

Resource Intensive Industrial Use - Life, Health, Safety Analysis Report

An industrial land use including manufacturing characterized by exceptionally high demands on utility and public service systems, including electric loads of 1 megawatt (MW) or more, water use exceeding 2,000 gallons per acre per day on average or 5,000 gallons per acre per day at peak, and wastewater discharge greater than 1,000 gallons per acre per day on average or 3,000 gallons per acre per day at peak. These uses typically rely on specialized infrastructure, operate continuously, and create significant, sustained pressures on electrical, water, wastewater, and communications networks. Activities in this category are defined by one or more of the following: intensive resource consumption; elevated carbon or heat emissions; specialized water or sewer needs; heightened emergency response or security requirements; hazardous materials storage; and/or nuisance noise impacts.

Executive Summary

Early zoning frameworks were rooted in the separation of nuisance-generating uses, most commonly industrial activities, from residential areas to minimize conflicts and safeguard public health. The impacts of any land use generally increase with its scale and intensity. Scale and intensity are typically measured through factors such as the number of dwelling units, the amount of parking required, or the total floor area of a building. These metrics form the basis for assumptions about the level of public resources, services, and infrastructure needed to support a particular development. However, these assumptions hold only as long as land use patterns remain within expected parameters. When emerging industries or new development models exceed traditional thresholds, they may challenge existing service capacities and infrastructure systems, prompting the need to reevaluate zoning regulations and impact-measurement frameworks.

While emerging industrial facilities can have exceptionally high demands for electricity, water, wastewater capacity, communications bandwidth, or other public services, certain operations also provide essential community and regional functions. Critical infrastructure facilities—such as energy generation and storage, water and wastewater treatment, emergency communications hubs, or other mission-essential operational centers—may require resource levels that exceed typical industrial thresholds. Despite their intensive utility needs, these facilities play a vital role in maintaining public health, safety, and continuity of government and community services. Accordingly, zoning regulations should balance the need to manage and mitigate the health, life safety impacts of heavy-resource industrial uses with the equally important need to support critical infrastructure. This includes ensuring that essential facilities can be sited, expanded, and modernized, when necessary, while still incorporating safeguards that protect surrounding neighborhoods, conserve natural resources, and maintain the integrity of local service systems.

These emerging facility types are no longer analogous to the industrial uses traditionally regulated by the Flagstaff Zoning Code, nor are they adequately addressed by the mitigation measures and development exactions typically applied to less intensive land uses. As the City of Flagstaff considers amendments to the Zoning Code to regulate heavy, resource-dependent industrial uses, the following health and safety impacts should be evaluated:

Water/Wastewater Constraints

The largest individual daily water users in the City of Flagstaff include industry, hospitality, and service providers such as laundries and carwashes. One of the most water-intensive industrial users in the city currently consumes, on average less than 150,000 gallons of water per day. Individual water users, however, are not routinely monitored (outside of billing) or evaluated for growth and expansion outside of new development review process. The Water Services Division is currently preparing a Large Water Use Ordinance to manage water-intensive land uses in the City.

Prior to approving new development, the City completes a Water and Sewer Impact Analysis to determine whether the proposed project can be adequately served and to identify any required infrastructure improvements. This analysis generally focuses on distribution system capacity rather than overall water production or wastewater treatment capacity.

In Flagstaff, capacity fees are used to recover the capital costs of building, expanding, or upgrading major water production and wastewater treatment infrastructure needed to create capacity for new development. A capacity fee is a one-time charge applied to new connection, and to existing customers seeking increased capacity, to recover the proportional cost of system-level improvements. These improvements include water supply facilities, treatment plants, transmission mains, wastewater conveyance infrastructure, and effluent disposal systems. Capacity fees are the mechanism by which new development “pays its own way,” minimizing the financial burden placed on existing customers.

The City’s adopted levels of service (design standards) have not been updated since the 1980s. As a result, recent capacity-fee calculations rely on actual water production and wastewater treatment data from 2020–2022, along with the most recent census data. While this provides a more accurate representation of current system performance, these calculations may not fully account for new industrial uses with substantially higher utility demands than those historically present in the city.

In light of this, Planning recommends that any new industrial project using more than 2,000 gallons of water per acre per day on average, or 5,000 gallons per acre per day at peak, or generating an average wastewater discharge of 1,000 gallons per acre per day (gad) and 3,000 gad at peak be evaluated through a more comprehensive planning review process designed to assess system-level impacts, long-term service feasibility, and necessary infrastructure upgrades for proposed new development or development expansion. The purpose of this enhanced review process is to allow for these developments to be considered in relation to the City’s available capacity and improvements necessary to meet the larger demands of the development.

Energy Demands

Resource-intensive industrial uses, such as large-scale data centers, high-temperature manufacturing, and heavy processing facilities, can place substantial strain on an electrical grid due to their high and often continuous power demand. When these facilities operate at peak capacity, they draw significant amounts of electricity, which can reduce the grid’s overall flexibility and resilience. In regions where the grid is already constrained or aging, this surge in demand can increase the risk of voltage instability, localized outages, or the need for emergency load-shedding. These impacts may be especially

pronounced if multiple large industrial users are clustered in the same area, creating concentrated demand that outpaces existing transmission and distribution capabilities.

In addition to immediate grid stress, resource-intensive industrial uses can complicate long-term planning for utilities and local governments. High power loads may trigger the need for new substations, upgraded transmission lines, or additional generation capacity—investments that are costly and take years to implement. Rapid industrial growth can outpace the speed at which utilities can expand or modernize infrastructure, leading to bottlenecks that hinder future development. As cities and regions work toward electrification goals and integrate more renewable energy sources, the unpredictable or inflexible load profiles of certain industrial users can make balancing supply and demand more challenging, emphasizing the importance of coordinated planning between industry, utilities, and zoning regulations.

The City of Flagstaff is provided electrical energy from Arizona Public Service (APS). While the City of Flagstaff works in conjunction with APS to bring developments online the City has little oversight on how and when a property can be served with electricity. APS currently considers any project requiring 1 MW or more as a high demand land use. Planning recommends that Resource Intensive Industrial Uses provide documentation from local utility provider(s) affirming that sufficient power is available to serve the proposed development without disrupting service to other customers in the area. Additionally, it is recommended that an assessment be provided on the portion of the property that can be served by renewable energy sources including on-site generation, virtual power purchase agreements, and purchasing Renewable Energy Certificates (REC).

On-Site Power Production and Emissions

On-site or “behind the meter” power generation is one of the options being explored in locations of Arizona when grid connection is not a viable option for a Resource Intensive Industrial uses. The utilization of on-site power generation poses numerous challenges including potentially unregulated and independent power generation without state or federal oversight. These on-site power plants could create environmental impacts from air and water emissions depending on how the energy is generated. The life, health, safety impacts of Resource Intensive Industrial uses can dramatically increase if large-scale on-site power is necessary to serve the proposed land use either permanently or while the local utility is ramping up its generating capacity.

The most frequent type of on-site power generation for large power needs is a diesel generator. Diesel exhaust is a known air pollutant, containing fine particles that can impact the health of people who are exposed frequently and at high enough levels. Nuclear energy has also been identified as a potential power source. On-site nuclear power generation has gained enough support in Arizona that a bill to support it was approved by the state legislature but was ultimately vetoed by the Governor. Renewable energy sources may also be an option for some facilities but due to the variability of the resource it is difficult to rely on as a sole source and may require substantial battery storage.

Planning staff recommends that any on-site power generation proposed in conjunction with a Resource Intensive Industrial use be identified at the onset of any proposal and impacts and mitigation evaluated prior to any development approvals.

Noise Pollution

Significant noise generation can have detrimental health and safety consequences. Constant humming and buzzing near places where people live, work, and recreate can have adverse health impacts including headache, stress, and sleep disturbances, and may also contribute to cognitive impairment and cardiovascular risks. Resource Intensive Industrial uses can contribute to noise pollution due to the equipment in and around the development. In addition to audible noise, these uses may also produce infrasound, which consists of very low-frequency sound waves that are often not detected by the human ear but can still be perceived through vibration or pressure. While research on infrasound effects is ongoing, prolonged exposure may contribute to discomfort, stress, and additional sleep disturbances for sensitive individuals, particularly when facilities operate continuously. The National Institute for Occupational Safety and Health (NIOSH) threshold for requiring hearing protection is 85 dB(A) over an eight-hour period. Potential noise and infrasound impacts from Resource Intensive Industrial uses may exceed acceptable levels. Staff recommends requiring standards to ensure that these uses are adequately mitigated.

Public Safety

Certain land uses present unique fire, life safety, operational, environmental, and community risks due to their size, complexity, hazardous processes, critical infrastructure functions, or the potential consequences of an emergency event. To ensure these risks are properly identified and mitigated, the Fire Code Official recommends requiring a Hazard Mitigation Analysis (HMA), a Fire Department Impact Analysis (FDIA), or both for new construction, additions, major modifications, changes of occupancy, or operational changes associated with Resource Intensive Industrial uses. These uses may involve battery energy storage systems, electrical substations and related utility infrastructure, hazardous materials production or storage, energy generation or storage facilities, or other elements the Fire Code Official determines present significant fire, life safety, environmental, or operational risks.

The requirement for an HMA and/or FDIA should apply when Resource Intensive Industrial uses exceed parameters related to facility size, height, or occupant load or when the Fire Code Official determines that an HMA and/or FDIA is necessary due to the nature and complexity of operations; the type and quantity of hazardous materials present; fire and explosion hazards; energy storage capacity or technology; and water supply or fire protection demands. Additional factors include access and emergency response challenges, proximity to residential neighborhoods or sensitive areas, and potential impacts on fire department resources, staffing, equipment, training, and response capabilities as identified in the Standards of Cover report. The Hazard Mitigation Analysis should identify potential hazards associated with a facility and evaluate measures to eliminate, reduce, or control those risks. This may include hazard identification, fire and explosion scenario evaluation, shutdown procedures, assessments of fire protection systems, hazardous materials management, emergency response planning, environmental mitigation, and recommended strategies for enhancing life safety.

The Fire Department Impact Analysis should evaluate how a proposed facility may affect emergency response operations and broader community risk. This evaluation may consider response time impacts, staffing or deployment changes, specialized equipment needs, training requirements, water supply adequacy, access or operational concerns, the potential for long-duration incidents, mutual aid demands, and any applicable cost recovery or mitigation measures. Planning recommends that the Fire Code Official be authorized to determine when an HMA, FDIA, or both are necessary and to define the scope of these analyses based on the specific hazards, risks, operational characteristics, and location of the proposed Resource Intensive Industrial use.