- The city/county can prohibit energy facilities over which it has jurisdiction that will interfere with the migration of species of local, state or national interest unless appropriate mitigation is implemented. In other facilities, such interference of migration should be avoided.

TYPES OF MITIGATION MEASURES TO REDUCE IMPACTS

The three primary mitigation choices are avoidance by alternative site selection, on-site mitigation, and off-site mitigation.

- Avoidance or alternative site selection usually means locating the energy facility in an area that does not include areas of critical environmental concern or sensitive species habitat, but can also mean changing the facility footprint.

- On-site mitigation may include employee environmental awareness training, protection of on-site habitats, revegetation with native species, and facility or transmission line reconfiguration to reduce impacts.

- Off-site mitigation usually entails purchase of replacement habitat when avoidance and/or on-site mitigation is not sufficient. When off-site habitat is directly purchased, an adequate endowment is required to properly manage the replacement habitat in perpetuity. The amount of replacement habitat and the size of the endowment required will vary depending on the species affected and the specific habitat lost.

Examples of specific mitigation measures are provided in the box on page 5.2.6.

ADDITIONAL IMPLEMENTATION IDEAS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

- Ensure that the developer consults with the California Department of Fish and Game and/or United States Fish and Wildlife Service for all projects that may impact sensitive biological resources to help to determine which mitigation measures are recommended.

- Schedule construction to the time of year that is least disruptive to sensitive biological resources in the area.

- Use as a permit condition that a hydroelectric facility temporarily cease or reduce operations that could disrupt the migration of threatened, or endangered species, or economically important species. Consideration of migration routes during the planning phase for facility location can eliminate the need for this.

- Consider requiring the burial of pipelines in known migration routes of biologically sensitive, or commercially or recreationally important land species.

- Consider requiring that electric distribution lines, over which the local government has legal jurisdiction in areas known to have large birds of prey, be buried or built to specifications that eliminate the risk of electrocution. Bury the distribution lines up to the substation may be another feasible option.

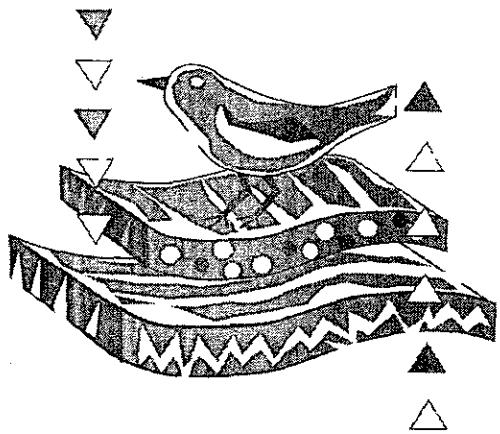
- In sensitive biological resource areas, consider requiring the use of helicopters for construction and maintenance of facilities that do not require frequent access.

- Implement a program to block access to and revegetate, or remove, temporary construction roads, and gate and lock permanent access roads.

- Prohibit the storage and handling of hazardous materials within a designated safe distance from sensitive species habitat, or other areas of critical environmental concern.

- Consider requiring that energy facility discharges that meet the requirements of National Pollutant Discharge Elimination System (NPDES) permits do not adversely affect biological resources.

- Develop a native plant revegetation program in areas where natural revegetation may be too slow to prevent adverse impacts. Consultation with a knowledgeable restoration ecologist may be necessary to develop and implement a program to ensure that an area disturbed by an energy facility is revegetated with appropriate species using the best available techniques to maximize success.



- Ensure that the project is provided an adequate source of water that does not adversely impact biological resources located in the area of the water supply.

- Consider requiring a specific plan to mitigate impacts to vernal pools, wetlands, and other areas of critical environmental concern if total avoidance is not possible. Mitigation may include the purchase and/or construction of compensation habitat. (See box on *Handling Facility Discharges* on the page 5.2.7.)

- Develop a specific mitigation monitoring plan when avoidance of the habitat of sensitive species is not feasible. The plan should identify how existing habitat will be protected, how and where new habitat will be provided to mitigate impacts to the existing habitat, how selected species will be encouraged to use the alternate habitat, a description of monitoring methods and frequency, and a definition of the criteria for successful mitigation. The plan should also describe the remedial measures to be implemented if any of the mitigation measures are deemed unsuccessful.

CASE STUDIES

Colusa County's *Transmission Line Element* includes policies for the protection of sensitive species and habitat. The element includes policies to:

- Avoid areas with soil and water conditions favorable for the sustenance of rare and endangered species.

- Avoid corridors which disrupt the nests of birds of prey and which create the potential for power line/bird electrocutions (if avoiding these corridors is not possible, provide perching sites on some of the power line towers).

- Map and inventory the habitat for sensitive species in the county to ensure their protection.

- Use helicopters to construct towers, string conductors, and perform maintenance activities in areas of extreme slopes and erosion hazards to minimize habitat disturbance.

- Require implementation of revegetation plans using species native to the site.

- Restrict public access to temporary and permanent roads serving transmission lines.

- Remove access roads where possible.

Contact: Colusa County Planning and Building Department, 220 12th Street, Colusa, CA 95932, (916) 458-8877.

Lassen County has included in its 1993 *Energy Element* a policy requiring consultation with and consideration of biological recommendations made by resource protection agencies, including the California Department of Fish and Game and the United States Fish and Wildlife Service. The element also includes policies and implementation measures regarding the use of native plant species during revegetation and a program to determine the success of revegetation efforts.
Contact: Lassen County Department of Community Development, 707 Nevada Street, Susanville, CA 96130, (916) 251-8269, FAX: (916) 251-8373.

Mono County's *Conservation/Open Space Element* contains policies related to the migration of deer, a recreationally important species. The element requires a site-specific deer study performed by a recognized deer biologist for projects with the potential to impact identified deer habitats, including migration corridors and winter range. Based upon deer study results, projects may be required to be modified or redesigned. The element also limits development in riparian areas and wetland zones. The county levies a developer mitigation fee to be used to enhance habitat elsewhere when mitigation measures on the site cannot reduce impacts to an acceptable level.
Contact: Scott Burns, Mono County Planning Department, P.O. Box 8, Bridgeport, CA 93517, (619) 932-5217, FAX: (619) 932-7145.

Alameda County has participated with Solano and Contra Costa Counties in the "Tri-County Wind Energy Mitigation Compliance Monitoring Program," funded in part with a $30 per wind turbine per year developer compliance fee. The purpose of this program is to revise land use policies to coordinate and supplement existing county plans, ordinances, and use permit conditions to protect endangered species and reduce or avoid other environmental impacts of wind farm development.

The county conducts ongoing five year reviews of all wind development operating permits, and imposes new conditions as its experience develops with the technology. Site restoration is required for wind farms that do not produce electricity for one year, or where more than 50 percent of the turbines are actively being removed or in disrepair, and that do not have a demonstrated plan to restore the equipment to a productive operat-

ing condition. Part of the developer compliance fee is used for an escrow account for abandoned wind generators.
Contact: Steve Richards, Zoning Administrator, Alameda County Planning Department, 399 Elmhurst Street, Hayward, CA 94544, (510) 670-5400, FAX: (510) 785-8793.

INFORMATION RESOURCES

The California Department of Fish and Game (CDFG) has developed the "California Natural Diversity Data Base." It is a sophisticated statewide geographic information system with current, very specific location and ecological information for California's rarest and most endangered species and rare natural communities. Hard copy data base reports and map overlays (any scale) are available. A menu-driven data base version called *Rarefind* is also available.
Contact: California Natural Diversity Data Base Information Services Coordinator, California Department of Fish and Game, 1220 "S" Street, Sacramento, CA 95814, (916) 327-5960.

CDFG has also developed the Wildlife Relationships Program which offers a great deal of life history, distribution and habitat information on California's endangered and common wildlife species. This information is available from a menu-driven data base, and a three volume set of books entitled *California's Wildlife*.
Contact: Wildlife Habitat Relationships Program Coordinator, California Department of Fish and Game, 1701 Nimbus Road, Suite D, Rancho Cordova, CA 95670, (916) 355-0124.

The California Native Plant Society's *Inventory of Rare and Endangered Vascular Plants of California* is an excellent source of location information (county and quadrangle), status (federal, State and California Native Plant Society), life form, phenology, and taxonomic information for California's many sensitive native plants. New editions are published approximately every four years. In addition, a menu-driven, data base version of the California Native Plant Society's *Inventory* is available.
Contact: California Native Plant Society, 1722 "J" Street, Sacramento, CA 95814, (916) 324-3816 or (916) 447-2677.

In addition, the California Energy Commission has worked with Alameda, Contra Costa, and Solano Counties, and the wind energy industry to study the effects of wind turbines on migratory birds. The *Wind Turbine Effects on Avian Activity, Habitat Use & Mortality in Altamont Pass & Solano County Wind Resource Areas 1989-1991, Final Report 1992,* available from the Energy Commission, describes the results of the study and suggests mitigation measures to reduce avian mortality.
Contact: California Energy Commission, Publications Office, 1516 Ninth Street, Sacramento, CA 95814, (916) 654-5200, FAX: (916) 654-4288.

RELATED CHAPTERS/ISSUES

- Energy Facility Planning (Chapter 3)
- Energy Facility Permitting (Chapter 4)
- Air Quality (Chapter 5.1)
- Water Use and Quality (Chapter 5.4)
- Visual and Noise Impacts (Chapter 5.5)

CHAPTER 5.3: HAZARDOUS MATERIALS HANDLING AND STORAGE

INTRODUCTION

The potential for accidental release of hazardous materials exists during the construction, operation, and closure of many types of energy facilities. Accidents not only result in public health hazards, but can also cause large economic loss to the involved businesses, costs to local government for emergency-related services, and a loss of public confidence in local government planning. Additionally, significant economic impacts to the community can result from accidents involving hazardous materials.

Although many of the laws regarding the management of hazardous materials were promulgated at the federal or state levels of government, it is often local governments that are ultimately responsible for implementing and enforcing such laws. (See the *Regulatory Environment* box on page 5.3.4) Therefore, local governments should be familiar with policies and procedures that ensure proper hazardous materials handling at facilities under their jurisdiction. Working with and providing advance guidance to prospective energy project developers will also result in a more efficient, effective, and expeditious permitting process which will benefit both the local community and the developer/applicant.

"... local governments will benefit from policies and procedures that ensure proper hazardous materials handling ..."

It is important for any agency issuing construction and/or operation permits for energy facilities to identify:

- The types of hazardous materials that may be used or stored at such facilities, or transported to or from them
- The hazardous properties of such material
- The quantities of hazardous materials
- The potential impact on surrounding populations
- Safe handling, storage and transportation procedures
- Less hazardous alternative materials that may be available

While it would be difficult to list all the potentially hazardous materials that may be associated with energy facilities, this chapter identifies some of the more common materials in use and some less hazardous alternative materials that can often be substituted. (See the box on page 5.3.3.)

WHAT ARE HAZARDOUS MATERIALS?

Materials are hazardous if they have the potential to cause injury to life and/or damage to property and the environment. Acutely hazardous materials (also called extremely hazardous in federal legislation) have the potential to cause serious toxic effects as a result of short exposure periods. Hazardous and acutely hazardous materials possess at least one of the following properties: toxicity, flammability, corrosivity or reactivity.

- **Toxic materials** have harmful effects on human health or the environment.
- **Flammable materials** are those that are easily combustible, with a flash point equal to or less than 140 degrees Fahrenheit.

- **Corrosive materials** have a pH less than or equal to 2 or greater than 12.5. They dissolve some materials or burn skin and are toxic if vaporized.

- **Reactive materials** are those that are unstable or undergo rapid or violent chemical reaction with water or other materials.

Both the state and federal government have created various lists of hazardous and acutely (or extremely) hazardous materials that define the substances subject to various regulations. The state list of acutely hazardous materials and the federal list of extremely hazardous materials are identical (See Code of Federal Regulations, Vol 40, Part 355; California Code of Regulations, Title 22, Article 9).

HOW ARE HAZARDOUS MATERIALS USED IN ENERGY FACILITIES?

The hazardous materials used at an energy facility are dependent on the type of facility and the specific technologies utilized. There are, however, several operations common to most types of energy facilities that typically use hazardous materials. These operations include the consumption of fuel, the control of emissions, water treatment, generator cooling, and the transfer of heat.

- **Consumption of Fuel.** The type of fuel used in an energy facility may be hazardous. Fuels such as natural gas, propane, refinery gas, hydrogen, and light fuel oil can be flammable and/or explosive when not properly contained, while fuels such as coal, coke, biomass, and municipal solid waste are less flammable and pose less risk of explosion. Many facilities which typically use less hazardous fuels will often need to utilize backup or supplemental fuels which do pose a hazard. Other energy facilities, such as hydroelectric plants and wind turbines do not utilize combustible fuels at all.

- **Emissions Control.** Energy facilities involving combustion of fuels usually require emissions control. The extent of controls used is dependent on the fuel and the combustion pollutants produced. The use of high sulfur fuels can require extensive sulfur and particulate removal systems in addition to controls for nitrogen oxides (NO_x). Sulfur removal systems often produce hydrogen sulfide (H_2S) as an intermediate product. In some facilities sulfur control can be achieved without producing H_2S.

"Human error is the most common cause of accidental release of hazardous materials. Human error may be involved in the design, operation, or management of a facility."

Natural gas-fired facilities require less control than facilities using high-sulfur fuel, but may involve the use of anhydrous ammonia, which is a hazardous material, to control NO_x emissions. A release of either anhydrous ammonia or H_2S can pose a significant risk to public health. Aqueous ammonia, on the other hand, may be substituted for anhydrous ammonia. Nonhazardous urea-based compounds may be substituted for ammonia compounds in some cases.

Facilities which produce energy from municipal solid waste often require extensive control of acid gases in addition to many of the controls described above. Such controls typically require the use of both strong caustics and acids.

- **Water Treatment.** Energy facilities often use water for a variety of purposes such as steam production, cooling, and water injection for NO_x control. Water treatment requirements vary, dependent upon its uses and the quality of water available. The water treatment chemicals of choice are often hazardous materials, such as chlorine, hydrazine, strong acids, and strong caustics. Accidental release or inadvertent mixing of these materials can pose a significant risk to public health.

- **Generator Cooling.** Some large electrical generators require the use of hydrogen to cool the conductors in the rotor. Hydrogen is the only material that is technically feasible for use in this application. The risks associated with hydrogen, especially fire and explosion, increase with the amount of hydrogen present. To reduce risks, on-site generation of hydrogen, and its immediate use, is preferred over storage of large amounts for use over time.

COMMON HAZARDOUS MATERIALS USED BY ENERGY FACILITIES AND LESS HAZARDOUS SUBSTITUTES

Use of Material	Hazardous Material	Hazardous Characteristics	Alternate Material	Hazardous Characteristics
NO_x control	Anhydrous ammonia	Toxic, stored at high pressure	Aqueous ammonia	Less volatile, lower potential for atmospheric release
Water treatment	Hydrazine	Volatile, flammable, toxic, carcinogenic, reducing agent	Carbohydrazide	Less toxic, much less flammable, noncarcinogenic
	Chlorine Gas	Volatile, very toxic, corrosive	Pelletized chlorine, sodium hypochlorite, & sodium bromide	Not volatile, lower potential for atmospheric release, less corrosive, less toxic,
Generator cooling	Stored hydrogen	Explosive, flammable	Hydrogen generated on-site	Small quantities in the generator provide greatly reduced potential for explosion
Heat transfer fluid	Biphenyl-diphenyl oxide and others	Toxic, flammable	None	
Other	Hydrochloric acid	Corrosive, toxic	Ethylene diamine tetra acetic acid	
	Sulfuric acid	Corrosive, toxic	None	

THE REGULATORY ENVIRONMENT FOR HAZARDOUS MATERIALS HANDLING

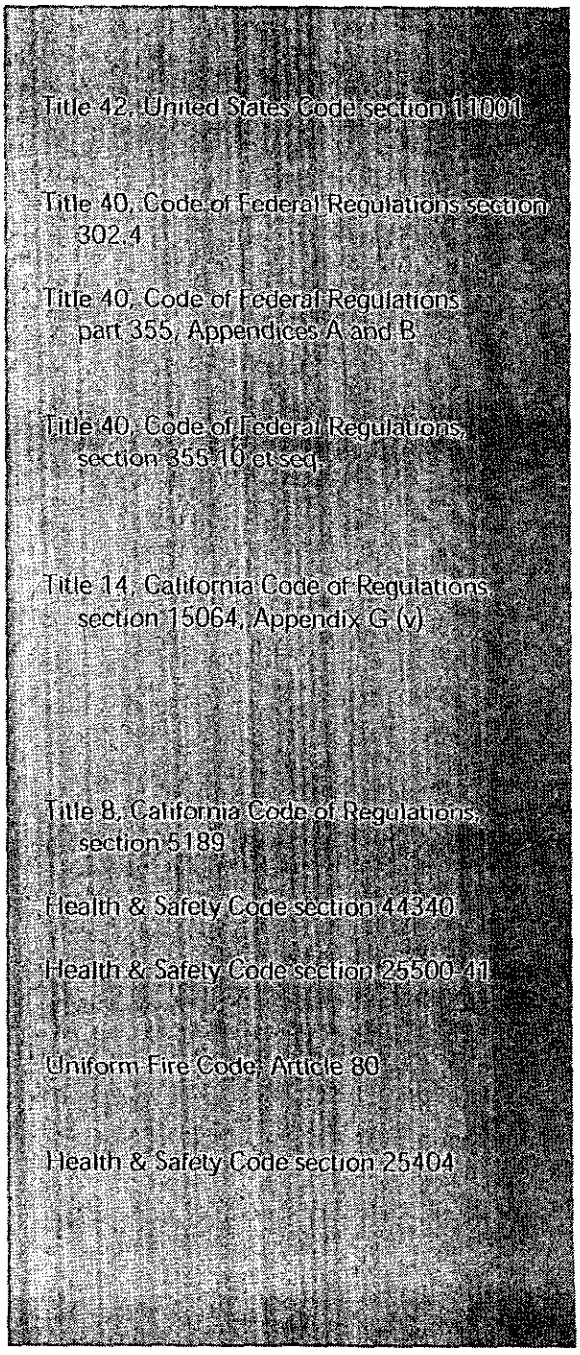
The Superfund Amendments and Reauthorization Act of 1986 (SARA) established a nationwide emergency planning and response program and required reporting for businesses that handle significant quantities of hazardous or acutely (or extremely) hazardous materials. This measure also requires states to implement a comprehensive system to inform federal and local government agencies and the public when significant amounts of acutely hazardous materials are stored or handled at a facility. California has implemented much of SARA in the California Health & Safety Code and has also enacted other laws as shown below.

Federal

- Superfund Amendments and Reauthorization Act 1986 (SARA)
- List of hazardous materials
- List of extremely hazardous materials with threshold amounts requiring a RMPP (Risk Management and Prevention Program)
- State and local emergency response plans

State

- CEQA Guidelines for significant impact: If a project creates a potential public health hazard or involves the use, production or disposal of materials which pose a hazard to people or animal or plant populations in the area affected
- Process Safety Management Program from Cal-OSHA
- Toxic emissions inventory to local air district
- Business Plan and RMPP subject to local approval
- Storage & handling of hazardous materials requirements
- SB 1082 requires a "Unified Program" be implemented by counties by 1/1/96 (See box on the following page.)



- **Heat Transfer.** Some innovative energy production facilities utilize heat transfer fluids other than water (which is used in conventional facilities). An example is the use of biphenyl-diphenyl oxide as a heat transfer fluid in solar thermal facilities. This heat transfer fluid is a hazardous material which can pose a public health risk if accidentally released. The hazards associated with this material are normally compounded by the supplemental heating of the fluid in a gas-fired heater.

- **Boiler Cleaning.** Cleaning of scale deposits from the inside of heat transfer equipment often requires the use of strong acids. Hydrochloric acid is typically used. Release of hydrochloric acid or inadvertent mixing with other incompatible material can pose a significant public health risk. In some cases alternative materials can be used to reduce such risk. However, acids have been used in industry for many years and their safe handling and storage are common practice.

WHAT CAUSES ACCIDENTAL RELEASE?

The following three general types of causal factors are associated with accidental release of hazardous materials:

- **Equipment failure** refers to a spontaneous failure without an external event, negligent maintenance, or operation outside of designed limits. Equipment failure is rare for new equipment that is designed and maintained to current standards. Design codes are regularly updated as equipment failures occur. Ensuring that current standards are used for a proposed energy facility should greatly reduce this risk.

- **External forces** that can cause the accidental release of hazardous materials include fires, earthquakes, explosions, and collisions. Facility design and strategic location of hazardous materials can reduce the risk of accidental release due to these causes. Careful routing and management of vehicles that transport hazardous materials into or out of the facility may also reduce this risk.

SENATE BILL 1082
(Statutes of 1993, Chapter 418)

Senate Bill 1082 required that a Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program) be developed and implemented by local governments by January 1, 1996. The Unified Program must consolidate the administrative requirements of

- Hazardous waste generators and hazardous waste treatment
- Underground storage tanks
- Hazardous materials inventories and hazardous materials release response plans
- Acutely hazardous materials risk management program plans
- Uniform Fire Code hazardous materials management plans and inventories
- Above ground storage tank spill prevention control and countermeasure plans

The statute requires each county, and allows each city, to designate a Certified Unified Program Agency (CUPA) which must be approved by the California Environmental Protection Agency (Cal-EPA). The CUPA must consolidate all permits or other grants of authorization issued related to the handling of hazardous waste or materials into a single permit. It also requires the CUPA to consolidate, coordinate and make consistent to the extent possible any local or regional regulations, ordinances, requirements, or guidance documents pertaining to hazardous waste or hazardous materials.

The CUPA must also develop and implement a single, unified inspection and enforcement program in order to ensure coordinated, efficient and effective enforcement of local ordinances and regulations. It must also coordinate, to the maximum extent feasible, its inspection and enforcement program with those of other federal, state, and local agencies which affect facilities regulated by the Unified Program. The statute requires each air quality management district or air pollution control district, each publicly owned treatment works, and each office, board, and department within the Cal-EPA to coordinate its programs with those of the CUPAs.

Human error is the most common cause of accidental release of hazardous materials. Human error may be involved in the design, operation, or management of a facility. The most important factor affecting the potential for human errors is the effectiveness of safety management practices at the facility. A safety management plan for hazardous materials should be required of every facility using hazardous materials. This plan can be based on the guidance provided by the American Institute of Chemical Engineers (AIChE) in *Technical Guidance for Management of Chemical Process Safety.* Additional guidance is provided in documents prepared by the California Occupational Safety and Health Administration supporting the new regulations regarding process safety management (PSM) programs. (See the INFORMATION RESOURCES section.)

WHAT FACTORS AFFECT THE POTENTIAL FOR IMPACTS FOR HAZARDOUS MATERIALS?

The factors that can affect the potential for impact of accidental releases of hazardous materials are typically site-specific. Some are subject to change over the project's life (e.g., the proximity and extent of population around the project). They include:

1) The quantity of the material on-site

2) The degree of toxicity or potential hazard under the proposed conditions of use and storage

3) External hazards associated with the project site

4) The distance to the nearest public receptor

5) The sensitivity of the receptors

6) Site-specific meteorological conditions

7) On-site and off-site emergency response capability

8) The extent and sensitivity of environmentally sensitive resources around the proposed site

Once information regarding these factors is available, modeling can be performed to determine the potential for impacts associated with all plausible release scenarios including the worst case scenario. The worst case would include the largest possible release under the least favorable meteorological conditions. Once the modeling is done, the agency and project proponent can develop methods for avoiding or mitigating such impacts to an acceptable level of risk as defined by the local government.

WHAT IS THE LOCAL GOVERNMENT ROLE?

Local governments, through their air quality, police, fire, and health departments, have the primary jurisdiction and responsibility for enforcement of applicable laws, implementation of state laws requiring emergency response planning, and ensuring the adequacy of hazardous materials management at facilities within their jurisdiction. They may also have responsibility as a CEQA lead agency for the permitting of some energy facility projects that use hazardous materials. Local governments may, therefore, need to develop their own policies and criteria for evaluating the risks associated with hazardous materials utilized in energy projects.

Either the local fire, public health, or emergency services department is usually designated the administering agency responsible for implementing regulations requiring

THRESHOLD OF SIGNIFICANCE: ENERGY COMMISSION STAFF APPROACH

The Energy Commission staff uses exposure criteria (levels) as a threshold for the purpose of identifying significant environmental impacts in power plant licensing proceedings. The Energy Commission staff's approach to choosing such criteria is to balance the small risk of accidental public exposure against the type of impact that would result. For low probability events staff recommends mitigation only for the potential for events with permanent injury or long term disability. Release scenarios that result in only transient irritation are not considered significant when it is unlikely that the event would ever occur. Thus staff focuses on low probability/high consequence events that have the potential to cause death or permanent injury. Mitigation for such events is appropriate for such high consequence events even if the probability of occurrence is low.

preparation of business plans and Risk Management and Prevention Programs (RMPPs). The Governor's Office of Emergency Services has developed a guidebook to help local government agencies develop requirements for RMPPs. Some communities have developed their own guidebooks for businesses to use when writing a RMPP. (See the INFORMATION RESOURCES section.)

The administering agency should be consulted in the early design stage of a project, when making structural changes is easiest and least costly. To involve it after a facility is built may require expensive and time-consuming engineering changes to satisfy its safety requirements. It may be desirable to have a representative from the administering agency in the planning department (at least part-time) for this purpose.

New state requirements for the consolidation of six existing programs are under one Certified Unified Program Agency (CUPA). (See the box, *Senate Bill 1082* on page 5.3.5.)

LOCAL GOVERNMENTS ESTABLISH FRAMEWORK FOR REVIEWS OF RISK

Local governments which permit energy facilities that handle hazardous or acutely hazardous materials may establish a framework to evaluate the significance of potential risks associated with their use. In other words, local governments can decide what constitutes a significant impact and at what point the risk of that potential significant impact will suggest the need for additional mitigation. Having such a framework already in place can provide a consistent and fair permitting process for all project developers.

Cal-OSHA GUIDELINES

Cal-OSHA guidelines for a Process Safety Management (PSM) audit include:

- Process safety information
- Process hazard analysis
- Operating procedures
- Training
- Contractors
- Pre-start-up safety reviews
- Mechanical integrity
- Hot work permit (such as welding or cutting)
- Incident investigation
- Emergency planning and response
- Injury and illness prevention
- Employee participation

See INFORMATION RESOURCES at the end of this chapter regarding ordering the Cal-OSHA Process Safety Management guidelines.

WHAT ARE BUSINESS PLANS AND RISK MANAGEMENT AND PREVENTION PROGRAMS (RMPPs)?

California law requires that a **Business Plan** be prepared for any proposed facility using reportable quantities of hazardous materials to protect public health and welfare by reducing the risk associated with the release of hazardous materials. If threshold quantities of acutely hazardous materials are involved, the administering agency may require an RMPP. Project developers are responsible for the preparation of Business Plans and RMPPs. These plans are subject to approval by local administering agencies.

A Business Plan is required to include a description of equipment, an inventory of hazardous materials, and a description of the location and use of all hazardous materials at the facility. It is usually based on detailed design information and is prepared after the final design of a project has been completed. The information in a Business Plan is necessary to protect the individuals responding to an incident, such as a fire, that involves the release, or potential release, of hazardous materials.

A **Risk Management and Prevention Program (RMPP)** is a facility's program for minimizing the risk of accidental release of acutely hazardous materials. It may be required of facilities handling acutely hazardous materials in amounts greater than or equal to threshold quantities established by the US-EPA (Title 40, Code of Federal Regulations part 355, App.A). In addition to the information contained in a Business Plan, a RMPP must also provide an analysis of potential avenues of accidental release of the acutely hazardous materials at the facility and an analysis of the potential off-site impacts that could be associated with plausible release scenarios. According to the California Office of Emergency Services, a RMPP should include documentation of:

- A safety review of design for new and existing equipment

- A safety evaluation of standard operating procedures

- A review of equipment reliability

- Preventive maintenance procedures

- A risk assessment for failure of specific pieces of equipment or operating alternatives

- Emergency response planning

- Internal or external auditing procedures to ensure that safety programs and safety engineering controls are being executed as planned.

WHAT IS A PROCESS SAFETY MANAGEMENT (PSM) PROGRAM?

Cal-OSHA requires that businesses that use highly hazardous chemicals have a Process Safety Management (PSM) program. A PSM is the proactive, rather than reactive, identification, evaluation and prevention of chemical releases that could occur as a result of failures in processes, procedures or equipment. Employers are required to develop within their workforce the necessary expertise, experience, judgment and initiative to properly implement and maintain an effective PSM program. Employer evaluation of process safety was required to begin in 1994 and be completed by 1997. Employers who merge the two sets of requirements for RMPPs and PSMs will better assure compliance with each. (See the *Cal-OSHA Guidelines* box on page 5.3.7.)

HOW CAN COMMUNITIES BALANCE RISK?

Even with application of all feasible mitigation, a project may still pose a significant risk. Such projects should not be rejected solely on the basis of such risk. Permitting agencies should first determine what public service is provided by the project. Public service can be more than the production of energy alone. When evaluating the acceptability of the risk associated with such projects it is also important to analyze the risks associated with its alternatives, including no project.

For example, a waste-to-energy project that burns municipal solid waste will have air quality impacts but may also reduce the need for landfill wastes, thereby eliminating environmental threats associated with landfilling, including the release of toxic gases and methane into the atmosphere and groundwater contamination.

This risk comparison must also reflect the need to provide the public with an adequate and reliable energy supply. Energy Commission staff are available to help local governments in conducting these evaluations.

HOW CAN COMMUNITIES REDUCE RISK?

There are four general strategies that can be employed to minimize the risks associated with hazardous materials used at energy facilities. The best way to reduce risk is to use all four strategies to the extent feasible. These strategies should be employed in the following order based on their reliability in reducing risk:

- Substitution of alternative, less hazardous materials

- Use of engineered controls

- Use of administrative controls to reduce human error

- Emergency response planning

In some cases, it may also be feasible to site facilities that must utilize hazardous materials in remote areas. While such remote siting reduces the risk to the public, it does little to protect workers, reduce the potential for economic loss, or reduce liability. It should also be noted that future encroachment may occur in such areas unless buffer zones are permanently established through the purchase of adjacent lands. This type of mitigation can require the purchase of large tracts of land to be effective, since some types of hazardous materials releases can result in significant impacts at large distances from the point of release. Thus, this type of strategy is less effective in addressing the overall potential for injury and other forms of loss and should be restricted to those facilities that must use the most hazardous types of materials.

◪ Material Substitution. The most certain way to reduce risk from hazardous materials is to substitute less hazardous materials where possible. For example, anhydrous ammonia is a substance often used in power production facilities to control nitrogen oxides. It is acutely toxic and is commonly stored as a liquefied gas at high pressure, thereby posing a high risk of a large accidental release and subsequent public health impacts. Aqueous ammonia, which is much less volatile, can be used as a substitute in many applications. (On the following page see the section "An Example of Risk Reduction Strategies: Using Aqueous Ammonia.")

Urea-based compounds that can be used with selective non-catalytic reduction (SNCR) systems pose a much lower health risk, no fire hazard, no reactivity hazard, and are therefore inherently safer than ammonia compounds. Currently only about 20 percent of power plants operating in California are candidates for SNCR systems due to the temperature range in which these compounds are effective. However, many of this 20 percent are smaller power plants that local government agencies permit. A non-ammonia compound is in the development and testing stage for use in selective catalytic reduction (SCR) systems and will probably be available in the near future.

Substituting less hazardous materials speeds the permitting process and may eliminate the need for preparation of a RMPP. Use of such materials may also reduce the costs of storage and handling facilities and liability insurance and the likelihood of lawsuits. These factors may more than offset the additional cost typically associated with use of a less hazardous material.

There may be cases where use of a less hazardous substitute may not be technically feasible, or where the project proponent may be able to provide adequate assurances that the risk of using a more hazardous material can be reduced to an acceptable level. Local governments should be prepared to evaluate each facility based on the merits of the individual permit application.

- **Engineered Controls.** Engineered controls are design features or equipment which are specifically undertaken to reduce the risk associated with hazardous materials storage, handling, or use. Examples of such controls include use of increased safety margins in structural design storage vessels, pressure relief valves, fire protection systems, vent scrubbers, excess flow controls, additional instrumentation, automatic shutdown systems, spill containment systems, etc.

Implementation of effective engineered controls can greatly reduce the risk of equipment failure and accidental releases of hazardous materials. Incorporation of such controls is common in modern design codes. As a result, equipment failure is rare for new equipment that is designed and maintained to current standards. Design codes are regularly updated as equipment failures occur. Ensuring that current standards are used for a proposed energy facility should greatly reduce the risk associated with equipment failure.

"Having specific policies and ordinances in place allows both the developer and permit agencies to know the specific requirements for an energy facility before expensive facility design plans are completed..."

- **Administrative Controls.** Administrative controls are usually the only way to address the cause of most accidents (human error). Administrative controls may include employee training in the proper handling and storage of hazardous materials, or the use of checklists. Business Plans, RMPPs, and process safety management (PSM) programs can and should be used as a method to require accountability for hazardous materials management. Local administering agencies can carefully review these plans before they are approved and provide regular inspections on-site to ensure compliance. Providing effective review and enforcement of hazardous materials handling requirements can result in significant costs to local government. The city/county may want to consider a mechanism to recover such costs from hazardous materials handlers.

- **Emergency Response Plans.** The final risk reduction strategy should be an emergency response plan. Facilities using hazardous materials are responsible for developing their own emergency response strategy. Facilities must document their emergency response plans in their Business Plan or RMPP. Such plans should be developed in close cooperation with local emergency response authorities.

AN EXAMPLE OF RISK REDUCTION STRATEGIES: USING AQUEOUS AMMONIA

Power plants located in air quality non-attainment areas for ozone must use a NO_x control system. Two processes are typically used to control NO_x: selective catalytic reduction (SCR), and selective non-catalytic reduction (SNCR). Each introduces an agent into the pro-

cess that reduces NO_x back into nitrogen and oxygen. SCR systems presently can use some form of ammonia as the reducing agent. SNCR systems and systems that are hybrids of the two can use a urea-based compound or aqueous ammonia.

Anhydrous ammonia is often the material of choice for use in NO_x control systems. It is, however, an extremely hazardous material that is stored under high pressure as a liquefied gas. It has the potential to be released in a catastrophic manner due to the pressure needed for storage, and can travel significant distances resulting in off-site fatalities and serious injury.

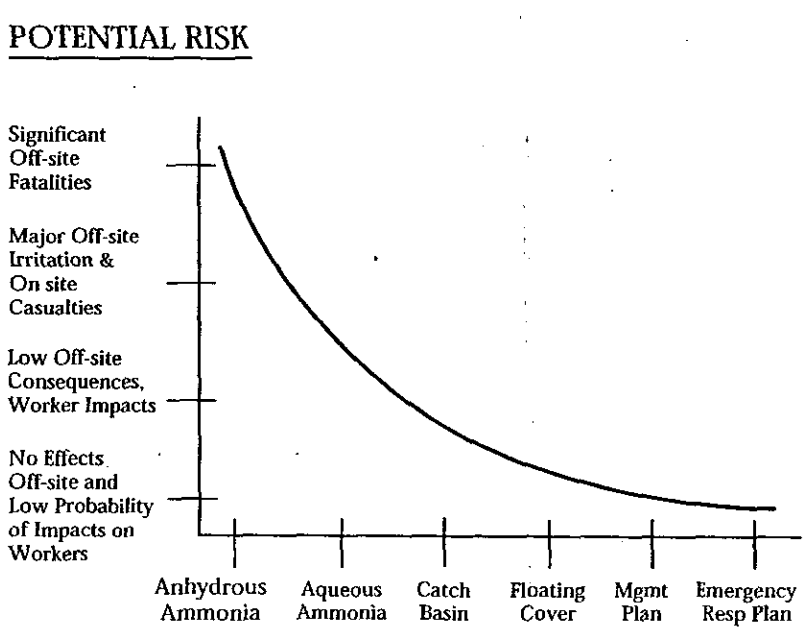
Aqueous ammonia is a substitute for anhydrous ammonia. It is bound to water and is released from a spill by evaporation from the spill surface. Since the release rate for evaporation is much slower than for a pressurized release, the degree of potential exposure resulting from an aqueous ammonia spill is greatly reduced.

Providing a catch basin in the area where transfers occur limits the area affected by an accidental spill and reduces the surface area available for evaporation. If the catch basin has a floating surface cover of polystyrene foam balls, the evaporation rate will be further reduced.

Implementation of an effective hazardous materials safety management plan, including training in proper handling procedures, and an emergency response plan will further reduce the possibility of an accidental spill and any resultant health damage.

The graph below is a visual representation of the decreasing risk of the above risk reduction strategies.

DECREASE THE RISK USING SEVERAL RISK REDUCTION STRATEGIES



Note: The above graph is used for illustration purposes only and is not meant to be an exact representation of the relationships involved.

HOW CAN POLICIES AND PROGRAMS RELATED TO FACILITY DESIGN SPEED PERMITTING?

Having specific policies and ordinances in place allows both the developer and permit agencies to know the specific requirements for an energy facility before expensive facility design plans are completed and eliminates time-consuming re-submittals. Providing standard conditions of use for particular types of energy facilities, or for facilities using particular hazardous materials, will reduce the time needed to permit a facility and provide consistent regulation of hazardous materials. (See Chapter 4 regarding the use of pre-application meetings.)

HOW CAN LOCAL GOVERNMENTS COVER ADMINISTRATIVE COSTS?

Options are available to local governments to recoup at least some of the costs of reviewing technical documents, and monitoring and enforcing hazardous materials regulations. First, the permit fees collected by a local agency can and should reflect the costs that are commonly associated with review and approval. Any ongoing monitoring costs can be part of the yearly permit fee structure.

Second, fines may be a source of recovery. For example, the Safe Drinking Water and Toxics Enforcement Act allows county health officials and police agencies that assist in the enforcement process to receive 25 percent of the fines that are collected, in addition to the 25 percent that district and city attorneys receive for use in funding enforcement activities.

Third, cost recovery ordinances may be adopted to allow the recovery of the costs of abating or cleaning up hazardous materials that are unlawfully released, discharged, or deposited upon or into any property or facility within that city or county. Costs may be collected for direct out-of-pocket city or county expenses, for the cost of city or county personnel involved in a corrective action, and for work contracted by the city or county. The costs may be recovered from whomever negligently or willfully caused the pollution, whomever owned or possessed the hazardous substance (regardless of fault), and whomever owned or possessed the container holding the hazardous material when it spilled. (See the CASE STUDIES section of this chapter.)

ECONOMIC CONSIDERATIONS

Unfortunately, the avoided costs from accident prevention become evident only when an accident actually occurs. The costs associated with accidental releases of hazardous materials can be very substantial and may not be limited to the direct cost of damages. Accidental releases can also result in plant downtime, permitting delays, restricted output, equipment repair, loss of markets, loss of public acceptance and confidence, and increased insurance costs (F. Lees, 1992).

A major cost often associated with an accidental release that results in public impact is the loss of public confidence in the permitting agency's ability to protect them from similar events at other facilities. Such a lack of public confidence can result in reduced development opportunities and significant economic impacts on the entire community.

In the mid-1980s, Santa Barbara County, in response to increased federally approved offshore drilling activity requiring increased onshore facilities as support, created an Energy Division in their Resource Management Department. The Division is 100% funded by permit fees.

Contact: William Douras, Santa Barbara Planning and Development Department, 123 E. Anapamu Street, Santa Barbara, CA 93101, (805) 568-2040.

GENERAL PLAN IDEAS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

- The city/county can establish buffer zones around sensitive receptors such as schools, hospitals, and residences which exclude energy facilities that use hazardous or acutely hazardous materials in quantities that pose a significant risk.

- The city/county can require that any potential for significant hazardous materials' impacts on public health or safety be minimized to the maximum extent feasible. (This is a CEQA requirement.) This should include using state-of-the-art equipment and mitigation measures that reduce the probability of impacts to a level of insignificance. The extent of mitigation should be based on technical feasibility and the cost of mitigation measures. Project productivity and profitability can be secondary considerations in reducing the risk of significant public health impacts. The preferred order of risk reduction strategies is:

  - Material substitution
  - Engineered controls
  - Administrative controls, and
  - Emergency response plans.

- The city/county can develop a process to ensure accountability for facility safety management plans that in turn require early review and approval of such plans, and regular periodic inspections at all facilities that handle hazardous materials.

- The city/county can develop a process to coordinate hazardous materials management activities with other jurisdictions in the area.

IMPLEMENTATION IDEAS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

- Develop a framework to evaluate the significance of risks related to hazardous materials for the purpose of implementing policies and ordinances. The framework may include the basis of what constitutes a significant impact.

- Schedule a pre-application meeting with the energy project proponent and all interested local, state and federal agencies. The purpose of the meeting is to provide the developer with early feedback on the proposal, including the possible issues that may need to be addressed and mitigation measures that may be required. (See Chapter 4 for further information.)

- Revise zoning ordinances to reflect siting policies regarding energy facilities that use hazardous materials. Designate adequate industrially zoned land for energy facilities away from sensitive receptors such as schools, hospitals, parks, and residential areas.

- Require that the facility developers identify in the application the quantity and type of hazardous materials to be used at any proposed energy facility.

- Consider requiring the use of less hazardous substances, when technically feasible, in place of acutely hazardous materials in energy facilities. A variance from this requirement may be granted if the project proponent can demonstrate to the satisfaction of the city/county that the risk associated with use of the acutely hazardous material can be reduced to an acceptable level.

- Consider requiring that all equipment at energy facilities meet current industry standards.

- Develop standard conditions of use for permitting various energy facilities or for the hazardous materials used by them.

- Develop design guidelines for handling and storage areas for hazardous materials, if it is not technically feasible to replace them with less hazardous substances, based on the recommendations set forth in the Uniform Fire Code, Article 80.

- Consider developing a fee structure to pay for plan, review and enforcement activities.

- Develop Risk Management and Prevention Program guidelines. (The Governor's Office of Emergency Services has created a guidebook to help communities develop their own guidelines based on the requirements of the law.)

- Create a hazardous materials management coordinating committee composed of members from the following departments: planning, building, fire, police, health, emergency services, public works, sewage and water treatment, purchasing, city/county attorney, city manager, and air pollution control district. Coordinating committees can promote information sharing, streamline permitting, educate staff, coordinate emergency response efforts, and facilitate law enforcement.

- Create an interjurisdictional hazardous materials management committee with other governments in the area. The committee should be composed of members from the following departments from the various jurisdictions: planning, building, fire, police, health, emergency services, public works, sewage and water treatment, purchasing, the city/county attorney, the city manager, and the local air district.

- Establish cost recovery ordinances. Include the cost of application evaluation, as well as monitoring services and cost of clean-up in the event of a release, as part of the permit fee structure.

CASE STUDIES

Contra Costa County and Los Angeles County have developed Risk Management & Prevention Program (RMPP) guidelines for businesses handling acutely hazardous materials. The guidelines detail the requirements for the RMPP and the associated technical studies (Hazard & Operability Studies, Off-Site Consequence Analysis, and Seismic Studies). *Contact:* Sandra Hollenbeck, Contra Costa County Health Services, Environmental Division, 4333 Pacheco Blvd, Martinez, CA 94553-2295, (510) 646-2286. *Contact:* Barbara Eu, Los Angeles County Fire Department, Hazardous Materials Division, 5825 Richenbacker Road, City of Commerce, CA 90040, (213) 720-5186.

The City of Irvine has assigned a representative from the Fire Department to spend part of his time in the Planning Department. This staff person performs plan review and answers applicant questions. The Fire Department representative has recently been indispensable as a resource when the City has made land use compatibility decisions involving hazardous materials. *Contact:* Bob Storchheim, City of Irvine, Planning Department, P.O. Box 19575, Irvine, CA 92713, (714) 724-6453.

The City of Modesto has had a cost recovery ordinance for hazardous materials cleanup and wastes or materials abatement since 1982. As required by law, responsible parties (persons who intentionally or negligently caused hazardous

materials to be deposited onto property or into the atmosphere within the City) are billed for cleanup activities. Normal fire suppression activities are separated from those spent abating a hazardous materials portion of an incident. Department costs billed include labor, fringe benefits, equipment use, and indirect costs.

Modesto has been able to successfully recover costs under the ordinance. The ordinance has also reduced the number of hazardous materials releases. Repeated releases of anhydrous ammonia from the pressure relief system on an ammonia storage vessel at an energy facility caused complaints from neighbors. An emergency team was dispatched and the facility was billed. After a few such incidences, the facility installed a vent scrubbing system to capture material vented.
Contact: Blair Bradley, City of Modesto Fire Department, P.O. Box 642, Modesto, CA 95353, (209) 572-9512.

INFORMATION RESOURCES

Local Administering Agencies can provide local government permitting agencies and developers with the information they require to satisfy Business Plan and RMPP requirements. Administering Agencies should be involved from the start with the permitting of an energy facility in order to insure that risks from hazardous materials will be adequately mitigated, and to reduce the time and cost of permitting by providing developers with requirements in the early design stage.
Contact: Your local administering agency, usually the fire, public health, or emergency services department.

Governor's Office of Emergency Services has developed two documents to aid local agencies dealing with hazardous materials. *Guidance for the Preparation of a RMPP* serves as a resource to administering agencies in developing reporting requirements for facilities. Communities can also use it to develop their own RMPP guidelines. *The Hazardous Material Incident Contingency Plan* describes the state's hazardous materials emergency response organization and the relationship of the state to local, federal, volunteer and private organizations. This plan may be used by local governments to clarify their roles and relationships concerning hazardous material emergencies.
Contact: Governor's Office of Emergency Services, 2800 Meadowview Road, Sacramento, CA 95832, (916) 262-1750.

Cal-OSHA has guidelines for process safety (PSM) management programs to prevent releases of hazardous chemicals. The U.S. Department of Labor has the pamphlet *Process Safety Management (OSHA 3131-1993)* which summarizes the OSHA (PSM) standard.
Contact: Cal-OSHA, 455 Golden Gate Avenue, Room 5246, San Francisco, CA 94102, (415) 703-4050.

The U.S. Environmental Protection Agency, Department of Transportation, and Federal Emergency Management Authority have developed two guidebooks on hazards analysis. The *Technical Guidance for Hazards Analysis* provides technical assistance to local emergency planning departments to assess the lethal hazards related to potential airborne releases of extremely hazardous substances. The guide can assist local planners in:

- Conducting hazards analyses
- Providing community awareness
- Promoting consistency among local emergency plans

The *Handbook of Chemical Hazard Analysis Procedure* expands on the above guidebook by including information for explosive, flammable, reactive and otherwise dangerous chemicals.
Contact: Karen Sundheim, US Environmental Protection Agency Library, Region IX, 75 Hawthorne Street, San Francisco, CA 94105-3901, (415) 744-1508.

The Local Government Commission is a nonprofit, nonpartisan, membership organization for local officials, city and county staff, and other interested individuals. It has the following materials related to local government management of hazardous materials: *Government Coordination at the Local Level: Creating Internal and Interjurisdictional Coordinating Committees;* and *Cost Recovery: Making Polluters Pay for Cleanup.*
Contact: Publications, Local Government Commission, 1414 K Street, Suite 250, Sacramento, CA 95814, (916) 448-1198.

The Center for Chemical Process Safety of the American Institute of Chemical Engineers has developed guidebooks for the use, storage and handling of hazardous materials. Titles include: *Guidelines for Technical Management of Chemical Process Safety, Guidelines for Chemical Process Quantitative Risk Analysis, Guidelines for Process Equipment Reliability Data with Data Tables, Guidelines for Vapor Release Mitigation, Guidelines for Safe Storage and Handling of High Toxic Materials, Guidelines for Use of Vapor Cloud Dispersion Models,*

and *Guidelines for Hazard Evaluation Procedures.*
Contact: Center for Chemical Process Safety, American Institute of Chemical Engineers, 345 East 47th Street, New York, NY 10017, (212) 705-7338.

Frank P. Lees has written *Loss Prevention in the Process Industries - Hazard Identification, Assessment and Control, 1992.* This is the authoritative reference source of information on the management of hazardous materials. It was written to prevent loss of lives and economic losses due to hazardous materials incidents.
Publisher: Butterworth-Heinemann Ltd, Linacre House, Jordan Hill, Oxford, England, OX2 8DP.

RELATED CHAPTERS/ISSUES

- Energy Facility Planning (Chapter 3)
- Energy Facility Permitting (Chapter 4)
- Air Quality (Chapter 5.1)
- Water Use and Quality (Chapter 5.4)

CHAPTER 5.4: WATER USE AND QUALITY

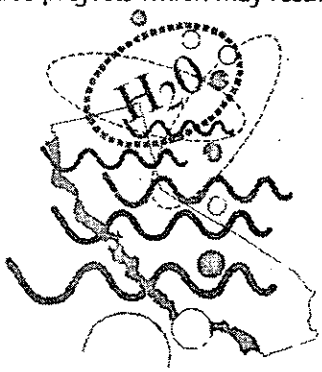
INTRODUCTION

Water is a critical issue in California and will continue to be so as population growth puts increasing pressure on existing water resources. With respect to energy facilities, local government should be concerned about the source of water utilized by the facility, including the quantity and quality needed, and the quality of the water discharged from the facility.

Local governments can be responsive and consistent when they provide energy project development guidance to prospective developers. Working with and providing advance guidance to prospective developers will result in a more efficient, effective, and expeditious permitting process which will benefit both the local community and the developer/applicant.

WHAT IMPACTS ON WATER RESOURCES ARE CONSIDERED SIGNIFICANT BY CEQA?

For those projects which are subject to CEQA, water resources may be a key issue in determining whether an EIR will be required. Those projects which may result in a significant adverse effect on water resources would be subject to an EIR.



The California Environmental Quality Act (Appendix G of CEQA Guidelines) deems a project will normally have a significant impact on water resources if there is the potential for:

- Substantial degradation of water quality, violation of existing water quality standards, or exacerbation of noncompliance of existing water quality standards
- Substantial degradation or depletion of groundwater resources
- Substantial interference with groundwater recharge, direction or rate of flow
- Substantial flooding, erosion or siltation
- Alteration of stream flow characteristics which result in upstream or downstream erosion, sedimentation or flooding
- Encouraging activities that will result in the use of large amounts of water or
- Using water in a wasteful way

HOW CAN WATER SUPPLIES BE AFFECTED BY ENERGY FACILITIES?

Energy production facilities, such as oil refineries or thermal power plants requiring cooling water, can use large amounts of water in their operations. Such facilities may affect not only local, but regional water supplies. Energy project use of groundwater, whether pumped directly by the facility or provided by another supplier, may lower the water table to a point where other users of the aquifer may experience increased pumping costs or reduced production from their wells.

Increased diversion of surface water may likewise affect downstream users and resources through reduced flows and lessened water quality. Hydroelectric dams can significantly alter stream flows, natural flooding cycles, and water quality. Biological resources, recreational opportunities, and other beneficial uses may be lost when water is impounded or diverted.

HOW CAN WATER SUPPLY IMPACTS BE REDUCED?

◪ Reuse of water. One way to reduce consumption by energy facilities is through the reuse of water. Historically in California, power plants sited in coastal areas have used "once-through" cooling processes which require the temporary diversion of a significant amount of water and result in associated adverse water quality and aquatic resource impacts. Inland facilities have historically recycled cooling water through their systems a number of times by using cooling towers, thereby reducing the amount of water a project requires. This, however,

may pose wastewater discharge problems.

- Use of lower quality water. Regardless of quality, any water source can be used for cooling purposes if it is available in sufficient quantities. For example, reclaimed water from wastewater treatment plants is often available. The major drawbacks to the substitution of these waters for high quality fresh water is the degree of mineralization and nutrient enrichment they exhibit and the cost of treatment needed to make them suitable for cooling purposes. The tendency for scaling and/or fouling heat exchanger surfaces, which decrease the efficiency of the cooling process, are exacerbated with the use of lower quality waters. Boiler makeup water generally requires a significantly higher quality water than is necessary for cooling tower makeup.

The California Water Code declares that the use of potable domestic water for nonpotable uses, including industrial and cooling tower uses, is a waste or unreasonable use of water if reclaimed water is available under certain prescribed conditions.

The use of ocean water, because of the high concentrations of mineral salts, is best suited for once-through cooling. The use of brackish water for use in cooling towers is possible but the water must first be treated to prevent scaling. Cost of fresh water use in the future will be the major determinant in the use of non-fresh water for cooling purposes. Use of fresh inland water for power plant cooling should be approved only after it has been shown that other sources of water are not feasible.

- Use of alternative technologies. Another way to minimize water consumption is to employ alternative technologies that require less water. For example, instead of the standard wet evaporative cooling tower technology, either a dry cooling or combination wet-dry cooling technology could be used. Because these alternative technologies are more expensive and are not as efficient, it is likely these alternatives would only be desirable where the financial or environmental costs of water is significantly high.

HOW CAN WATER QUALITY BE AFFECTED BY ENERGY FACILITIES?

Energy facilities can adversely affect water quality through direct and inadvertent discharge of pollutants to adjacent surface and groundwater bodies. These pollutants include heat, suspended or dissolved chemicals, and sediments.

- Heat. Heat, a by-product of energy generation, may significantly raise the temperature of cooling water. The effects of discharging heated cooling water or other wastewater will depend on a host of factors including the size of the facility, heating technology, and the size and water temperature of the receiving waters. Hydroelectric dams may also affect the natural temperature of surface waters.

Heated water decreases the availability of oxygen in water for aquatic organisms. Different organisms have varying tolerances to increased water temperatures. Adverse effects may range from fish kills to reduced reproduction. Trout and salmon species found in

FACILITIES WITH POTENTIAL ADVERSE WATER QUALITY IMPACTS

Energy Facility Type	Potential Impact
Facilities using water in cooling process	Thermal impact of receiving waters, impact of water treatment chemicals
Facilities that handle and store chemicals	Surface and groundwater contamination
Facilities with holding ponds in water treatment	Groundwater and wildlife impacts
Hydroelectric Dams	Temperature, volume, velocity and turbidity of rivers, and groundwater recharge
Geothermal Facilities	Surface and groundwater contamination from arsenic, vanadium, sulfur, heavy metals, and salts in drilling sludge
Oil and Gas Facilities	Surface and groundwater contamination from drilling sludge

California are particularly sensitive.

- **Suspended or dissolved chemicals.** Recycling of water through a power plant may significantly increase the concentrations of naturally occurring, but toxic elements such as arsenic, copper and selenium in the water, as well as other organic and inorganic compounds. Furthermore, certain chemicals, such as those used for antifouling or descaling purposes, may be introduced into the cooling water discharge. Small concentrations of these organic and inorganic compounds may be highly toxic. The chemistry of these compounds in water is complex and may transform pollutants to forms with lesser, equal or greater toxicity.

As with temperature, aquatic organisms vary greatly in their sensitivity to trace metals and other organic and inorganic compounds. Some compounds, such as selenium, can accumulate in sediments and tissue and reach toxic levels. Inadvertent spills or releases of chemicals that are used in the development and operation of energy facilities may impact surface and groundwater quality as well. (See Chapter 5.3 on Hazardous Materials Handling and Storage.)

- **Sediments.** Earth moving activities associated with the construction of energy facilities may result in sediment being washed into adjacent water bodies. Erosion and sedimentation may even continue after construction. During and following intense rains, stormwater runoff may introduce contaminated soil and water into adjacent surface and groundwater bodies.

HOW CAN WATER QUALITY IMPACTS BE REDUCED?

Although existing laws regulate point and nonpoint discharges to water, local governments can participate in the development of project-specific water quality control standards and mitigation measures and ensure these measures are correctly implemented.

- **Contain sediment and contaminated runoff during construction.** During construction of an energy facility, the potential for water quality impacts can be reduced by ensuring that no sediment or contaminated run-off leaves the project site or enters on-site or off-site water-bodies. This can be achieved through stabilizing disturbed areas as soon as possible, routing run-off away from such areas, treating run-off before it leaves the project site and separating and treating run-off from areas where chemicals such as diesel fuel are stored and handled.

Such mitigation measures should be required as part of the erosion and sediment control plan and the construction storm water management plan. Although preparation and implementation of the storm water management plan is required by the Regional Water Quality Control Boards, local governments may require that these plans be submitted to them for their review and approval.

- **Ensure adequate hazardous materials handling and storage.** During operation, impacts can be reduced through ensuring chemical storage and handling areas are sited in areas with impervious surfaces and berms with sufficient capacity to accommodate spills, including storage tank failures, and potential runoff. Runoff from such areas should be kept separate from other runoff and treated before discharge. Such mitigation measures should be required as part of the industrial stormwater management plan and spill prevention and control plans. (See Chapter 5.3)

- **Use water conserving technologies.** Use of water conserving technologies such as air-cooled condensers or wet-dry cooling towers that reduce discharge amounts, can also reduce the potential for water quality impacts.

- **Review discharge standards and monitoring program.** Discharge of wastewater to land or other waters is regulated by one of the nine Regional Water Quality Control Boards. Nevertheless, local governments should ensure that any mitigation measures identified for the project during the environmental review process be incorporated into the permit requirements of the regional board. Innovative wastewater treatment approaches such as the use of wetlands should be encouraged.

HOW CAN WATER USE AND QUALITY IMPACTS BE ANALYZED?

Energy facility impacts on water use and quality can be analyzed by consideration of the following topics:

- **Amount, source, and quality of water needed.** The energy facility permitting agency can determine if the proposed water source, and the treatment and transmission systems necessary to provide the water source, are adequate to meet the construction and operation needs of the facility without adversely diminishing local or regional water supplies. A "will-serve" letter from the water provider is not adequate to ensure significant impacts to water supplies do not occur.

THE REGULATORY ENVIRONMENT FOR WATER USE AND QUALITY

WATER USE

In California, water use and supplies are controlled and managed by an intricate system of federal and state laws. Common law principles, constitutional provisions, state and federal statutes, court decisions and contracts or agreements all govern how water will be allocated, developed and used within the state.

Federal

The federal government involvement in water supply issues primarily addresses interstate commerce, international waters, and protection of public resources. The Federal Power Act requires hydroelectric projects using navigable waters or federal land to receive a license from the Federal Energy Regulatory Commission (FERC). FERC retains the right to license all non-federal hydroelectric facilities in the country. The Nuclear Regulatory Commission licenses all nuclear power plants. In addition, energy development on federal land requires approval from the appropriate federal agency. Actions affecting rivers named in treaties (for example, the Colorado River) or designated in specific legislation (Wild and Scenic Rivers Act) are concerns of the federal government. Finally, activities involving the water from the Central Valley Project may require Bureau of Reclamation approval.

State

Appropriative rights to surface waters within the state are administered by the State Water Resources Control Board. Groundwater management in certain areas of the state is administered either by judicial adjudication or an agency with statutory powers. California Water Code section 10753 (AB3030 passed in 1992) authorizes local governments to adopt groundwater management plans. In addition, recent court cases have deemed that the public trust doctrine may limit water rights. Certain transfers of water outside the watershed of origin also require State Water Resources Control Board approval.

In addition, there are several laws and policies that govern the use of wastewater in California. In general, the California Water Code requires the maximum use of wastewater. Specifically, the Water Code prohibits use of potable water for nonpotable uses, including cooling tower and other industrial uses, if reclaimed water is available under certain prescribed conditions. In addition, for power plants, the California Water Resources Control Board adopted a resolution encouraging the use of wastewater for power plant cooling and established the following order of preference for cooling purposes:

1) Wastewater discharged to the ocean
2) Ocean water
3) Brackish water or irrigation return flow
4) Inland wastewater of low total dissolved solids (TDS)
5) Other inland water

State Water Resources Control Board issues permits for the appropriation of surface water	California Water Code, Division 2, section 100 et seq.
State Water Resources Control Board encourages water conservation and maximum reuse of water, especially in water short areas	Resolution 77-1

THE REGULATORY ENVIRONMENT FOR WATER USE AND QUALITY (CON'T)

State Water Resources Control Board's priority for sources of cooling water	Resolution 75-58
Use of Reclaimed Water	California Water Code sections 13550 et seq.
Groundwater Management Plans	California Water Code section 10752 et seq.

WATER QUALITY

Federal

The Federal Water Pollution Control Act, or Clean Water Act, provides for the restoration and maintenance of the nation's water quality. It provides for the elimination of the discharge of pollutants, and prohibits the discharge of pollutants in toxic amounts. The act sets forth the National Pollutant Discharge Elimination System Permit Program (NPDES). The Clean Water Act, section 307(b) and 307(c), also sets forth pretreatment requirements for discharges to publicly owned wastewater treatment plants. The Environmental Protection Agency has added requirements for such discharges. These discharges are not subject to NPDES Permits, but are subject to federal and local requirements. The United States Environmental Protection Agency permits deep well injection within the state.

Clean Water Act regulates disposal of waste from point sources to navigable waters	Title 33, United States Code sections 1251-1387
Safe Water Drinking Act regulates deep well disposal	Title 42, United States Code sections 300 et seq.
The Resource Conservation and Recovery Act establishes proper methods for handling and disposal of hazardous and non-hazardous wastes	Title 42, United States Code sections 6921-6939

State

California's Porter-Cologne Water Quality Control Act and the Safe Drinking Water and Toxic Enforcement Act established agencies and standards for controlling the water quality in the state. Authority to issue NPDES Permits has been delegated by the federal government to the state. These are issued by Regional Water Quality Control Boards (RWQCB). RWQCB also regulate water quality in the state by issuing pretreatment requirements for publicly owned wastewater treatment plants. The regional boards also issue permits for waste disposal to dry land and regulate stormwater discharges. These permits guarantee that certain named substances are kept at or below levels deemed to be safe.

Porter-Cologne Water Quality Control Act grants the State Water Resources Control Board and the Regional Water Quality Control Boards the authority to regulate discharges to land, surface and groundwaters	California Water Code section 13000 et seq.
Safe Drinking Water and Toxics Enforcement Act prohibits contaminating drinking water with chemicals known to cause cancer or chemicals reproductive toxicity	California Health and Safety Code section 25249.5 et seq.

Emergency water demands should be identified in the event that the primary water source is interrupted.

The source of the water will affect the nature of the analysis. For example, if the source is groundwater, the effects on other users through the draw-down of groundwater levels, the ability to recharge the aquifer and movement of contaminants in the aquifer should all be considered. Analysis of surface water use also needs to look at the effect on other users through adverse impacts on water quality.

- Use of water consumption reduction means, such as water conservation, use of lower quality water, and use of alternative technologies, as discussed in a previous section.

- Impacts on biological and recreational resources and aesthetic values. (Please refer to Chapters 5.2 and 5.5).

- The ability of the treatment plant and the water delivery system to accommodate increased flows.

- Wastewater discharge requirements. For wastewater discharges, the analysis needs to consider the amount, quality and method of discharge. The method of discharge will be either through evaporation ponds, discharge to natural or man-made water bodies, deep well injection or discharge to the sewer system and wastewater treatment plant. Although each of these disposal methods requires permits, either from state, federal or local governments, it is still necessary for the energy facility permitting agency to address the potential impacts to water quality and biological resources.

Damaged liners within evaporation ponds may allow contamination of surface and groundwater bodies. Discharges to the sewer and wastewater treatment system may exceed the ability of the system to handle increased flows, interfere with the treatment process or limit the ability to reuse treated effluent for irrigation or other purposes. Deep well injection has the potential to contaminate groundwater aquifers. Discharges to man-made or natural surface water bodies may significantly affect water quality and biological resources.

"Due to the large number of special districts within California, management of water supplies or wastewater treatment plants may or may not rest with the local government evaluating a proposed energy facility."

- Chemical spill containment. Related considerations include whether there is adequate spill containment around chemical storage and handling areas, not only for the volume of chemicals contained but also to accommodate precipitation from a ten-year storm.

- The potential for off-site waste disposal sites or transportation of toxic materials to degrade water quality needs also to be addressed, as should the adequacy of the proposed treatment of chemical spill and runoff.

WHAT IS THE LOCAL GOVERNMENT ROLE IN THE REGULATION OF WATER USE AND QUALITY IN ENERGY FACILITIES?

Due to the large number of special districts within California, management of water supplies or waste water treatment plants may or may not rest with the local government evaluating a proposed energy facility. Local governments have the opportunity, if not the requirement, to adopt policies and ordinances addressing erosion and sediment control, hazardous materials handling, water conservation and wastewater discharges to local sewer systems. Local governments can actively participate in hearings of state and regional water control boards for permit hearings and regulation development.

GENERAL PLAN IDEAS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

- The city/county can work closely with the California State Water Resources Control Board (WRCB) and local water district to ensure that an energy facility applicant identifies adequate sources of water for facility construction and operation that will not adversely affect the local or regional water resource and other users of the resource.

- The city/county can involve the appropriate Regional Water Quality Control Board (RWQCB) early in the permit process for energy facilities to ensure the maximum protection of water resources in the area.

- The city/county can require a proponent of an energy facility to identify the anticipated amount of water needed during construction and operation, as well as the source of that water. The proponent should also identify a reliable backup source of water for use in case of emergency when the primary source is not available.

- The city/county can encourage the use of non-fresh water for cooling water for thermal power plants.

- The city/county can consult with responsible biological resource agencies regarding CEQA documentation to ensure that energy facility discharges, which may meet NPDES permit standards, will not adversely affect sensitive species. (See Chapter 5.2 on *Biological Resources* for further details.)

IMPLEMENTATION IDEAS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

- Consider requiring that the local water district or agency identify how the necessary water for the energy facility will be provided.

- Consider requiring the developer to investigate and discuss the use of non-fresh water in the operation of the facility, as well as all other available conservation measures.

- Provide incentives such as permit assistance and reduced permit fees for applicants that implement water-saving measures into their permit application and operations.

- Consider requiring spill containment dikes and berms around areas where materials that can adversely affect water quality are handled and stored. These should be sized to accommodate the volume of stored material plus precipitation from a 10-year storm. Require the developer to implement an emergency response plan for the accidental release of such materials.

- Provide for adequate mitigation procedures to ensure that surface water quality is not impacted by sedimentation due to erosion. Suggested mitigations include, but are not limited to, the use of sediment traps and catch basins, lined diversion ditches and energy dissipaters.

- Consider requiring a water quality monitoring plan to identify degradation, if it occurs, for energy facilities that have potential adverse water quality impacts. Provide a mechanism to add mitigation measures if water quality monitoring identifies problems.

- Provide an emergency water supply plan. If an emergency water supply cannot be secured, facility operations may be required to be discontinued until the primary water supply is again available.

- Consider requiring the developer to provide monetary compensation or an alternate water supply to water users adversely impacted by the facility's degradation of water quality.

- Consider requiring monetary compensation to publicly-owned treatment works for upgrading their facilities to handle the wastewater discharges from an energy facility.

CASE STUDIES

Siskiyou County has developed zoning ordinances in its Energy Element related to water quality protection. The County encourages the use of portable tanks and sumpless drilling for geothermal facilities when the well is located within 500 feet of surface water. The County also requires stream monitoring and emergency planning for spills and blowouts of the wells. For any thermal facility, the County requires the identification of the source and disposal plan of cooling water, and encourages the use of less water or recycled water. *Contact:* Rick Barnum, Siskiyou County Planning Department, P.O. Box 1085, Yreka, CA 96097, (916) 842-8200.

Lassen County has adopted an Energy Element which addresses erosion control, water quality permits and geothermal development and water quality, and requires consideration of the level of efficiency and water conservation measures for proposed energy facilities. Erosion control plans are required to include channelling stormwater runoff into adequate sewage/stormwater systems, use of

energy dissipaters, and culvert and ditch cleaning.

The County requires that developers get all necessary RWQCB permits. It discourages geothermal development in riparian or wetland areas, prohibits uncontrolled discharge of geothermal fluids to the site or surrounding area, and encourages carefully planned injection of geothermal fluids as an alternative to surface disposal.
Contact: Lassen County Department of Community Development, 707 Nevada Street, Susanville, CA 96130, (916) 251-8269, FAX: (916) 251-8373.

The Lake County Sanitation District, in cooperation with the California Energy Commission, US Department of Energy, US Environmental Protection Agency, Department of Commerce and local economic development agencies and several geothermal developers, is working on a treated wastewater discharge injection system that will result in the improvement of local water quality. The City of Clearlake and community of Lower Lake in Lake County, are growing communities which have had to limit growth due to a Regional Water Quality Control Board prohibition on new sewer hook-ups. This measure was adopted because the wastewater treatment plant is over capacity and has had unauthorized discharges of secondarily treated wastewater to the surface water of Clear Lake.

A public/private partnership is designing a pipeline to transport the treated wastewater to the Geysers steam field for injection into the geothermal reservoir. This injection will result in the recovery of about 70 megawatts of electricity. In addition to the energy benefits, the project will also provide an environmentally-superior method of wastewater disposal; will help retain hundreds of jobs in the region; and provide added tax and lease revenues for local communities, and state and federal governments.
Contact: Mark Dellinger, Lake County Planning Department, 225 N. Forbes Street, Lakeport, CA 95453, (707) 263-2273.

Glenn County's Energy Element contains policies that limit development of hydroelectric facilities to those that demonstrate that there will be no adverse effect on the availability or quality of water downstream or on recreation opportunities. The county also requires review by the Regional Water Quality Control Board and Department of Fish and Game for hydroelectric facilities. The policies require all project proposals to include a contingency plan to mitigate the adverse effects of drought or excessive rain.
Contact: Glenn County Planning Department, 125 S. Murdock Street, Willows, CA 95988, (916) 934-6540.

INFORMATION RESOURCES

The Central Valley Regional Water Quality Control Board has published *Guidelines for Protection of Water Quality During Construction and Operation of Small Hydro Projects* a good reference for determining mitigation measures for small hydroelectric facilities.
Contact: Central Valley Regional Water Quality Control Board, 3443 Routier Road, Sacramento, CA 95827, (916) 255-3000.

Sierra County prepared *Environmental Assessment of Hydroelectric Development within the North Yuba River Basin of Sierra County* in 1989 as a detailed analysis of the issues and mitigations for small hydroelectric development in the county.
Contact: Sierra County Planning Department, P.O. Box 530, Downieville, CA 95936, (916) 289-3251.

The California Department of Water Resources' Division of Local Assistance (DLA) offers programs to help local governments with their planning and permitting functions. DLA encourages more efficient use of California's water through a number of urban and agricultural water conservation programs, including gray water use and industrial water conservation. Staff also assists local agencies in analyzing water recycling plans and helps them through the regulatory process. Staff can provide information on subsidence caused by ground water extraction, as well as other types of subsidence throughout the State.
Contact: California Department of Water Resources, Division of Local Assistance, 1020 9th St., Sacramento, CA 94236-0001, (916) 327-1649.

RELATED CHAPTERS/ISSUES

- Energy Facility Planning (Chapter 3)
- Energy Facility Permitting (Chapter 4)
- Biological Resources (Chapter 5.2)
- Hazardous Materials Handling & Storage (Chapter 5.3)
- Appendix F, Power Plant Generating Efficiency

CHAPTER 5.5: VISUAL AND NOISE IMPACTS

INTRODUCTION

This chapter includes two main sections covering the potential visual and noise issues regarding energy facilities. Following background information on each issue there are ideas for general plan policies, mitigation and implementation for avoiding potential visual and noise impacts. Also included are case studies and information resources for these "nuisance" impacts. Local government planning and permitting efforts will be most successful when project developer and agency coordination, and public involvement are included from the beginning. (Please refer to the energy facility-related planning process discussed in Chapter 3.)

The visual and noise impacts of some energy facilities may be regarded as unpleasant or nuisances, and are generally treated as such. In addition, noise may be a disturbance to some activities of animals, including the rearing of young, feeding, and nesting behavior.

The section on Visual Resources begins on this page. The Noise Impacts section begins on page 5.5.7.

The reader interested in potential odor impacts from energy facilities should refer to Chapter 5.1 on Air Quality.

> *"A project's visual impact on a community depends on how the project affects visual character or visual quality."*

5.5.1 VISUAL RESOURCES IMPACTS

Visual resources are the natural and cultural features of the environment that can be viewed. The construction and operation of energy facilities may cause adverse visual impacts by introducing human-made features into a generally natural setting or by creating discordant visual contrasts with an existing urban setting.

BASIC VISUAL RESOURCES ASSESSMENT FACTORS

Several factors are important in determining the susceptibility of the existing setting to visual impacts. These include visual quality, viewer sensitivity, visibility, and viewer exposure.

- Visual Quality. Visual quality is the value of visual resources. In general, human modifications to the view in natural areas lower visual quality. Even in urban areas, natural features are generally preferred over human-made features. Visual quality may be described as high, moderate, or low. There is greater concern over protecting high quality views than protecting those of low quality. For example, there would be more concern over siting a large, combustion-type electric generation facility in an area of natural beauty than placing it in an existing industrial zone.

- Viewer Sensitivity. Viewer sensitivity describes the level of interest or concern of potential viewers. Existing surrounding land uses are a useful indirect indicator of viewer response. For example, the addition of another similar industrial facility in an established industrial zone would probably not affect the level of concern of the people working in or traveling through the area. The same facility next to a community park would probably affront the sensibilities of many of the park's users. Uses found to be sensitive to visual impacts, from the most to the least

sensitive, are recreational, residential, agricultural, commercial and industrial.

Visibility. Visibility describes how easily something can be seen. It depends on the presence or absence of screening, the angle of view, meteorological conditions, time of day, and lighting. Placing project structures behind other structures is an example of screening, as is the use of walls, berms, trees, or other landscaping. The viewer's angle will also affect the visibility of the project. The more direct the angle of view, the greater the visibility.

Viewer Exposure. Viewer exposure depends upon viewer distance from the feature or view, the number of viewers who will see the view, and the length of time the view will be seen.

Distance is important because fewer details remain with greater distance. At long range, only the horizon and major land forms such as mountains are visible. In the middle distance, surface features may be visible such as forests or clusters of buildings. At close range, textures and colors are perceptible on objects such as energy facilities.

The number of viewers can be described in terms of absolute numbers of viewers or the percentage or type of affected viewers in the view shed. The higher the number of viewers, especially of more sensitive viewers, the more significant the impact.

The longer the duration of the view, the greater the impact. Visual impacts during construction are often unavoidable, but are not permanent and, while unpleasant, are less likely to be significant than are the long-term impacts of the completed project. (Another example of extended exposure to energy facilities is the presence of electric transmission lines that run for long distances and are in public view for much, if not all, of their length.)

ENERGY FACILITIES WITH POTENTIAL VISUAL IMPACTS

Facility Type	Potential Visual Imapct
Utility-Scale Wind Turbines	Large tracts of land Highly visible locations (ridges) Change from rural to industrial
Utility-Scale Solar Facilities	Large tracts of land Concentration of sunlight Change from rural to industrial Vegetation removal, scarring
Hydroelectric	Change from free-flowing to industrial use Dams are often large Vegetation removal, scarring
Geothermal Facilities (electrical generation)	Large plants Cooling tower plumes Drilling equipment Sometimes pipelines Change from rural to industrial Vegetation removal, scarring
Gas/Oil Facilities	Large processing plants Tall derricks, drilling equipment Pipelines
Combustion Facilities	High exhaust stacks Emission plumes Massive appearance
Transmission Lines	Introduction of industrial element Long, linear facilities can affect many viewers Impacts can depend on tower types

WHAT ARE THE NEGATIVE VISUAL IMPACTS OF ENERGY FACILITIES?

A project's visual impact on a community depends on how the project affects visual character or visual quality. A project can adversely affect visual character or visual quality by creating contrast with the form, line, color, texture, or spatial arrangement of the existing setting; by introducing a dominant element to a view; by blocking a scenic view; or by causing light or glare. Energy facilities can produce glare (if reflective materials are used) that can shine on surrounding areas. Nighttime lighting can be directly visible or can illuminate the sky.

HOW CAN YOU DETERMINE THE SIGNIFICANCE OF VISUAL IMPACTS?

For those projects which are subject to CEQA, the Guidelines to the California Environmental Quality Act (CEQA) (section 15382) define a significant effect on the environment as one that produces "a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including...objects of...aesthetic significance." The Guidelines also state that a project will normally have a significant effect on the environment if it will have a substantial, demonstrable negative aesthetic effect (Supplementary Document G (b)). The Guidelines also recognize that a project may have a significant environmental effect if it produces new light or glare, results in the obstruction of any scenic vista open to the public, or creates an aesthetically offensive site open to public view (Supplementary Document F, Environmental Checklist Form, Section VII, Light and Glare, Item (a), and Section XVIII, Aesthetics, Items (a) and (b)).

Other state and federal laws also can help determine if an energy facility has significant visual impacts when the resources they were meant to protect are impacted by the facility. The California Coastal Act in Public Resources Code section 30251 states that "scenic and visual qualities of coastal areas shall be protected as a resource of public importance." The state has also developed the California Scenic Highway Program to protect the views from designated highways. The Wild and Scenic Rivers Act includes protection of the visual resources of the federal lands involved. (See the box on *The Regulatory Environment for Visual Resources* on the next page.)

Local governments and regional entities may also choose to protect certain vistas or visual resources, and may do so in their ordinances, policies and plans. See the box below on *Questions to Consider to Evaluate Visual Impact Significance* for pertinent questions to help determine if a significant adverse visual impact may result from a project.

WHAT INFORMATION CAN BE USED TO ASSESS VISUAL RESOURCES IMPACTS?

Appropriate information includes:

1) **A description of the existing regional and local visual setting,** including the topographic, vegetative, hydrologic and cultural elements of the landscape as it exists prior to the proposed project

The baseline setting should address:

a) A description of the viewshed

b) The existing visual quality in the viewshed

c) Viewer sensitivity

d) Visibility

e) Viewer exposure

f) Identification of the most sensitive viewing locations or "Key Observation Points" (KOPs)

QUESTIONS TO CONSIDER TO EVALUATE VISUAL IMPACT SIGNIFICANCE

- Will the project substantially alter the existing viewshed, including any changes in natural terrain?
- Will the project deviate substantially from the form, line, color and texture of existing elements of the viewshed that contribute to visual quality?
- Will the project substantially degrade the existing visual quality of the viewshed or eliminate visual resources?
- Will the project be in conflict with directly identified public preferences regarding visual resources?
- Will the project comply with local goals, policies, designations or guidelines related to visual quality?
- Will the project significantly increase light and glare in the project vicinity, particularly nighttime glare?
- Will the project result in significant amounts of backscatter light into the nighttime sky?
- Will the project result in a significant reduction of sunlight, or the introduction of shadows, in areas used extensively by the community?
- Will the project result in a substantial visible exhaust plume?

THE REGULATORY ENVIRONMENT FOR VISUAL RESOURCES

Federal

Wild and Scenic Rivers Act protects the visual quality of designated rivers

National Environmental Policy Act (NEPA) - Established the federal basis for addressing aesthetics

State

CEQA - defines significance and includes aesthetics

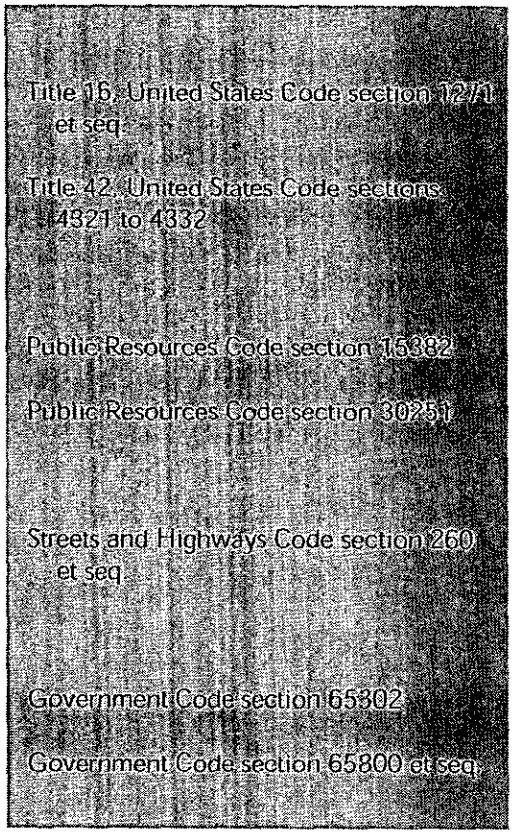
California Coastal Act - protects the scenic and visual qualities of coastal areas as a resource of public importance

California Scenic Highway System

Local

Open Space Element in General Plans

Zoning and design guideline authority



2) Topographic maps to show the location and the viewshed(s) of the project and its related facilities, and the locations of the KOPs

3) Photographs of the sites of the project and related facilities from each KOP

4) Simulations showing the project and related facilities from each KOP

5) A discussion of the methodology used to evaluate impacts resulting from the project and related facilities

6) A discussion of the significance of the visual impacts from construction and operation of the project, including:

a) A comparison of the pre-project visual setting with expected construction and operation visual impacts from each KOP

b) A discussion of cumulative impacts

7) A discussion of the mitigation measures (see the box titled *Potential Visual Mitigation Measures*) to eliminate or reduce the significant visual impacts of the project, including:

a) Design (including relocation)

b) Color and texture

c) Landscaping

d) Lighting

8) A compliance monitoring plan to ensure successful implementation of required mitigation

GENERAL PLAN IDEAS FOR VISUAL RESOURCES

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

POTENTIAL VISUAL MITIGATION MEASURES

If it has been determined that an energy facility will result in significant visual impacts, the following mitigation measures may be employed to reduce the impact to a level of non-significance:

1) Relocation

a) Find a different site where the project will not cause significant visual impacts

2) Facility design

a) Paint the facility to minimize contrast with the surrounding environment
b) Avoid or reduce exhaust stack plumes
c) Reconfigure equipment/buildings to be less visible
d) Reduce the size of equipment/buildings to be less visible
e) Eliminate equipment/buildings
f) Replace disturbed vegetation

3) Lighting and glare

a) Design all lighting to not shine directly on nearby residences or streets
b) Shield all lighting to minimize illumination of the nighttime sky
c) Use non-reflective colors and materials

4) Screening

a) Plant a vegetative barrier with a long-term maintenance plan
b) Build a perimeter fence

5) Transmission lines

a) Bury transmission lines
b) Use an existing right-of-way
c) Avoid ridgetops and upper slopes
d) Locate transmission lines adjacent to the slope in valleys
e) Use existing vegetation to screen view of transmission lines
f) Use a curving right-of-way in forested areas to reduce line of sight
g) Follow natural contours
h) Use dull, non-reflective finishes
i) Vary the width of the right-of-way, remove vegetation in an irregular pattern
j) Use transmission structures that minimize visibility

- The city/county can designate significant viewsheds/corridors based on local preference and can develop a management plan to protect them. The city/county can seek the input of the public to identify the most visually sensitive areas.

- The city/county can designate industrial land away from sensitive viewing areas in order to reduce the possibility of conflict.

- The city/county can develop an order of preference for the development of transmission line corridors. For example:

  1) Use existing lines

  2) Upgrade existing lines to meet increased demand

  3) Build new lines parallel and adjacent to existing lines

  4) Build new lines requiring new corridors

- The city/county can support the development and use of standard criteria for determining significant adverse visual effects, and provide suggested mitigation measures to reduce visual impacts.

IMPLEMENTATION IDEAS FOR VISUAL RESOURCES

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

- Organize a committee to determine significant local viewsheds. The committee can be composed of members from interested municipal departments (such as the planning and zoning departments), community organizations

(such as historical or environmental groups), local businesses, and the general public. This committee can also develop and propose for city council or county supervisor approval, an order of preference for development of transmission line corridors.

- Revise zoning ordinances to separate industrial areas from areas designated for protection because of their visual significance.

- Develop standard questions for determining significant adverse visual impacts and develop mitigation suggestions to reduce visual impacts. (See also the box on the previous page entitled *Potential Visual Mitigation Measures.*)

CASE STUDIES FOR VISUAL RESOURCES

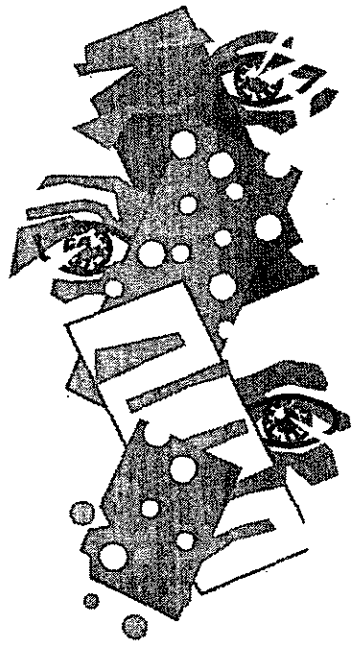
Colusa County developed a Transmission Line Element for its General Plan that contains policies to work with adjoining jurisdictions, utility companies, and state agencies in the siting process for new transmission lines. The Element also includes an order of preference for transmission line development (use of existing lines, upgrade existing lines to meet increased demand, parallel and adjacent lines, and lines requiring new corridors), and sensitivity rating for types of agricultural lands, transmission line routing in agricultural land, and tower type preference. The county also seeks local input to identify areas of most visual sensitivity, alternate routes, and to rate route alternatives when planning for new transmission lines.
Contact: Colusa County Planning Department, 220 12th Street, Colusa, CA 95932, (916) 458-8877.

Mono County's Conservation/ Open Space Element contains policies to designate important scenic resources and scenic highway corridors for protection, to preserve the visual identity of areas outside communities, and to protect significant scenic areas by maintaining land in those areas in public ownership. Proposed activities to implement these policies include identifying the scenic resources and coordinating with state and federal visual policies, restricting development in areas outside of communities, purchasing conservation easements, and use of zoning regulations to preserve open space.
Contact: Mono County Planning Department, P.O. Box 8, Bridgeport, CA 93517, (619) 932-5217.

INFORMATION RESOURCES FOR VISUAL RESOURCES

The **United States Department of Agriculture** has written *The Visual Management System in Agriculture Handbook* which includes a chapter titled "National Forest Landscape Management." The chapter includes the rationale and methodology used to determine the value of visual resources within the National Forest system and the potential impacts on them.
Contact: United States Department of Agriculture, United States Forest Service, 630 Sansome Street, San Francisco, CA 94111, (415) 705-2874.

The **United States Department of the Interior's** *Visual Resource Management Program* includes the methodology to be used in assessing the value and impacts to visual resources on lands under its control. Energy facilities that are on or cross lands managed by the National Park Service or Bureau of Land Management will have to use this methodology.
Contact: United States Department of the Interior, Bureau of Land Management, California State Office, 2800 Cottage Way, Room E-2807, Sacramento, CA 95825, (916) 978-4754.



5.5.2 NOISE IMPACTS

Noise may be associated with the construction and operation of energy facilities.

◪ Construction Impacts. Potential community impacts during energy facility construction include speech interference, and disruption of school or worship activities during the daytime and sleep disturbance at night.

Some communities have determined that a certain amount of construction noise, while exceeding local standards, is unavoidable and have chosen to exempt it from the limits in their ordinances. They do, however, restrict particularly noisy operations to certain hours of the day.

◪ **Operation Impacts.** While construction noise impacts are temporary, operational noise impacts potentially last for the life of the facility.

Operational noise levels are rarely allowed to exceed local limits since they could continue day and night for many years.

The effects of noise on people can be classified as follows:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as anxiety or hearing loss

Community noise impacts are almost always in the first two categories, while workers in industrial plants can experience the more physically damaging effects of the last category.

NOISE TERMINOLOGY

The following definitions are important when talking about noise impacts.

- *Decibel* (dB) is a unit of measurement that describes the magnitude (loudness) of a particular quantity of sound (sound level) with respect to a standard reference value.
- *A-Weighted Sound Level* (dBA) is a number representing the sound level which contains a wide range of frequencies weighted in a manner representative of the human ear's response.
- *Ambient Noise Level* is the sound level that exists at any instant at a point as a result of the combination of many distant sources which are individually indistinguishable. Statistically, it is taken as the sound level that is exceeded 90 percent of the time.
- *Tone* is a sound at a particular frequency. Distinct tones are easily perceived by the human ear.

HOW CAN THE SIGNIFICANCE OF NOISE IMPACTS BE DETERMINED?

There are also several concepts related to the subjective human response to noise that will help to determine if energy facility noise impacts are significant. In general, when determining a person's subjective response to a new noise by comparing it with the existing noise level to which he or she is accustomed, the more the level or tone of a new noise exceeds the existing ambient noise level or tonal quality, the less acceptable the new noise will be.

A study on increases in A-weighted noise levels has shown that, in general:

ENERGY FACILITIES WITH POTENTIAL NOISE IMPACTS

Facility Type	Potential Noise Impact
Most facilities during construction	Equipment and delivery noises Pile driving
Facilities with solid fuel delivery (Biomass, Municipal Solid Waste, Coal)	Delivery equipment noises
Biomass facilities	Fuel chipping/grinding
Facilities with pressure release valves (Cogeneration, Biomass, Geothermal)	High pitched steam release valve noise
Utility Scale Wind	Turbine noises and vibration
Hydroelectric	Turbine noises

• Outside of a laboratory, a 3 dB change is considered a barely noticeable difference.

• A change in sound level of at least 5 dB is required before any noticeable change in community response would be expected.

• A 10 dB change is subjectively heard as an approximate doubling in loudness and almost always causes an adverse community response. (National Academy of Sciences, 1977.

When noises are combined, people do not perceive them to increase in linear fashion. For example, if the sound of a car passing by is 30 dB, the perceived sound level of two cars passing by is not 60 dB, but 33 dB, an increase of 3 dB. As the difference in the decibel values of two additive noises increases, smaller increments are added to the larger decibel amount to predict the combined sound level.

Operation noise impacts on a community usually require great scrutiny since they may last for the life of the facility. There are three situations where noise levels from the operation of an energy facility have potentially significant impacts:

• The operation raises the ambient noise level 3 dBA or more even though the resulting ambient noise level increases from below the maximum acceptable level to above the maximum acceptable level established in local plans or ordinances.

• The operation raises the ambient noise level 5 dBA or more even though the resulting ambient noise level is below the maximum acceptable level established in local plans and ordinances.

• The operation introduces an annoying tonal quality into ambient sound levels.

WHAT INFORMATION CAN BE USED TO ASSESS POTENTIAL NOISE IMPACTS?

Both construction and facility operation impacts can be predicted in advance by the project designer. They may also both be measured and analyzed during construction and facility operation with on-site worker safety level measurements and off-site measurements at specified locations. The off-site measurements should be taken at the identified sensitive receptors, such as nearby residences, schools, hospitals, etc.

Useful assessment information includes:

a) A description of the project's noise-producing features, including the range of noise levels expected, and the tonal and frequency characteristics expected

b) A description of the noise-sensitive environment, including any sensitive receptors, i.e., residences, hospitals, libraries, schools, places of worship and other facilities where quiet is important

c) A list of applicable noise laws, plans and ordinances

THE REGULATORY ENVIRONMENT FOR NOISE

Federal

Occupational Safety and Health Act stipulates maximum worker noise exposure levels

Title 29, Code of Federal Regulations, section 1910 et seq.

State

California Occupational Safety and Health Administration sets employee noise exposure limits

Title 8, California Code of Regulations, sections 5096-5098

CEQA Guidelines state a project's impacts are significant if it increases substantially the ambient noise levels for adjoining areas

Title 14, California Code of Regulations, sections 15064, Appendix G (b)

Local

A Noise Element is required in each local General Plan to establish acceptable noise limits for various land uses, usually used to enable policing of annoying noise

Government Code section 65302

Nuisance abatement

Civil Procedure Code section 731

d) A survey, typically conducted for at least a 24 hour period, preferably during the quietest part of the week, and analysis of the pre-existing ambient noise regime, including measurements and analyses at affected sensitive receptors

e) A description of the potential noise impacts, including estimates of expected noise impacts upon construction and operation workers, and estimates of expected noise levels at sensitive receptor locations

f) A description of cumulative noise impacts

g) A description of the project's proposed noise control features, including specific measures proposed to protect workers, and specific measures proposed to mitigate noise impacts on sensitive receptors to a level of insignificance

h) Identification of any problem areas

GENERAL PLAN IDEAS FOR NOISE IMPACTS

The following are ideas which can be incorporated into general plan policy language providing they are consistent with goals adopted in the general plan. As is true for any adopted general plan language, if the city or county does not actually implement the language, any action taken by the local government to authorize a project would be subject to challenge based on the lack of implementation of the general plan.

◩ The city/county can require the project developer to design, implement and maintain an effective noise complaint resolution program during construction and subsequent operation of the energy facility.

◩ The city/county can require an ambient noise survey and analysis prior to construction, and can require noise surveys of the facility and of the surroundings (worker protection and ambient surveys) after the energy facility is operational. If the surveys indicate that either the workers or the community has been significantly impacted, further mitigation can be required.

IMPLEMENTATION IDEAS FOR NOISE IMPACTS

The following ideas can be used for the implementation of general plan policies. Any of the ideas used should, of course, be consistent with the entire general plan.

◩ **Construction Noise Impacts.** When off-site impacts from the construction of an energy facility exceed acceptable levels, the following mitigation measures may be required individually or collectively. Sample mitigation measures include:

- Provide functioning mufflers on construction equipment to reduce the noise levels to the extent possible.
- Locate noise sources (e.g., compressors) away from sensitive receptors where possible.
- Erect a temporary noise barrier (wall or berm) around construction site.
- Limit noise-producing construction work to daytime hours.
- Establish an effective noise complaint resolution process. The process should include publishing in advance in local newspapers when construction and/or operation will commence, as well as the schedule for particularly noisy operations (such as steam blows), and establishing and publishing a telephone number to call with noise complaints. A noise complaint resolution form should also be developed and records maintained to ensure that community concerns are adequately addressed. See the example of a noise complaint resolution form on the following page.

◩ **Operation Noise Impacts.** When off-site impacts from the operation of an energy facility are expected to exceed local standards, or are found to exceed local standards after operation begins, the following mitigation measures may be required, individually or collectively, to reduce the impacts to an acceptable level. Sample mitigation measures include:

- Install quieter equipment.
- Redesign and rebuild noisy equipment.
- Apply acoustic treatment on or around noisy equipment.
- Install acoustic barriers as appropriate, including walls or enclosures around noisy portions of the facility, and walls or berms around facility property line.
- Limit extreme noise-producing operations to daytime hours.
- Establish an effective noise complaint resolution process. (See accompanying form on the following page).
- Retain the right to modify noise mitigation requirements if subsequent construction and operation noise levels of an

NOISE COMPLAINT RESOLUTION FORM

PROJECT NAME:
CITY/COUNTY WHERE PROJECT IS LOCATED:

Complainant's Name and Address: Complaint Log No.

Phone Number:

Date complaint received:
Time complaint received:

Nature of noise complaint:

Definition of problem after investigation by plant personnel:

Date complainant first contacted:

Initial noise levels at 3 feet:	dBA	Date:
Initial noise levels at complainant's property:	dBA	Date:
Initial noise levels at 3 feet:	dBA	Date:
Initial noise levels at complainant's property:	dBA	Date:

Description of corrective measures taken:

Complainant's signature: _____ Date:

Approximate installed cost of corrective measures: $

Date installation completed :
Date first letter sent to complainant: (copy attached)
Date final letter sent to complainant: (copy attached)

This information is certified to be correct:

Plant Manager's Signature: _____

(Attach additional pages and supporting documentation, as required.)

energy facility, based on construction and operation noise surveys, exceed the projected levels originally permitted. Accurate preconstruction estimates of noise levels will reduce the time and cost associated with later revisions.

CASE STUDIES REGARDING NOISE

Alameda County requires in its conditional use permits for wind energy generators that these facilities be located more than 1000 feet in the upwind direction and at least 300 feet in any other direction from any existing dwelling or building site.
Contact: Alameda County Planning Department, 399 Elmhurst Street, Hayward, CA 94544, (510) 670-5400, FAX: (510) 785-8793.

Solano County's *Wind Turbine Siting Plan and Environmental Impact Report* contains policies that prohibit wind turbines which exhibit high infrasonic noise generation potential from locating within one mile of residential uses or land zoned for residential use.
Contact: Solano County Environmental Management and Planning Department, 601 Texas Street, Fairfield, CA 94533, (707) 421-6765.

Kern County's Energy Element contains a policy that requires an acoustical analysis for energy project proposals that might impact sensitive and highly-sensitive uses as listed in the Noise Element of its General Plan.
Contact: Kern County Department of Planning and Development Services, 2700 M Street, Bakersfield, CA 93301, (805) 861-2615.

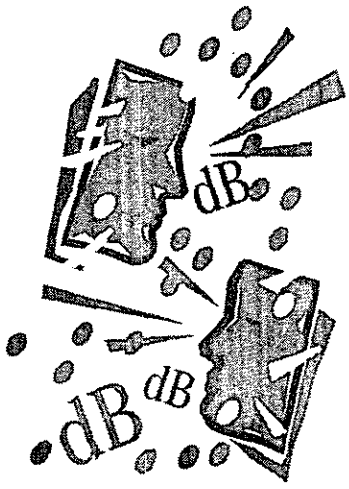
INFORMATION RESOURCES REGARDING NOISE

The California Energy Commission has information on dealing with energy facility noise levels, measurements, and mitigations. The Commission has licensed numerous energy facilities since it was first authorized to do so, and has developed expertise that it is willing to share with others less familiar with energy facility permitting. The Commission staff has developed a document on noise which may be useful to local governments.
Contact: Engineering Office, Energy Facilities Siting and Environmental Protection Division, California Energy Commission, 1516 Ninth Street, Sacramento, CA, 95814, (916) 653-1608.

The California Department of Health Services has issued *Guidelines for the Preparation and Content of Noise Elements in General Plans,* and *Model Community Noise Control Ordinances.* While there are no direct state regulations for off-site noise levels, these publications may help a community develop a set of evaluation criteria.
Contact: California Department of Health Services, 744 P Street, Sacramento, CA 95814, (916) 445-4171.

The Governor's Office of Planning and Research has developed *General Plan Guidelines,* including those for the required Noise Element in every General Plan.
Contact: Governor's Office of Planning and Research, 1400 10th Street, Sacramento, CA 95814, (916) 445-4831.

The National Academy of Sciences published (1977) a report entitled *Guidelines for Preparing Environmental Impact Statements on Noise,* Appendix A, page 3, in the Report on Working Group 69 on Evaluation of Environmental Impacts of Noise by the Committee on Hearing, Bioacoustics and Biomechanics Assembly of Behavioral and Social Sciences National Research Council.



NOTES NOTES NOTES

CHAPTER 5.6: PUBLIC CONCERNS ABOUT ELECTRIC AND MAGNETIC FIELDS (EMF)

INTRODUCTION

Both electric and magnetic fields occur naturally and are present around electrical equipment, appliances and power lines. Recent interest and research have focused on whether magnetic field exposure affects human health. Before this, most of the focus was on electric fields. This new focus started with reports of a possible link with cancer in humans presumed to have been exposed for long periods to magnetic fields. No such association was suggested in these reports when examining exposure to electric fields from the same sources.

Although there is general agreement among scientists that the cancer or other disease-causing potential of magnetic fields has not been established from the available evidence, it is also true that the possibility of such health effects cannot be dismissed by scientists based on the same evidence.

Because of this uncertainty, most utility regulatory agencies in the U.S. have acknowledged the need for clarifying research while some now consider it appropriate to incorporate field reduction techniques at minimal cost for new and upgraded power system projects. The present scientific uncertainty also means that public health officials cannot establish a standard or level of exposure known to be safe or harmful.

The challenge for local governments is how to respond reasonably to the concerns of local citizens in the face of scientific uncertainty. Public concerns may relate to both new and existing power lines and other electrical power facilities. Both new and existing power lines, for example, may affect existing or planned land uses and community development in general. Generally, utilities have taken the initiative to inform citizens about the current state of the knowledge on magnetic field issues. Local governments and utilities working together can ensure electric facility development in a manner consistent with the general plan.

> *"...an electric field is created when an appliance is plugged into the energized circuit while the magnetic field is produced only when the appliance is turned on."*

This chapter presents background information about electric and magnetic fields. First, we describe the basic nature of each field as commonly encountered in the environment and summarize findings from early and recent scientific studies on the health effects issue. We then discuss what the federal and state governments are doing to address concerns about EMF. Finally, we present recommendations on how local governments might address the present concern with regard to EMF sources in their respective areas. We hope that the information and resources provided will assist local governments in making informed decisions for their respective communities and in working with utilities and addressing state policies and programs.

HOW DID THE CONCERN OVER EMF EXPOSURE BEGIN?

The modern concern over possible EMF health effects can be traced mostly to reports by Soviet scientists in the mid-1960s about health effects among occupationally exposed individuals. The effects reported were effects other than cancer. Based on knowledge of the basic nature of EMF, the electric field component of EMF was assumed more likely than the companion magnetic field to be responsible for these effects. Despite serious flaws in the epidemiological studies involved, these reported findings served throughout the world to intensify research on the EMF health effects issue. Most such research focused on the

electric fields for the kinds of non-cancer effects suggested by these Soviet reports.

Scientists who have reviewed these research findings generally agree that they neither confirmed the early Soviet report of effects nor established biological mechanisms that might be responsible for such effects. The internal electric fields, currents and energy that might be induced by exposure to fields from even the highest-voltage lines would be much smaller than those occurring naturally in the body. For these and other reasons, no attempt was made in the past by regulatory agencies to establish health-based numerical limits on fields from power-system and other common EMF sources.

WHAT IS THE REASON FOR THE PRESENT LEVEL OF CONCERN OVER EMF EXPOSURE?

The present-day concern over EMF and health began with a 1979 report of a higher than normal incidence of cancer in children assumed by the authors to have been exposed to above-normal levels of EMF because they lived near power lines. The cancers involved are generally rare, of mostly unknown causes, difficult to link to any one environmental agent, and at the levels suggested, difficult to detect in the types of human (epidemiological) studies involved.

Since electric fields cannot penetrate building materials like magnetic fields, the authors assumed, without actual measurements, that only the magnetic fields could have been responsible for such cancers. When field measurements were made in similar studies conducted later, no such direct cancer link was detected for magnetic or electric fields, raising the possibility that the reported cancer risk increase could have been due to factors other than magnetic fields. It is because of the ubiquitous nature of electricity and EMF that any possibility of a health risk was identified as in need of further scientific investigations.

WHAT TYPES OF RESEARCH HAVE BEEN CONDUCTED TO ADDRESS THIS MOSTLY CANCER RISK-BASED EMF CONCERN?

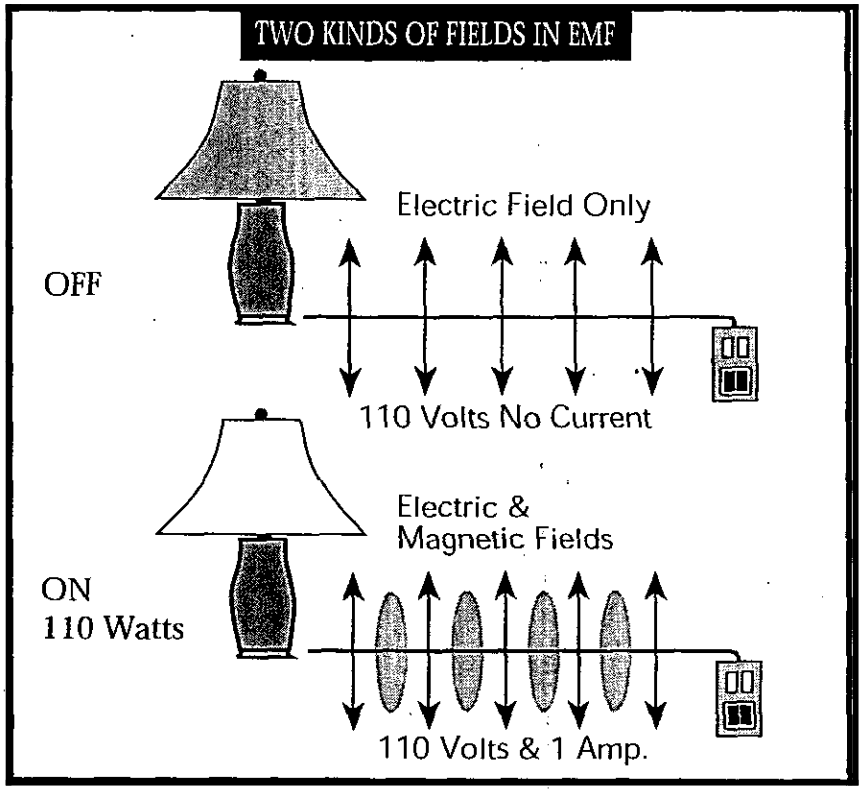
Basically, three kinds of studies have been conducted since the early reports of cancer:

1) Laboratory studies that expose single cells, groups of cells, or organs to fields under a variety of conditions to look for measurable effects which can provide insight into how effects in humans or laboratory animals might be produced

2) Laboratory studies that expose animals or humans to fields under controlled conditions and to look for effects in body function chemistry, disease or behavior

3) Epidemiological studies within human populations exposed in the home, work place or from medical applications, to look directly for any effects of exposure

These studies have been difficult to conduct mostly because of the difficulty in establishing a unit of dose to the exposed study subject, identifying what characteristics or



Electric fields are generated by voltage, while magnetic fields are generated by current. Both types of fields occur around power lines.

SOURCE: Colusa County Transmission Line Element

types of exposure might be most biologically important, detecting the usually small effects of such weak fields and identifying the biological mechanisms that might be involved.

Biological effects have been reported in some of the laboratory studies on EMF. Most of these effects are observed only using electric or magnetic fields much stronger than those encountered in the residential environment. Biological effects of these types do not necessarily point to the potential for human health effects.

Determining whether or not these effects influence human health is complicated because they are subtle, do not increase with increasing field strengths, and results are not consistent from one laboratory to the next. These and other factors have made it difficult to assess the possibility of human health effects from such reports of biological effects.

DO THESE RESEARCH FINDINGS SUGGEST A HEALTH RISK TO THE EXPOSED PUBLIC?

As noted in the introduction to this chapter, most scientists now agree that the available EMF research findings have not established either power-system electric or the magnetic field as posing a risk of cancer or non-cancer effects to the exposed public. The same conclusion has been reached by several scientific review panels such as those of the Environmental Protection Agency (1992), Oak Ridge Associated Universities (1992), the National Radiological Protection Board of Great Britain (1994), the American Physical Society (1995), the Swedish Electric Safety Board (1993), and the National Research Council (1996). (Also see page 5.6.7 for information about the review of the National Research Council.) While such health risk has not been established, there is agreement among those in favor of some type of action that these same findings have not ruled out the possibility of such health risks, hence the appropriateness, in some cases, of measures to reduce exposures. Given the limited nature of the evidence suggesting the possibility of a health risk, there is general agreement among those in favor of some type of action that only measures with minimal costs would be justified (either relative to system design, or placement away from humans) since a health benefit might not necessarily result.

WHAT ARE ELECTRIC AND MAGNETIC FIELDS?

Electric and magnetic fields are invisible force fields present in nature, and in the case of the man-made power-system fields of the present focus, around any wire or device in which electricity flows. Since these power-system fields exist and can be measured separately in the environment, they can be considered separately with regard to any biological effects they might produce. (See the insert, *Measurement of EMF* on page 5.6.5)

Electric fields represent the forces that charges exert on other charges while magnetic fields represent the additional forces that moving charges exert on other moving charges. Voltage is the force applied across a conductor to cause charges to move from one point on that conductor to another. This directional movement of electric charges constitutes current flow.

The strength of the fields from any given source will diminish rapidly with distance away from that source. Therefore, one way to reduce human exposure is to increase the distance between the source and potentially exposed humans.

TYPICAL 60-Hz MAGNETIC FIELDS MEASURED AT VARIOUS DISTANCES FROM SOME ELECTRICAL APPLIANCES - mG

	1.2 Inches	12 Inches	39 Inches
• Microwave Oven	750-2,000	40-80	3-8
• Clothes Washer	8-400	2-30	0.1-2
• Electric Range	60-2,000	4-40	0.1-1
• Electric Shaver	150-15,000	1-90	0.4-3
• Fluorescent Lamp	400-4,000	5-20	0.1-3
• Hair Dryer	60-20,000	1-70	0.1-3
• Television	25-500	0.4-20	0.1-2

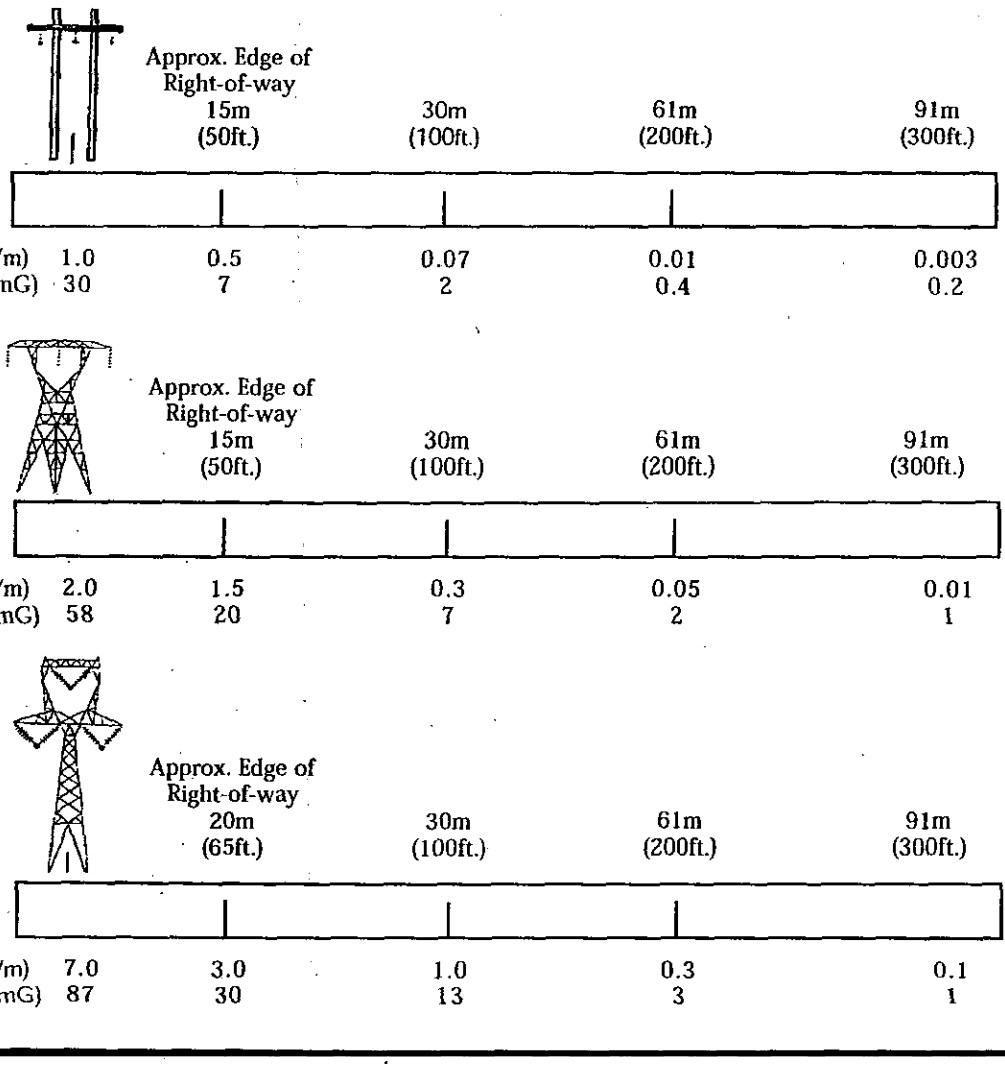
SOURCE: Bonneville Power Administration, 1993.

WHERE ARE POWER-SYSTEM ELECTRIC AND MAGNETIC FIELDS FOUND?

An electric field is produced whenever voltage is applied to energize a circuit, but a magnetic field will be produced only when electric current flows in that circuit. This means, in the examples shown in the insert on page 5.6.2, *Two Kinds of Fields in EMF*, that an electric field is created when an appliance is plugged into the energized circuit while the magnetic field is produced only when the appliance is turned on. Since both fields are associated with the generation and use of electric power, they will be found around electric power plants, transmission and distribution lines, substations, transformers, wall wirings, building grounding systems, as well as electrical appliances and equipment.

The voltage on any circuit in a power system typically varies very little so the electric fields that are produced will remain relatively steady at any given point around that circuit. Since the magnetic field is produced only when current flows, its magnitude will vary according to the current in the conductor. This means, in the case of power lines, that the magnitude of the magnetic field will vary constantly over time according to changing loads on the line.

TYPICAL TRANSMISSION LINE ELECTRIC & MAGNETIC FIELD STRENGTHS



SOURCE: DOE/BP-2081, *Electric Power Lines*, November 1993.

Given the well established potential shock hazards and other environmental effects of power-system fields, (such as audible noise and radio and television interference), power lines and related facilities are designed and operated in ways that reduce the intensity of their electric and magnetic fields without affecting safety, reliability, efficiency, maintainability and economy of operations. The procedures and design measures involved have been established from research and industry experience.

MEASUREMENT OF EMF

The strength of electric fields from any source is measured in volts per meter (V/m) or kilovolts (one thousand volts) per meter (kV/m). Magnetic field strength is measured most commonly in gauss. The milligauss (mG), or one thousandth of a gauss, is used for describing fields of relatively low intensities. For power lines, electric and magnetic field strength measurements are made, by convention, at a height of 1 meter (3.3 ft) from the ground. When a line is proposed for any location, estimates of expected electric and magnetic fields can be calculated using computer programs. Such estimates can then be used to assess potential public exposure as well as the effectiveness of specific field reduction measures proposed for any location along a chosen route.

WHAT ARE COMMON LEVELS OF EXPOSURE TO POWER-SYSTEM ELECTRIC AND MAGNETIC FIELDS?

Since the intensity of electric and magnetic fields decreases with distance from the source, any individual would be exposed at levels dependent on his or her distance from the source in question. (See the inserts on pages 5.6.3 and 5.6.4 showing fields to which an individual might be exposed near sources of electric and magnetic fields.) Individuals using any of the common electrical appliances shown might be exposed to magnetic fields at levels reaching up to tens or thousands of milligauss at very close distance. Such exposures would be much greater than most commonly happen around power lines. The intensity of fields from point sources such as appliances diminishes more rapidly with distance than happens with fields from more expansive sources such as power lines. Therefore, appliances or electrical equipment do not contribute significantly to the background residential levels to which the individual may be exposed involuntarily for long periods of time.

According to a report by the Department of Energy (DOE), the background magnetic levels (away from appliances) in the typical American home varies from 0.5 to 4.0 mG depending on the presence of their main sources such as power lines, unusual wall wirings and grounding systems. The average value is 0.9 mG. Although exposure to appliance-related fields would be much greater than to fields from the typical power line, it is important to note that such high-level exposures would occur only for the relatively short period the appliance is in use. Scientists have not determined whether such high-level, but short-term exposures would be more biologically significant than the low-level, but long-term background exposures. Such exposure differences are noted only to show that relatively high-level magnetic field exposures are not confined to the powerline environment.

According to the same DOE report, several EMF studies of effects in humans (epidemiological studies) have used two or three mG as an arbitrary cut off point for distinguishing between presumably exposed and unexposed groups, but not to suggest a safety threshold. There is no scientific evidence for human effects at these or any other levels. It would therefore be inappropriate to use these, or any other numerical value as an exposure threshold of regulatory significance. (See INFORMATION RESOURCES at the end of this chapter for the DOE booklet).

For any given overhead line, the strength of measured magnetic fields will depend on such characteristics as the distance from the line, the height of the line, the amount of current (not voltage) in the line, distance between conductors and conductor arrangement. For information on the measurement of EMF, see the insert on page 5.6.5.

CAN EMF PENETRATE OBJECTS?

Electric fields cannot penetrate most materials; therefore, trees, houses and other large objects can shield the individual from them. By contrast, magnetic fields can penetrate most materials, therefore, buildings, trees, other large objects, and the ground cannot shield the individual from them.

Placing power lines underground (where their conductors are placed closer together) usually decreases the strength of their magnetic fields as compared to similar overhead lines. However, exposure to the individual standing directly above the underground line may be the same or even higher than those associated with comparable overhead lines. This means, therefore, that undergrounding might not necessarily reduce exposure to fields from power lines. Because the conductors of underground lines are placed closer together, the intensity of their magnetic fields diminishes more rapidly with distance than happens with comparable overhead lines.

The ability to penetrate building materials also means that power lines, whether overhead or underground, can add to the average (background) levels in nearby residences and contribute to long-term exposures not within the direct control of the individual.

WHAT IS MEANT BY PRUDENT AVOIDANCE WITH REGARD TO EMF EXPOSURE?

The term "prudent avoidance" is often used in literature relating to EMF. This term was defined by M. Granger Morgan, of the Department of Engineering and Public Policy at Carnegie Melon University to mean "Limiting exposure which can be avoided with small investments of money and effort. [Emphasis added.] Don't do anything drastic or expensive until research provides a clearer picture of whether there is any risk and, if there is, how big it is."

The difficulty with using this term is that there can be differences in opinion about what is "prudent" in regards to particular costs or inconveniences. In California, the California Public Utilities Commission (CPUC) has established a policy of reducing exposures to electric and magnetic fields for new and upgraded energy facilities through no-cost/low-cost measures for EMF management. (Refer to the CPUC and utilities' sections below.)

EMF PROGRAM ASSISTANCE TO LOCAL GOVERNMENTS

The California Department of Health Services in conjunction with the California Public Health Foundation, as part of their EMF Program, can provide the following assistance:

- Interpret the state of the science with regards to what is known and not known about exposure to magnetic fields and possible effects on human health.
- Give presentations on the state of the science about EMF to community groups, including boards of supervisors, which may be concerned about or interested in exposure to magnetic fields from powerlines.
- Provide advice on the content of technical documents such as exposure assessment protocols that local governments may develop.
- Provide a list of jurisdictions which have developed policies related to EMF.
- Provide advice to a particular local government about a perceived disease cluster that it or its constituents are concerned may be associated with exposure to magnetic fields from powerlines.
- Provide advice on organizing community groups in areas of their jurisdiction where there is a concern about magnetic field exposure from powerlines.
- Send out program documents if a particular local government wishes to follow the Program's progress.
- Encourage local government representatives to attend the Stakeholder Advisory Committee meetings.

For assistance, contact M.A. Stevenson of the Electric and Magnetic Fields Program at (510) 450-3818.

The states that have responded to the present concern have mostly established policies designed to ensure that exposure to fields from new power-system sources do not exceed those from existing ones. In no case have there been requirements to modify existing sources.

WHAT IS THE FEDERAL GOVERNMENT DOING TO ADDRESS EMF?

One of the more recent actions of the federal government was to establish the Electric and Magnetic Fields Research and Public Information Dissemination (EMF RAPID) Program, as required by the Energy Policy Act of 1992. The U.S. Department of Energy (DOE) administers the overall program and directs research on exposure assessment and field management techniques. The National Institute of Environmental Health Sciences (NIEHS) directs the risk assessment and health effects research. The public information component of the program is the responsibility of both DOE and NIEHS. They have developed several publications to inform the public about the current state of knowledge of EMF research.

In 1991, Congress asked that the National Research Council review the EMF research literature for evidence of any health risk to exposed humans. Based on a comprehensive evaluation of over 500 EMF studies conducted over a seventeen-year period, the National Research Council concluded in an October 31, 1996 report, with regard to residential exposure, that it found no consistent and conclusive evidence that EMF poses a health hazard to exposed humans. The committee did not address the possible effects from occupational exposure in this report. It called for more research to explain the factors responsible for a small increase in childhood leukemia in houses close to power lines which may be the result of factors other than magnetic fields. It also called for more research into the relationship between high exposures to EMF and breast cancer in animals already exposed to other carcinogens. (See the insert, *Conclusions of the National Research Council Regarding the Possible Health Effects of Exposure to Residential Electric And Magnetic Fields*).

Research conducted under the RAPID program covers a broad range of scientific disciplines and complements EMF research being conducted in the United States and throughout the world. The program coordinates and focuses the federal EMF effort and provides a central point from which to evaluate research findings, interpret them for the public and disseminate the information.

For information available to the public, see the INFORMATION RESOURCES section at the end of this chapter.

CONCLUSIONS OF THE NATIONAL RESEARCH COUNCIL REGARDING THE POSSIBLE HEALTH EFFECTS OF EXPOSURE TO RESIDENTIAL ELECTRIC AND MAGNETIC FIELDS

"Based on a comprehensive evaluation of published studies relating to the effects of power line frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposures to these fields present a human health hazard. Specifically, no consistent and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects.

The committee reviewed residential exposure levels to electric and magnetic fields, evaluated the available epidemiologic studies, and examined laboratory investigations that used cells, isolated tissues, and animals. At exposure levels well above those normally encountered in residences, electric and magnetic fields can produce biologic effects (promotion of bone healing is an example), but these effects do not provide a consistent picture of a relationship between the biological effects of these fields and health hazards. An association between residential wiring configurations and childhood leukemia persists in multiple studies, although the causative factor responsible for that statistical association has not been identified. No evidence links contemporary measurements of magnetic field levels to childhood leukemia."

(Conclusions from the Executive Summary of the Committee on the Possible Effects of Electromagnetic Fields on Biologic Systems, October 31, 1996)

HOW IS ENERGY FACILITY EMF BEING ADDRESSED IN CALIFORNIA ?

Design, construction and operation of electrical transmission facilities in California is generally outside the regulatory authority of local governments. Depending on the particular facility, this authority may rest with the California Public Utilities Commission (CPUC), the California Energy Commission, or a publicly owned utility.

The CPUC specifies requirements for the shock hazard safety of all electrical transmission facilities in the state. Since (a) all power lines and related facilities must meet the shock hazard safety requirements of the CPUC and (b) EMF reduction measures might impact facility safety, efficiency, reliability and maintainability, the Energy Commission staff considers it most appropriate for all state and local agencies to regard CPUC's policy on EMF reduction (discussed below) as a basis for assessing the acceptability of all power-system sources in the state.

In 1988, the California Legislature directed the CPUC and the Department of Health Services (DHS) to jointly review the scientific information available on EMF health effects and to report their findings in consultation with the Energy Commission and other state and federal agencies. The findings were presented in a September 15, 1989 report to the Legislature. This report concluded that available scientific evidence did not show a reliable link between exposure to electric or magnetic fields and health effects, and was insufficient to warrant regulatory action.

California Public Utilities Commission (CPUC).

Following the September 5, 1989 report , the CPUC established a 17-member group in January 1991, to develop consensus recommendations on an interim EMF policy for electric utilities under its jurisdiction, pending scientific/ medical conclusions. The group consisted of representatives of the general public, consumer advocacy groups, environmental groups, state agencies, utility worker unions, and utility representatives. In response to recommendations of this group, the CPUC issued a Decision on November 2, 1993.

In this decision, the CPUC:

- Ordered Investor Owned Utilities (IOUs) to develop and implement no-cost and low-cost steps to reduce EMF levels at new and upgraded facilities; to develop EMF design guidelines for the construction of new and upgraded facilities; to continue providing free uniform residential and work-place EMF measurement programs; and to provide yearly bill inserts to their customers regarding the EMF issue

- Established a $1.5 million four-year educational program and a $5.6 million four-year non-experimental research program to be funded by California ratepayers and managed by the California Department of Health Services

The CPUC has included the no-cost and low-cost magnetic field reduction measures as a requirement in its certification process for new and upgraded transmission lines of 50Kv to 200Kv and substations (General Order 131-D), having determined that the existing knowledge on the health issue did not justify setting any numerical exposure standards.

California Energy Commission.

The Energy Commission, through its staff, was a member of the EMF consensus group discussed above. The staff of the Energy Commission supports the recommendations that emerged from that process. The Energy Commission, like the CPUC, has not set any health-based limits concerning either electric or magnetic fields.

When an applicant seeks a license from the Energy Commission for a power facility and transmission lines, the staff conducts an independent analysis for the proposed project. This analysis includes examination of design measures proposed to be incorporated into the project to limit human exposure to magnetic fields and, in the case of utility projects, to implement the utility's EMF management guidelines. Staff considers the possible measures that might be incorporated in a given project in light of their effectiveness, effects on safety, reliability, efficiency, and cost practicality. The analysis, together with any conclusions based on it, is included in the staff's recommendations concerning whether the Energy Commission should grant a license or impose certain conditions on a licensee.

State Department of Health Services.

The CPUC's November 1993 Decision (see above) established a four-year EMF Research and Education Program (Program). The CPUC selected DHS to be the program manager to oversee and

coordinate EMF-related research, facilitate public education and policy analysis in California, interpret research findings, and advise (the CPUC and other agencies) on any health-based need for changes to existing EMF policies. The Program is structured to allow substantial input from the general public and other interested parties through the EMF Program Stakeholders Advisory Committee. The committee, consisting of core and ex-officio members, provides a forum where citizens and professionals can express any concerns about potential health effects and can ask questions about EMF policy. Local government representatives are invited to participate as ex-officio members or as visitors at the publicly noticed meetings. The committee advises DHS Program staff regarding program direction.

The Education and Technical Assistance Subcommittee was formed in the spring of 1995 to provide the EMF Program with input for future activities that may be of assistance to local governments. The insert on the previous page presents types of assistance currently available to local governments.

- State Department of Education.

While noting that EMF health effects have not been established for exposed humans, the California Department of Education established regulations in 1993 that included specific distance requirements for the area between the edges of the property line of new schools and the rights-of-way of high-voltage lines. These regulations were established conservatively on the basis of electric field strengths for the various classes of high-voltage transmission lines.

The regulations were the result of public concerns and included the input of the Department of Health Services and California utilities. These regulations have no particular relationship to magnetic field exposures since magnetic fields are proportional to current rather than voltage. They also do not address exposures from either electrical sources within school grounds or the location of new lines in the area around schools. The distance requirements are specified in the California Code of Regulations, title 5, section 14010c (Regulations for School Site and Plans) as follows:

- 100 feet for 50-133 kV lines
- 150 feet for 220-230 kV lines
- 350 feet for 500-550 kV lines

Since (a) no EMF health effects have been established and (b) the most biologically important types of exposures are yet to be established, such distance requirements should not necessarily be seen as providing any health benefits. EMF exposure as noted in these regulations is one of many factors that should be considered in the choice of sites for new schools.

WHAT ARE SOME OF THE ACTIONS BEING TAKEN BY CALIFORNIA UTILITIES TO RESPOND TO EMF CONCERNS?

All IOUs (and many municipal utilities) have incorporated the CPUC specified no-cost low-cost concept in their field management policies regarding the design and operation of new and upgraded facilities, including transmission lines, distribution lines, and substations.

Many utilities have EMF information programs for their employees and the general public, provide technical assistance to local agencies and also provide updates on research findings.

Utilities generally consider it important to involve the public as they present the rationale for the choice of exposure reducing measures proposed for a particular power line. Customer questions on EMF exposure are handled through answer lines usually dedicated to this purpose. When desired, residential field measurements are made mainly by either the utility staff or with a meter loaned to the interested individual.

Where an individual or group desires modification of an existing facility, a number of utilities have shown a willingness to allow the modification at the expense of the entity desiring it provided such modifications do not impact safety, maintainability, reliability and efficiency. Because field strengths are influenced by many factors, utilities would be unable to guarantee that the fields in question would be lower than before the desired modifications.

WHAT IS BEING DONE ABOUT EMF IN SCHOOLS?

Individual school districts in California have acted on a case-specific basis to assess magnetic field exposures in schools and, in a few cases, have negotiated actions with utilities to reduce exposures from existing energy facilities. However, there presently are no scientific reasons for children to be more sensitive than adults to the effects, if any, of EMF. Therefore, such modifications would not necessarily provide any health benefits. The actions taken in these few

CONTACTS FOR EMF INFORMATION AND GUIDELINES

Utilities	Contact	
Anaheim Public Util Dist.	Dave Pine	(714) 254-4288
Burbank Public Service Dept.	Greg Simay	(818) 953-9640
City of Alameda Electric Dept.	Bill Lewis	(510) 748-3901
City of Banning Public Utilities	Tim Trewyn	(714) 922-1247
City of Colton Electric Utility	Nitin Modi	(909) 370-5104
City of Redding Electric Dept.	Frank Ryan	(916) 245-7017
Glendale Public Service Dept.	William Hall	(818) 956-2107
Imperial Irrigation Dist.	Rich White	(619) 339-9477
Los Angeles Dept. Water & Power	Info-line	(213) 367-2616
Modesto Irrigation District	Randy Erickson	(209) 526-7491
Pasadena Water & Power Dept.	Henry C. Lee	(818) 405-4479
Pacific Gas and Electric Co.	Info-line:	(800) 743-5000
Riverside Electric Utilities Dept.	David Redding	(800) 442-4950
Sacramento Municipal Utility District	Info-line	(916) 732-6009
San Diego Gas & Electric Co.	Info-line:	(800) 336-SDGE
Santa Clara Electric Dept.	Larry Owens	(408) 244-SAVE
Sierra Pacific Power Co.	Kuldip Sandhu	(702) 689-4581
Southern California Edison Co.	Info-line	(800) 200-4723

State Agencies	Contact	
California Department of Health Services/California Publication Health Foundation	M.A. Stevenson	(510) 450-3818
California Energy Commission	David Maul	(916) 654-3941
California Public Utilities Commission	Jody London	(415) 703-1137

cases to reduce exposure have been due to concern among some members of the public about the possibility of such sensitivity.

The typical cost of any such modifications would be much higher than justifiable per present CPUC policy. Alterations in transmission lines have been done in a few school districts, with costs to them ranging from $20,000 to $100,000 or more. The Energy Commission staff does not encourage such expensive measures with regard to schools or any other location.

The cost of such actions (as with residential customers) is borne by that school district or the customer.

Only no-cost or low-cost steps have been taken in the majority of cases with regard to EMF. In several cases, the main sources of magnetic fields in the schools were found not to be power lines. In these cases, the sources were electrical appliances or equipment, faulty wiring, or school transformers.

WHAT CAN LOCAL GOVERNMENT AGENCIES DO TO ADDRESS PUBLIC EMF CONCERNS?

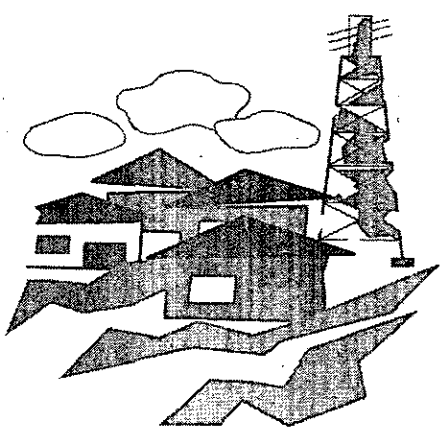
This section provides ideas for local governments on how best to address some of the concerns that the public may have about electric and magnetic fields. Public concerns about EMF exposure relate to developments (such as residential areas, schools, day care centers) near existing power lines or substations, as well as the development of new or upgraded power lines and substations in their communities.

As noted in the above section on the California Public Utilities Commission (CPUC), the policies of that state agency require investor-owned utilities to address EMF in the construction of new or upgraded utility facilities with the use of no cost and low cost measures. The CPUC EMF-related policies do not require changes to existing energy facilities.

Jurisdictions throughout California have been struggling with developing policies and practices to assist them as the permitting agencies for projects which are proposed adjacent to existing power lines or substations. Local governments are cautioned against adopting any specific numerical standard of magnetic field strength or specific buffers or setbacks, until there is a scientific basis for doing so. (The adoption of numerical standards is inconsistent with the CPUC EMF policy for new electrical facilities.) In addition, CEQA does not require or encourage the analysis of EMF because the impacts are presently unknown and speculative. (Sec. 15145 of CEQA Guidelines)

Local government policies can, of course, designate preferences for land use in general plans. However, due to the present scientific uncertainty surrounding the EMF issue, local governments should exercise caution regarding potential policy pitfalls and give due consideration to the no-cost and low-cost EMF reduction policy of the CPUC. Planning provisions that discourage development adjacent to transmission lines or rights-of-way may create legal controversy between local governments and property owners. Local fiscal as well as legal problems may also result from the perception of "safe" and "unsafe" zones and potential property value variations.

Local governments should also be wary of simply adopting a policy that another jurisdiction adopted after its own study and review. There may be unique local land use issues in different jurisdictions which require different policies. Notwithstanding the above cautions, ideas are provided for your consideration in the following local government program areas:



Local Government and Public Education and Involvement

• Whether the facilities are new or existing, local governments are encouraged to stay informed by working with all stakeholders, including the CPUC and the Energy Commission when they have jurisdiction, the utility, constituents, and developers.

• Participate in the Electric and Magnetic Fields (EMF) Program Stakeholders Advisory Committee Meetings as an ex-officio member or as a visitor to ask policy or technical questions, to learn about the state program and what research is being done. (See insert *EMF Program Assistance to Local Governments* on page 5.6.6.)

• If you are unable to attend any meetings, you may request information from the EMF Program on the state of the science, state policy development, and technical assistance available. You may request to be put on the mailing list as an interested party.

• Provide a status report to the governing body (Board of Supervisors/City Council) periodically regarding the current status of EMF health studies (using EMF Program information) and policy or implementing measures adopted by local utilities, state agencies and other local jurisdictions. Invite a well-informed EMF Program speaker or panel to make a presentation at governing body or public meetings.

• Learn from the experience, both positive and negative, of other counties and cities regarding how EMF is being addressed. The DHS EMF Program can provide a list of cities and counties which have worked to develop EMF-related policies. The EMF Program also plans to collect case study information. (Information about the Colusa County Transmission Line Element appears on page 3.11 of Chapter 3.)

• Work with the local or State Department of Health Services and local utilities in the development of public education efforts regarding the issue of EMF and health. Invite the public to attend briefings regarding EMF and EMF management techniques. See the insert on page 5.6.6 regarding assistance from DHS in organizing community groups.

• Include the public in discussions of EMF management during early community involvement for the siting of electric generating facilities and power lines and include the CPUC EMF policy in the discussions.

Local Planning Considerations

• Land use planning techniques and zoning provisions can provide, in general, that:

a) human exposure to magnetic fields be considered and

b) the heightened public concern over childhood exposure be considered.

• Land use designation within and adjacent to rights-of-way can be made to limit unnecessary human exposure, but at the same time allow for flexibility so that local governments can respond to evolving scientific findings.

Working With Utilities/Project Proponents

- Consult with project proponents to keep informed regarding the location of planned new or upgraded power lines, substations, and transformers, and the implementation of feasible EMF-reducing design measures. Inquire whether the local utility intends to design and operate the new facilities in keeping with current CPUC EMF policy, where applicable. Include this information in a status report to your governing body.

- Express specific local concerns to "lead" and "responsible agencies" during the permitting process when the local agency does not have the lead.

GENERAL PLAN AND IMPLEMENTATION IDEAS

The following are ideas which can be used for the development of general plan policies and implementation programs, providing they are consistent with the entire general plan.

In addition, working with and providing advance guidance to prospective energy project developers will result in a more efficient, effective, and expeditious permitting process which will benefit both the local community and the developer/applicant.

- Local governments can, whenever possible, maintain a public information program of the current state of knowledge about EMF. Monitor the research and policy developments concerning EMF. Include written material about EMF, what is being done, and what options individuals have based on the current knowledge about potential health risks, if any.

- When the safety element (or any other appropriate element) of the general plan is revised, local agencies can include a commitment to monitor the research and policy developments concerning EMF. Any exposure standards, if established in the future by state and/or federal agencies, should be considered for inclusion in the general plan and applicable ordinances.

- Local agency planning for new energy facilities (for which the local government has authority) or for upgrades to existing facilities can ensure implementation of no-cost and low-cost EMF reduction measures consistent with the CPUC policy.

- Local governments can adopt land use plans which accommodate and include preferences concerning the location of new power lines consistent with a no-cost and low-cost policy.

- Local governments can coordinate with the appropriate local utility the adoption of land use plans that designate preferred secondary uses for rights-of-way.

- Local governments can coordinate joint review of land use applications with the appropriate local utility for areas where significantly increased electrical demand may be anticipated.

- Local governments can ensure that developers and planners have access to information about EMF so they can consider factors influencing public EMF exposure in the context of proposed projects.

- Local governments can choose to discourage some types of new development adjacent to existing transmission lines and rights-of-way.

- Local governments can encourage commercial, industrial or open space land uses adjacent to existing transmission lines and rights-of-way.

INFORMATION RESOURCES

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