapid water quenching to control slag crystal growth and particle size. By contrast, air-cooled blast furnace slag production mechanically crushes and screens the larger slag skulls resulting from the slower cooling process. Water is used to suppress dust in the crushing operation. Slag piles are intentionally exposed to precipitation to hydrate residual lime and therefore reduce potential future volumetric instability in construction applications. Uses of slag in portland cement concrete products include road base

courses and structural building concrete, including residential slabs and foundations. Slag asphalt is also used as a pavement alternative to standard hot mix asphalt.

Trash

All the Alternatives generate potential surface water exposure pathways from trash handling, stockpiling, and loading at the licensee facility and disposal of all or part of the trash in LLW disposal facilities. All Alternatives except the LLW Disposal Alternative generate additional potential surface water exposure pathways from trash disposal in an EPA/State-Regulated Subtitle D landfill or disposal of ash from an EPA/State-regulated incinerator.

This analysis assumes that the disposition of trash under all alternatives would be limited to disposal, and that there are no other anticipated end uses for trash. Specifically, recycling options have been excluded from this analysis because it is unlikely that trash would be recycled. The potential surface water exposure pathways under the No Action, Unrestricted Release, and Limited Dispositions Alternatives are the same as those described for the EPA-Regulated Disposal Alternative.

The surface water affected environment for trash includes all runoff and collected leachate derived from waters which come into contact with the trash released from a licensed site during the release and handling of the trash on the site; transportation of the trash to a disposal facility; processing or placement of the trash at the disposal facility; and subsequent operation of the disposal facility. The disposal facilities considered are limited to EPA-regulated Subtitle D solid waste landfills, EPA-regulated solid waste incinerators for trash, and LLW disposal facilities.

Potential surface water exposure pathways for disposal in an EPA/State-regulated Subtitle D landfill or a LLW disposal facility include runoff or leachate from trash piles at the licensee facility during sorting, stockpiling, handling, and loading activities; and collected leachate at the material disposal facility.

Potential Non-Licensed Facility Worker exposure pathways involving surface water for EPA/State-regulated incineration of trash include activities associated with generation and combustion of the trash. Solid waste combustion facilities typically generate process wastewater from the tipping floor runoff system, pollution control systems, and ash quenching. Process wastewater can often be recycled for ash quenching, reducing the total water volume required. Typical facilities use a few gallons per ton of waste burned (EPA 1995). Incinerator ash would subsequently be disposed in an ash landfill. Ash landfill leachate could contribute to additional surface water exposures.

Ground Water

Ground water refers to any water in the soil interstitial pore spaces, including water found in phreatic aquifers, confined aquifers, and the vadose zone, but excluding pore water in any soil excavated. Process wastewater, surface runoff, or leachate which is not retained by or escapes barrier systems and subsequently seeps into the soil becomes ground water for the purposes of this discussion. The affected environment for ground water includes Workers at Licensed

Facilities, Workers at Non Licensed Facilities, the General Public, and Ecological Receptors potentially exposed to compromised ground water. Ground water which discharges into a surface water body is considered surface water and has been previously discussed. Drinking water issues, even if the water is obtained from ground-water wells, are discussed separately.

Ground-water wells may be used at Licensed Facilities or Non-Licensed Facilities as a source for process water or dust suppression water. Due to mixing and dilution with unaffected ground water, concentrations of contaminants in extracted ground water will be lower than the concentrations in the escaped wastewater, runoff, and leachate.

Ground-water wells may be used beyond the boundaries of Licensed Facilities and Non Licensed Facilities for agricultural or residential water supply. Standard monitoring of public water supplies limits the risk of exposure to elevated levels of harmful constituents. However, private ground-water wells remain potential exposure pathways. The General Public faces potential non-drinking water exposures to affected ground water through dermal contact only. Ground water has little to no ecological influence until it is extracted from a well.

Drinking Water

The affected environment for drinking water includes Workers at Licensed Facilities, Workers at Non Licensed Facilities, and the General Public. Process wastewater, surface runoff and leachate have the potential to escape their engineering controls and seep into the underlying soil, becoming ground water. This ground water may be extracted from wells, or it may discharge into surface water bodies. Ground water or surface water bodies may be used as sources for drinking water.

Standard monitoring and treatment of public drinking water supplies limits the risk of exposure to elevated levels of contaminants from the Alternatives. Ingestion of drinking water from onsite ground-water wells has not been included as an exposure pathway for Workers at Licensed Facilities or Workers at Non Licensed Facilities. Wells on industrial property regularly serving more than 25 persons are regulated as public water supplies. Drinking water wells on industrial property, especially in industries with potential sources of contamination, are usually monitored regularly for water quality and are not considered to be a significant exposure pathway.

Ingestion of drinking water from private ground-water wells or private surface water supplies may lead to potential exposures. Since significant exposure by direct runoff flows into surface waters would be precluded by NPDES controls, only surface water bodies fed from a ground-water source are potential exposure pathways. Surface water bodies with low enough turnover and dilution to be impacted by ground-water flow would generally be unattractive candidates for a drinking water source. In areas of the country where alternative surface water supplies are rare, precipitation is also generally low, so initial leachate and runoff contamination of ground-water supplies will be minimal.

5.0 Environmental Consequences

Environmental consequences for Workers at Licensed Facilities and Workers at Non Licensed Facilities are limited to dermal exposure to surface water in the form of process wastewater, runoff, and collected leachate. There are not anticipated to be any significant ground-water or drinking water impacts to workers.

The General Public does not face any significant environmental consequences from any of the Alternatives related to surface water. The General Public may experience impacts from dermal exposure to ground water extracted from a private well, or ingestion of drinking water from a private ground-water well or private ground-water fed surface water body. However such exposure is expected to be minimal due to the low probability of the simultaneous occurrence of the combination of factors required, e.g. high runoff or leachate volumes, high runoff or leachate concentrations, limited ground-water dilution, the presence of a drinking water well downgradient of and close to the runoff or leachate source, and a combination of ground-water gradient and permeability conducive to ground-water mobility.

Ecological receptors only face potential environmental consequences from surface water in ground-water fed surface water bodies. Ground water extracted from a well and used for agricultural or residential irrigation is not considered a significant pathway for ecological impacts.

Water quality effects are primarily associated with point source and area source water discharges from the storage, handling, and processing of solid materials. For the No Action and Unrestricted Release Alternatives, the effects are generated mostly by runoff discharges from rubblization of concrete and runoff and process wastewater discharges from recycling of ferrous metal. The incremental quantity of these discharges would be small as compared to the overall amount of discharges generated from the total amount of concrete and ferrous metal being recycled annually in the U.S. The impact on water quality would be equally small. Similarly, the quantity of additional leachate and potential effects on ground water associated with disposal of solid materials under the EPA/State-Regulated Disposal and LLW Disposal Alternatives would be small compared with the overall amount of leachate being generated annually by these facilities. Therefore the overall effects on water quality associated with all of the alternatives would be small when compared with other sources of discharges. The quantities of materials released and therefore the volumes of surface water potentially impacted will differ between the alternatives. The contaminant concentrations in impacted waters may also be higher in scenarios in which greater volumes of material are released.

5.1 No Action Alternative

The surface water, ground water, and drinking water environmental consequences for the No Action Alternative are identical in nature to those discussed below under the Unrestricted Release Alternative.

5.2 Unrestricted Release Alternative

The Unrestricted Release Alternative includes all activities associated with material handling, stockpiling, and loading at licensee facilities; material unloading, handling, stockpiling, and loading at recycling facilities; transportation of released materials; processing at recycling or manufacturing facilities; handling and utilization of end use products; handling and disposal of byproducts and waste products from processing activities; and direct disposal of released materials.

5.2.1 Surface Water

Activities under the Unrestricted Release Alternative generate surface water runoff or leachate, or use water directly in recycling processes to convert the materials into marketable products. The waters which contact the materials or their byproducts have the potential to acquire contaminants or deleterious characteristics. These waters may eventually contact Workers at Licensed Facilities, Workers at Non Licensed Facilities, the General Public, or ecological receptors.

Concrete

Surface water impacts related to concrete under the Unrestricted Release Alternative stem from runoff or leachate generated by precipitation or water used for dust suppression. The precipitation becomes alkaline through contact with the concrete rubble or its residual byproducts. The increased alkalinity of the water depends on the specific surface area of the concrete and the duration of the water-concrete contact. Runoff would remain in contact with the concrete rubble piles for minutes or hours. Leachate could accumulate and concentrate for weeks or months.

This analysis considers four likely stages in the concrete recycling process:

- Concrete separated from other materials, aggregated, and stockpiled;
- Concrete crushed and screened to create a more useable product, or crushed to facilitate transportation;
- Crushed concrete recycled as concrete aggregate and concrete rubble as fill material; and
- Concrete dust from the crushing operation disposed in a landfill.

The quantity of runoff or leachate generated depends primarily upon the amount of precipitation and the areal extent of the piles of concrete rubble, recycled concrete aggregate, or concrete dust. The impact is on water quality, specifically the pH of the water. The results for pH from reported NPDES discharges generally do not exceed 9.0, but higher values could exist prior to the discharge point. The pH of cement itself falls between 12 and 13. A leaching study of construction and demolition waste reports concrete leachate consistently with pH between 11 and 12 (Townsend 1998), which is strongly alkaline. Table H-1 provides estimates of the pH of the runoff and leachate waters for concrete for the Unrestricted Release Alternative.

Table H-1 Estimated pH for Concrete Runoff and Leachate - Unrestricted Release Alternative

Affected Waters	Exposure Location	Estimated pH
Material Generation		
Runoff from material piles	Licensee Facility	9.5
Leachate collected from material piles	Licensee Facility	11
Concrete Recycling		
Runoff from material piles	Recycling Facility	101
Leachate collected from material piles	Recycling Facility	11.51
Concrete End Use		
Runoff from Recycled Concrete Aggregate in road construction	Road Construction Site	9.5
Runoff from Recycled Concrete Aggregate in general fill	Area of fill	9.5
Concrete Dust Disposal		
Collected landfill leachate	Industrial Landfill	12

[1] Concrete at recycling facilities is assumed to have a greater specific surface area than concrete at the licensee facility due to additional crushing

Licensed and Non-Licensed Facility Workers may suffer acute and chronic skin impacts from contact with leachate waters. Normal human skin is slightly acidic with a pH between 4.5 and 5.5. Leachate with a pH of 11.5 is 1 million to 10 million times as alkaline as skin. Strongly alkaline material is caustic and corrosive to skin, eyes, and mucous membranes. Prolonged or repeated contact with runoff waters would produce less severe irritation due to the generally lower pH, but may still lead to chronic skin irritation. However, such exposure is unlikely to occur because workers would avoid contact with leachate or wear personal protective equipment in conducting activities.

End uses of recycled concrete aggregate such as road bed construction material, general fill, or other applications with a high specific surface area may continue to generate leachate or runoff with elevated pH. End uses which bind the recycled concrete aggregate in cement or asphalt would not produce such leachate or runoff from the aggregate itself.

Leachate or runoff that seeps into ground water and ultimately reaches a surface water body, especially a small pond, could raise the pH of the surface water body. Aquatic and riparian animals and vegetation face potential exposure to water containing pH in excess of 8 in surface water bodies impacted by high pH ground water. Waters with elevated pH depress biological activity, and pH in excess of 8 can be detrimental to fish. Reducing water with a pH of 12 to a pH of 8 would require dilution by a factor of 10,000. Nevertheless, such exposure is expected to be minimal due to the low probability of the simultaneous occurrence of the combination of factors required and the natural acidity of the majority of lakes and ponds.

There are no anticipated surface water impacts to the General Public from concrete-related activities.

Ferrous Metal

Surface water impacts related to ferrous metal under the Unrestricted Release Alternative stem from runoff or leachate generated by precipitation, and from ferrous metal recycling process wastewater discharges. Table H-2 identifies the contaminants of concern in the waters associated with various ferrous metalmaking activities.

Table H-2 Ferrous Metal Exposure Pathways for Surface Water – Unrestricted Release Alternative

Affected Waters	Exposure Location	Contaminants
Material Generation		
Runoff from material piles	Licensee Facility	oils and grease
Leachate collected from material piles	Licensee Facility	oils and grease
Scrap Recycling		
Runoff from scrap piles	Recycling Facility/Ferrous metal Mill	oils and grease
Leachate collected from scrap piles	Recycling Facility/Ferrous metal Mill	oils and grease
Blast furnace wastewater	Ferrous metal Mill	high pH, zinc
EAF Dust process wastewater	Ferrous metal Mill	lead, cadmium
EAF Dust stabilization wastewater	Ferrous metal Mill	lead, cadmium
Runoff from slag pile	Ferrous metal Mill	pH = 7.5 to 9.5
Leachate collected from slag pile	Ferrous metal Mill	pH = 8 to 11
Slag End Use		
Ground granulated blast-furnace slag or crushed slag cement production (runoff or process water)	Cement plant	high pH, metals
Ground granulated blast-furnace slag or crushed slag asphalt production (runoff or process water)	Asphalt plant	high pH, metals
Slag cement or slag asphalt in roads (runoff, dust suppression water)	Road Construction Site	high pH, metals
Air-cooled blast furnace slag for embankments and fills (runoff, dust suppression water)	Earthwork, landscaping site	high pH, metals
EAF Dust Secondary Processing		
EAF dust process wastewater	Processing facility	lead, cadmium
Residue disposal		
EAF dust landfill collected leachate	Industrial Landfill	lead, cadmium
Slag landfill collected leachate	Industrial Landfill	high pH, metals

Licensed and Non-Licensed Facility Workers may suffer skin disorders from contact with runoff or leachate waters from piles of scrap ferrous metal. The quantity of runoff or leachate generated during each process or activity depends primarily upon the amount of precipitation and the areal extent of the piles of ferrous metal scrap at the licensee facilities and recycling facilities. Runoff and leachate from ferrous metal scrap piles may contain oils and grease from nonstructural components such as pumps and other machinery. The oils and grease may cause skin irritation if the exposures are extended, but adherence to safe work practices and the use of personal protective equipment such as gloves and appropriate work clothing would minimize direct exposure.

Workers at Non-Licensed Facilities may suffer skin disorders from contact with runoff or leachate waters from ferrous metal slag or EAF baghouse dust. Ferrous metal slag leachate can have pH values as high as 11, which is strongly alkaline and can cause damage to skin, eyes, and mucous membranes. EAF baghouse dust can have high concentrations of zinc and other metals, but the impact would be limited by the peak expected annual production of 36 tons/year.

There are no anticipated surface water impacts to the General Public from ferrous metal-related activities.

Potential ecological impacts involving surface water for the Unrestricted Release Alternative for ferrous metal include the existence of aquatic or riparian animals or vegetation living in or along surface water bodies at or near the site of activities associated with handling of scrap ferrous metal at the licensee facility site; recycling of the scrap into finished recycled ferrous metal; processing of the finished ferrous metal into end use products; processing and use of byproducts generated by recycling processes; and disposal of wastes generated by recycling processes. Leachate or runoff that seeps into ground water and ultimately reaches a surface water body, especially a small pond, could raise the pH or metal content of the surface water body. Aquatic and riparian animals or vegetation face potential exposure to water containing elevated levels of metals, such as manganese and chromium. Waters with elevated pH depress biological activity, and pH in excess of 8 can be detrimental to fish. The low probability of the simultaneous occurrence of the combination of factors required to affect surface water chemistry through ground-water flow limits the potential for impacts from indirect discharges, and the mild acidity of the majority of lakes and ponds provides natural protection against the most likely impact, an increase in pH level.

Trash

The surface water impacts from trash for the Unrestricted Release Alternative are the same as those described for the EPA/State-Regulated Disposal Alternative.

5.2.2 Ground Water

Activities under the Unrestricted Release Alternative can impact through the escape of process wastewater, leachate, or runoff past engineering barriers and seepage into the soil.

Concrete

Licensed Facility and Non-Licensed Facility Workers are not anticipated to have any significant concrete-related non-drinking water impacts from ground water. It is unlikely that even workers routinely involved in activities involving sprayed water, such as dust suppression on concrete rubble piles, would suffer skin or eye irritation because the high volumes of water required for these activities would generally dilute to low levels any deleterious components in the small volumes of escaped runoff or leachate.

The General Public may face impacts from ground water extracted from residential wells and used for bathing or swimming. The pH of runoff and leachate from concrete-related activities varies from 9.5 to 12. Reducing ground water with a pH of 12 to a pH of 8.0 would require dilution by a factor of 10,000. The Center for Disease Control warns that swimming pool water with a pH above 8.0 may cause skin and eye irritation. Ground water that reaches a private well could exceed that standard, but the low probability of the simultaneous occurrence of the combination of factors required minimizes the risk of exposure.

Ferrous Metal

Licensed Facility and Non-Licensed Facility Workers are not anticipated to have any significant non-drinking water impacts from ground water. It is unlikely that even workers routinely involved in activities involving sprayed water, such as slag quenching, would suffer skin or eye irritation because the high volumes of water required for these activities would generally dilute to low levels any deleterious components in the small volumes of escaped runoff or leachate.

The General Public may face impacts from ground water extracted from residential wells and used for bathing or swimming. Leachate from slag may have a pH as high as 11. Reducing ground water with a pH of 11 to a pH of 8.0 would require dilution by a factor of 1,000. Swimming pool water with a pH above 8.0 may cause skin and eye irritation. Ground water that reaches a private well could exceed that standard, but the low probability of the simultaneous occurrence of the combination of factors required minimizes the risk of exposure.

Trash

This analysis assumes that the disposition of trash under all the Alternatives would be limited to disposal, and that there are no anticipated recycling or other end uses for trash because it is unlikely that trash would be recycled. Therefore, there are no potential exposure pathways under the Unrestricted Release Alternative for trash other than those described below for the EPA/State-Regulated Disposal Alternative.

5.2.3 Drinking Water

Licensed and Non-Licensed Facility Workers are not anticipated to have any significant drinking water impacts. Impacts to the General Public are discussed below.

Concrete

Potential General Public drinking water exposure pathways involving concrete related activities include the use of ground water, or surface water fed by ground-water flow, as a drinking water supply from a source located near the site of activities associated with handling of concrete at a licensee facility, handling of concrete at a recycling facility, recycling of the concrete as aggregate, end use of recycled concrete aggregate, disposal of concrete dust generated from concrete recycling, or direct disposal of concrete. Potential impacts include ingestion of water with high pH, and perhaps elevated levels of calcium, aluminum, or iron. Reducing water with a pH of 12, typical of concrete dust leachate, to the upper limit of the National Secondary Drinking Water Standards, pH = 8.5, would require dilution by a factor of over 3,000. Ground water that reaches a private well could exceed the standard, but General Public exposure to impacted drinking water from a private ground-water well or private ground-water fed surface water body is expected to be minimal due to the low probability of the simultaneous occurrence of the combination of factors required.

Ferrous Metal

Potential General Public exposure pathways involving water resources include the use of ground water or surface water as a drinking water supply from a source located near the site of activities associated with handling of scrap at the licensee facility site; recycling of the scrap into finished recycled product; processing of the finished material into end use products; processing and use of byproducts generated by recycling processes; and disposal of wastes generated by recycling processes. Potential impacts include ingestion of water containing contamination from oils and grease, and containing elevated levels of iron, manganese, or other metals. Reducing water with a pH of 11, typical of ferrous metal slag leachate, to the upper limit of the National Secondary Drinking Water Standards would require dilution by a factor of over 300. Ground water that reaches a private well could exceed the standard, but exposure to impacted drinking water from a private ground-water well or private ground-water fed surface water body is expected to be minimal due to the low probability of the simultaneous occurrence of the combination of factors required.

Trash

This analysis assumes that the disposition of trash under all Alternatives would be limited to disposal, and that there are no other anticipated end uses for trash. Specifically, recycling options have been excluded from this analysis. Therefore, there are no potential exposure pathways under the Unrestricted Release Alternative for trash other than those described below for the EPA/State-Regulated Disposal Alternative.

5.3 EPA/State-Regulated Disposal Alternative

Under the EPA/State-Regulated Disposal Alternative all of the potentially clearable concrete, ferrous metal, and trash would be disposed of in EPA/State-regulated Subtitle D landfills. Some or all of the trash could be disposed in EPA/State-regulated incinerators. These disposal options

are also available under the No Action, Unrestricted Release, and Limited Dispositions Alternatives.

5.3.1 Surface Water

Subtitle D Landfill Disposal of Concrete, Ferrous Metal, and Trash

Under the EPA/State-Regulated Disposal Alternative, released concrete, ferrous metal, and trash would be disposed in EPA/State-regulated Subtitle D landfills. Workers at Licensed Facilities would face similar surface water impacts during material generation, segregation, and stockpiling of ferrous metal at the licensee facility as those incurred under the Unrestricted Release Alternative. Concrete could have lower water-related impacts under the EPA/State-Regulated Disposal Alternative because less crushing and screening could be performed at the licensee facility than under the Unrestricted Release Alternative, reducing the specific surface area of the concrete rubble and the likelihood for pH impacts to runoff and leachate.

Surface water impacts to Workers at Licensed Facilities include contact with runoff or collected leachate from trash piles during handling, stockpiling, or loading activities. Surface water impacts to Workers at Non Licensed Facilities from trash are limited to contact with runoff produced during the processing or placement of the trash at the landfill and leachate collected during subsequent operation of the landfill.

The precise characteristics of the runoff from trash will depend on the components of the trash, but may be similar to leachate from municipal solid waste. Since the contact time for runoff is hours or days, instead of the months or years for leachate, the contaminant concentrations in runoff are expected to be much lower than the concentrations in leachate. Runoff from trash piles is apt to contain more biological pathogens than leachate.

Municipal solid waste landfill leachates characteristically exhibit slight acidity (pH>4.5), and contain elevated levels of ammonia, chlorides, zinc, copper, cadmium, lead, nickel, chromium, and mercury. Organic compounds detected in Subtitle D landfill leachate include organic acids, ketones, aromatic compounds, chlorinated aromatic compounds, ethers, phthalates, halogenated aliphatic compounds, alcohols, amino-aromatic compounds, nitro-aromatic compounds, phenols, heterocyclic compounds, pesticides, sulfur substituted aromatic compounds, polyaromatic hydrocarbons, polychlorinated biphenyls, and organophosphates (Reinhart et al. 1998). In sufficient concentration, several of these can cause an acute skin reaction. In lower concentrations, compounds such as PCBs, pesticides, and organophosphates can cause serious chronic health problems. However, such exposures are unlikely to occur because workers would avoid contact with leachate and wear personal protective equipment when conducting activities that could lead to leachate contact.

There are no anticipated surface water impacts to the General Public from EPA/State-regulated disposal of concrete, ferrous metal, or trash.

Potential ecological receptors include aquatic or riparian animals and vegetation living in or along surface water bodies at or near the site of activities associated with handling of materials at

the licensee facility site; and disposal of material in an EPA/State-regulated landfill. Leachate from landfills may contain concentrated metals, and hazardous organic and inorganic compounds. Leachate or runoff that seeps into ground water and ultimately reaches a surface water body, especially a small pond, could alter the pH of or introduce organic and inorganic compounds into the surface water body.

EPA/State-Regulated Incineration of Trash

The surface water impacts to Workers at Licensed Facilities from trash are the same whether the disposal destination is an EPA/State-regulated Subtitle D landfill disposal or an EPA/State-regulated incinerator, and include contact with runoff or collected leachate from trash piles during handling, stockpiling, or loading activities. Activities associated with EPA/State-regulated incineration of trash have different potential surface water impacts for Workers at Non Licensed Facilities. The process wastewater from the tipping floor runoff system contains many of the components found in MSW landfill leachate, but since the contact time is hours or days, instead of months or years, the contaminant concentrations are much lower. Tipping floor runoff water is apt to contain more biological pathogens than MSW leachate. Process wastewater from pollution control systems will develop acidic characteristics, primarily from SO_2 in the combustion gases. Extended dermal contact with these waters can cause skin irritation. Such exposures are unlikely to occur because workers would avoid contact with process wastewater and wear personal protective equipment when conducting activities that could lead to contact.

There are no anticipated surface water impacts to the General Public from EPA/State-regulated incineration of trash. Ground-water contamination at incineration sites has proven rare, so impacts to aquatic or riparian animals at or near ground-water fed surface water bodies are not expected.

5.3.2 Ground Water

Licensed and Non-Licensed Facility Workers are not anticipated to have any significant non-drinking water impacts from ground water. No activities associated with the handling, stockpiling, transportation, placement of trash in an EPA/State-regulated landfill, or placement of incinerator ash in an ash landfill would require the use of ground water. Solid waste combustion facilities typically use water for cleaning the tipping floor, pollution control systems, and ash quenching. Ground-water contamination at incineration sites has proved rare, so worker contact with ground water extracted for these uses is not expected to cause any significant impacts.

The General Public may experience non-drinking water ground-water impacts from water extracted from private residential wells located near licensee facilities, EPA/State-regulated Subtitle D landfills, or incinerator ash landfills. Standard landfill ground-water monitoring helps to reduce this risk. MSW landfill leachates characteristically contain elevated levels of ammonia, chlorides, zinc, copper, cadmium, lead, nickel, chromium, and mercury. Organic compounds detected in Subtitle D landfill leachate include organic acids, ketones, aromatic compounds, chlorinated aromatic compounds, ethers, phthalates, halogenated aliphatic compounds, alcohols, amino-aromatic compounds, nitro-aromatic compounds, phenols, heterocyclic compounds, pesticides, sulfur substituted aromatic compounds, polyaromatic hydrocarbons, polychlorinated

biphenyls, and organophosphates (Reinhart et al. 1998). In sufficient concentration, several of these can cause an acute skin reaction. In lower concentrations, compounds such as PCBs, pesticides, and organophosphates can cause chronic health problems. General Public dermal exposure to impacted water from a private ground-water well is expected to be minimal due to the low probability of the simultaneous occurrence of the combination of factors required.

5.3.3 Drinking Water

For disposal in an EPA-regulated Subtitle D landfill, potential General Public impacts are based on the use of a private ground-water or surface water source as a drinking water supply from a source located near the site of activities associated with the handling of the materials at the licensee facility site, placement and storage of the materials at the landfill, or placement of ash from trash incineration in a landfill.

The composition of runoff or leachate from trash varies, but can be expected to contain a host of harmful contaminants. MSW landfill leachates characteristically exhibit slight acidity (pH>4.5), and contain elevated levels of ammonia, chlorides, zinc, copper, cadmium, lead, nickel, chromium, and mercury. Organic compounds detected in Subtitle D landfill leachate include organic acids, ketones, aromatic compounds, chlorinated aromatic compounds, ethers, phthalates, halogenated aliphatic compounds, alcohols, amino-aromatic compounds, nitro-aromatic compounds, phenols, heterocyclic compounds, pesticides, sulfur substituted aromatic compounds, polyaromatic hydrocarbons, polychlorinated biphenyls, and organophosphates (Reinhart et al. 1998). Many of these components, if ingested, can cause health problems.

Incineration of trash in an EPA/State-regulated incinerator generates ash which is disposed in an ash landfill. Leachate from incinerator ash may contain high concentrations of metals.

General Public exposure to impacted drinking water from a private ground-water well or private ground-water fed surface water body is expected to be minimal due to the low probability of the simultaneous occurrence of the combination of factors required.

5.4 Low-Level Waste Disposal Alternative

Under the LLW Disposal Alternative, all of the potentially clearable materials released from licensed facilities would be transported and placed in a LLW disposal facility.

For the purposes of this analysis, all potentially clearable solid materials released by licensed facilities are assumed to be sent to a disposal facility in Clive, Utah (Section 2.4.4). The Envirocare disposal facility incorporates waste cells constructed over naturally clayey soils. A 2-foot thick layer of compacted clay lines the bottom of each cell. The Envirocare facility is located in a remote desert location with an arid to semi-arid climate. The site is over 20 miles from the nearest permanent human habitation.

5.4.1 Surface Water

Surface water impacts to Workers at Licensed Facilities under the LLW Disposal Alternative include contact with runoff or collected leachate from trash piles during handling, stockpiling, or loading activities, as well as contact with runoff at the disposal facility.

The concentrated placement of all the released materials in a single location would concentrate the surface water related impacts in the vicinity of the disposal facility. The volume of additional waste at a single facility would likely require the opening of additional cells and the increase in areal extent would increase the potential for runoff generation. Based on a peak annual disposal volume of 2.3 million tons (2.1 metric tons) and an estimated average bulk specific gravity of 2.0, the peak annual volume of materials equals 1.05 million cubic meters. Assuming a typical cell depth of 15 meters, the peak annual volume would require the opening of about 7 hectares of new disposal cells annually. Annual rainfall in Clive, Utah is about 3.0 cm/year (7 in/year). The volume of water which would fall on 7 hectares equals about 21,000 m^3/year. Actual leachate generation would be significantly less due to the potential evaporation rate of 152 cm/year (60 in/year), and placement of interim covers.

The runoff would need to be removed from the cells and evaporated onsite. The exact constituents of the runoff depend on the segregation or mixing of waste types at the disposal facility. Runoff from trash would be expected to exhibit characteristics similar to MSW leachate. MSW leachate is typically acidic, and contains a wide variety of organic chemicals, inorganic chemicals, and pathogens. Runoff from areas of concrete disposal would have a higher pH. The high evaporation rates at the Envirocare facility would have the effect of concentrating the contaminants, except volatile components, in the remaining runoff thus increasing the potential dermal exposure hazards. Rigorous worker training at the Envirocare facility, adherence to safe work practices, and the use of personal protective equipment such as gloves and appropriate work clothing would minimize direct exposure.

There are no anticipated surface water impacts to the General Public from the LLW Disposal Alternative.

Potential ecological impacts involving surface water for the LLW Disposal Alternative depend on the existence of aquatic or riparian animals living in or along surface water bodies at or near the site of activities associated with handling of materials at the licensee facility site and disposal of material in the Envirocare facility. Since there are no ground-water fed surface water bodies in the vicinity of the Envirocare facility, there are no anticipated ecological impacts at or near the disposal facility.

5.4.2 Ground Water

Workers at the Envirocare disposal facility are unlikely to use ground water in ways which would lead to non-drinking water ground-water impacts. There are no General Public impacts expected from non-drinking water ground water use at the disposal facility or offsite as the nearest residence is 20 miles from the Envirocare site.

5.4.3 Drinking Water

Workers at the Envirocare disposal facility are unlikely to use ground water in ways which would lead to drinking water impacts. There are no General Public impacts expected from use of drinking water at the disposal facility or offsite, as the nearest residence is 20 miles from the Envirocare site.

5.5 Limited Dispositions Alternative

The following sections describe the environmental impacts associated with the Limited Dispositions Alternative.

5.5.1 Surface Water

The surface water environmental consequences for concrete are identical in nature to those discussed under the Unrestricted Release Alternative (Section 5.2.1).

Surface water impacts for ferrous metal and trash are identical in nature to those discussed under the EPA/State-Regulated Disposal Alternative (Section 5.3.1).

5.5.2 Ground Water

The ground-water environmental consequences for concrete are identical in nature to those discussed under the Unrestricted Release Alternative (Section 5.2.2). Ground-water impacts for ferrous metal and trash are identical in nature to those discussed under the EPA/State-Regulated Disposal Alternative (Section 5.3.2).

5.5.3 Drinking Water

The drinking water environmental consequences for concrete are identical to those discussed under the Unrestricted Release Alternative (Section 5.2.3). Drinking Water impacts for ferrous metal and trash are identical in nature to those discussed under the EPA/State-Regulated Disposal Alternative (Section 5.3.3).