# Health Issues Regarding Proposed Concentrating Solar Power Plants in Navajo County

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Steen Hviid, MS engineer, Noise and Health Committee

Large scale solar power plants have been proposed for Navajo County. The technology chosen is referred to as “power towers”, where a field of mirrors direct sunlight into the top of a central tower. The intense sunlight creates temperatures above a thousand degrees Fahrenheit, which is used to generate steam that runs a steam turbine. The water used to generate the steam is re-circulated, after being cooled. This works very much the same way as a coal or a nuclear power plant, just using solar energy instead of burning coal or uranium.

A number of solar tower plants have been planned worldwide, especially in the Mojave Desert. The first is just now (August 2009) entering operation [Sierra SunTower]. The total lack of commercial scale experience with these plants makes it difficult to identify all health issues for the surrounding community, and there are no studies of actual impact on adjacent residents.

Some issues have been identified:

- Noise from cooling towers (wet and dry)
- Air pollution from cooling towers (wet only)
- Declining water quality
- Glare
- Area lighting
- Dust
- Noise and pollution from cleaning the mirrors
- Emissions from gas fired boiler
- Electrical lines
- Fire protection

## Special Population

Navajo County is blessed with some of the cleanest air in the country. For that reason, many people with severe respiratory ailments have settled here, especially in the area around Cedar Hills. Air pollution is thus of a greater concern there than it normally would be.

## Cooling Towers

A solar tower plant can use either wet or dry cooling towers, or a hybrid. A 250 megawatt solar tower plant would consume about 2.7 million tons (710 million gallons) of water a year using wet cooling towers. [CSP Water, Appendix A].

Since water is limited in Navajo County, the developer may be required to use dry cooling towers instead. These cost about three times as much to construct, and also cost more to operate [CSP Water].

## Wet Cooling Towers

A wet cooling tower evaporates a tremendous amount of water into the air (about 350 gallons per minute for a 50 megawatt plant [Beacon Dry Cooling, Table 4]). This water contains minerals as well a chemicals added to the water, which will become dispersed into the air. Common chemicals include rust inhibitors, scale inhibitors, sulfuric acid, sodium hypochlorite, etc. [Beacon Dry Cooling 5.1]. These chemicals may be problematic in themselves, or combine to form PM10 particles. It may become a nuisance and possibly have direct health effects on nearby residents living downwind. This issue must be looked into.

Wet cooling towers operate by blowing very large amounts of air through the dispersed water, in the same manner as a swamp cooler. The fans are very powerful. One 50 MW solar system (using 20 eSolar towers) would need 3 to 4 tower cells, each with a 125 horsepower motor to run the fan. These very large fans may create a lot of noise, which will be an issue to nearby residents. [CSP Water, Appendix].

Wet (and hybrid) cooling towers require evaporation ponds to disperse of waste water from the cooling towers (blowdown). The presence of stagnant water may be a breeding ground for mosquitoes, which may carry the West Nile Virus.

## Dry Cooling Towers

Dry cooling towers evaporate no water, and thus emit no chemicals and no particulates. However, they are much larger and noisier than a wet cooling tower, as they require more air to be moved over a larger area. For a 50 megawatt (20 eSolar module) plant, about 5 fans, each with a 300 horsepower motor is required. [CSP Water, Appendix]. That is 3.6 times as much fan capacity as when using wet cooling towers.

Noise levels for such a set of gigantic fans appear not to be available, but are obviously a great concern.

## Declining Water Quality

The proposed project may consume so much water that the Coconino Aquifer becomes contaminated by brackish and/or highly saline water. The Coconino Aquifer is the only

reliable source of drinking water in the area. On the north side of NZ Legacy's property, it is highly saline and undrinkable. [Hydrologic Eval]. The aquifer is also surrounded by undrinkable water in other aquifers, such as the Moenkopi.

With greatly increased water pumping, there is a significant danger of the Coconino Aquifer becoming polluted from the other water sources. Perhaps especially in the area near Woodruff, where saline water may intrude.

Declining water quality is a health hazard, especially in an area with low-income families who can be expected to be extra resistant to drilling new wells or installing costly water treatment equipment, and thus may continue to drink unhealthy water.

## Glare Issues

The top part of the tower will be illuminated by sunlight reflected by 10,000 mirrors. This will create a very brightly lit area of the tower [Sierra SunTower].

Residents facing the illuminated side of a power tower may be exposed to a glare nuisance. The California Energy Commission [Ivanpah pg 1-12].mentions that glare is a potential problem affecting traffic on Interstate 15, located over a mile from the closest Ivanpah tower. It would also be a glare nuisance to nearby residents. Not enough information is available to determine a reasonable setback.

The mirror heliostats should not pose a glare problem in normal operation. However, with 10,000 mirrors for each tower, mounted on trackers to follow the sun, breakdowns are likely to be very common. A broken heliostat can point in any direction and become a glare problem to residents and traffic.

## Area Lighting

The solar systems may need lighting to do maintenance after sunset, such as washing the mirrors. The impact on the night skies as well as the surrounding area must be minimized, by using downward pointing fixtures, motion detection sensors, etc.

## Dust

Dust is a problem during construction and also where large areas have been graded.

The mirror fields will probably require extremely large areas to be graded, with a very large dust problem to follow. As the dust alone can create PM10 particles (particles smaller than ten microns) it is a health concern for all people in the area, and especially our population of respiratory-impaired people. PM10 is a federally regulated pollutant.

## Cleaning the Mirrors

The heliostat mirrors must be kept free of dust to reflect the sun optimally. They must be washed on a regular basis, perhaps even daily.

The plant managers may prefer to do this after sunset, possibly at night, which would be a nuisance to nearby residents from noise and floodlights.

The Ivanpah project expects to use diesel powered tractors pulling water trailers. Using their information [Ivanpah], about one or two tractors would be assigned to each 50 MW size power tower plant.

NZ Legacy may choose other types of vehicles, such as multiple ATVs with smaller water tanks in tow.

All these types of vehicles would greatly disturb the peaceful desert, especially at night. Alternative vehicles, such as electric vehicles, must be utilized whenever possible. This will also eliminate any “joyriding.”

The water used will most likely contain a cleaning agent or surfactant, to prevent buildup of mineral deposits on the mirror surfaces. Given the very large area, and the frequency of the washes, the impact of the runoff is a concern. Nearby residents may also be subjected to unwanted smells from the chemicals used – some people in this area live here because they are sickened by minute amounts of chemicals otherwise considered safe.

## Emissions from Gas Fired Boiler

Most concentrated solar power projects include a natural gas boiler to start up the plant in the morning and/or as a backup during cloudy periods. Examples of this configuration are the Ivanpah project, Nevada Solar One and Solana project near Gila Bend.

Such a large natural gas fired boiler has its own issues with emissions of small particles (PM10, PM 2.5) as well as nitrous oxides, carbon monoxide, VOCs, etc.

The eSolar system presently favored by the developer does not appear to have such a backup boiler, however we are not certain.

## Electrical Lines

The proposed project will need many miles of electrical lines. There will be lines to gather electricity from the individual generators (solar and wind), which typically run at 34,500 volts. Then there will be lines to bring the combined power out to the large 500,000 volt transmission lines that run to the south and west of the project area. These connection lines typically run at 69,000 volts or 115,000 volts. Possibly even higher for a very large project.

Large electrical lines are ugly. They are buried in most cities in the eastern United States, as well as in Europe.

Nearby power lines are a blight on the value of a property, thus all nearby property owners must be compensated.

The health effects from large power lines have been debated since a 1979 landmark study showed that people living near them have a higher risk of cancer. Absolute proof has not been found, which is nearly impossible, but the EPA lists them as a possible carcinogen.

The Cedar Hills/Hay Hollow area is special in this regard, as several people have moved here for health reasons that include sensitivity to electromagnetic fields. This particularly vulnerable population of disabled people would be impacted by siting the connection lines and the major substation south of the project area. They should instead be routed towards the west, along depopulated areas.

It is already standard practice to bury the lines between the wind towers. It was done at the Dry Lake project. It cannot be assumed that NZ Legacy's projects will follow custom, however, this must be mandated.

## Fire Protection

Fire protection is an issue for wind farms and solar systems, in particular during the construction phases. During operation, fires are mostly related to vehicle fires and lightning strikes on wind farms. The fire issues for solar farms need further investigation.

A report from Riverside County [Wind Monitoring] states that there have been 6 fires within wind farms over two years, although there have been years with fewer incidents.

The nearest fire departments to the project area are in Holbrook and Snowflake. There is no fire department in Woodruff. These fire departments are too far away to be effective. The project must thus include its own form of fire service.

This could include:

- Fire breaks around all buildings, wind turbines, transformers and other structures
- All service vehicles equipped with a portable fire extinguisher
- One fire fighting vehicle on site, perhaps including a water truck

## References


Beacon Dry Cooling

FPLE – Beacon Solar Energy Project Dry Cooling Evaluation, Worley Parsons Group, 2008

CSP

Concentrating Solar Power: Energy from Mirrors, U.S. Dept. of Energy/NREL, 2001

CSP Water

Concentrating Solar Power Commercial Application Study: Reducing Water Consumption of Concentrating Solar Power Electricity Generation, Report to Congress, U.S. Dept of Energy, 2009

Hydrologic Eval

Phase 1 Evaluation of Hydrogelogic Conditions in Vicinity of NZ Properties Navajo and Apache Counties, Arizona, Errol L Montgomery and Associates, Inc. 2003

Ivanpah

Ivanpah Solar Electric Generating System, Application for Certification (07-AFC-S), Preliminary Staff Assessment, California Energy Commission, 2008

Sierra SunTower

Sierra SunTower – A New Blueprint for Solar Energy, eSolar, 2009

Solana

Solana Generation Station Project, Abengoa Solar, 2009

## County Stipulations

Following is a list of appropriate stipulations the county can use to limit health impact from solar towers. More restrictions may be needed, as there are a lot of unknowns with this new technology.

- No solar tower may be erected closer than 2 miles from any residence, due to many unknowns, such as glare and noise. After 2 years of full operation, this setback may be re-evaluated.

- A noise limit of 5 decibels above ambient levels, measured at the property lines. A waiver may be granted, provided affected property owners all sign a written consent stating that they are aware of the proposed development and that they consent to allow noise levels to exceed the maximum limits allowed.

- Best management practices must be utilized during and after construction of solar installation to minimize dust and particle emissions, which include:

    - All traffic is limited to established roadways.

    - All construction sites will be watered sufficiently so that no visible dust plumes leave the project site.

    - Vehicle speeds will be limited to 20 mph within the construction site.

    - Wind erosion control techniques, such as wind brakes, water and vegetation will be used in all construction areas until the soil is stabilized or covered with vegetation.

    - Construction equipment will use low sulphur, low aromatic diesel fuel.

    - Construction equipment will be maintained in top service condition to limit emissions.

    - Construction equipment will be shut down to avoid excessive idling emissions.

- Cleaning of the heliostat mirrors cannot take place after 8 pm or before 6 am. Any lighting used must minimize glare onto adjacent properties, and be directed downwards at any time. The vehicles and machinery must be very low noise, such as electric, natural gas or gasoline powered light trucks, etc. ATVs, tractors and other noisy equipment cannot be used.

- Battery powered vehicles, such as golf carts, should be used to transport maintenance crews within the facility, where feasible. Under no circumstances may ATVs or other off-road equipment be used.

- Heliostat mirrors that are broken must promptly be set in a horizontal state to prevent glare problems to neighbors.

This list may need modification after a few years of experience with this new technology.

Insufficient information is available to determine appropriate setbacks to account for glare, incidental noise, dust, fumes (including particulates) and nighttime maintenance. The needed setbacks are likely to be substantial.

The Solana project has 1000 ft. to 2000 ft. setbacks, but that is for a solar trough type plant, which does not have the same glare issues as a power tower [Solana]. And it has not yet been built.

The first phases of these plants must be located far away from any residence, so operational experience can be safely obtained. Residents should not be used as guinea pigs with experimental technologies.