“Capacity Building and Strengthening Institutional Arrangement”

Workshop: “Environmental Impact Assessment (EIA) (for Assessors)”

EIA of an Electric Power Station

Thermal Power Plants

Ms. Maria Belvisi

APAT

Agency for Environmental Protection and Technical Services

What information should the developer-applicant provide upon application?

Developer-applicants need to prepare an EIS that includes the following information :

a. Project description

b. Site description

c. Engineering description of proposed facilities

d. Electric transmission lines and any other linear facilities related to the project

e. Project, site, and linear alternatives

f. Environmental description and expected impacts including biological surveys conducted at the appropriate time of year

g. Mitigation measures to reduce potentially significant environmental impacts

h. Information necessary for the local/regional air pollution control district to make a determination of compliance with local rules and regulations

i. Information necessary for the regional water quality control board to issue waste discharge requirements or a national pollution discharge elimination system permit

j. Compliance with applicable laws, ordinances, regulations, and standards

k. Financial impacts and estimated cost of the project

l. Project schedule

Description assesment

1. the existing environment;
2. the proposed project;
3. whether the facilities can be constructed and operated safely and reliably in accordance with applicable laws, ordinances, regulations and standards;
4. the environmental consequences of the project including potential public health and safety impacts;
5. mitigation measures proposed by the applicant, staff, and interested agencies and intervenors which may lessen or eliminate potential impacts;
6. the proposed conditions under which the project should be constructed and operated if it is certified; and
7. project alternatives.

Recommend that the project proponent work with the local agency building officials to ensure the project is built to current standards, and requires preparation of soils and geology engineering reports so that any potential geological conditions associated with a site can be mitigated

Mitigation measures are then recommended to reduce impacts to a less than significant level, and could include emission controls, alternative fuels, alternative process chemicals, and improvements in facility design.

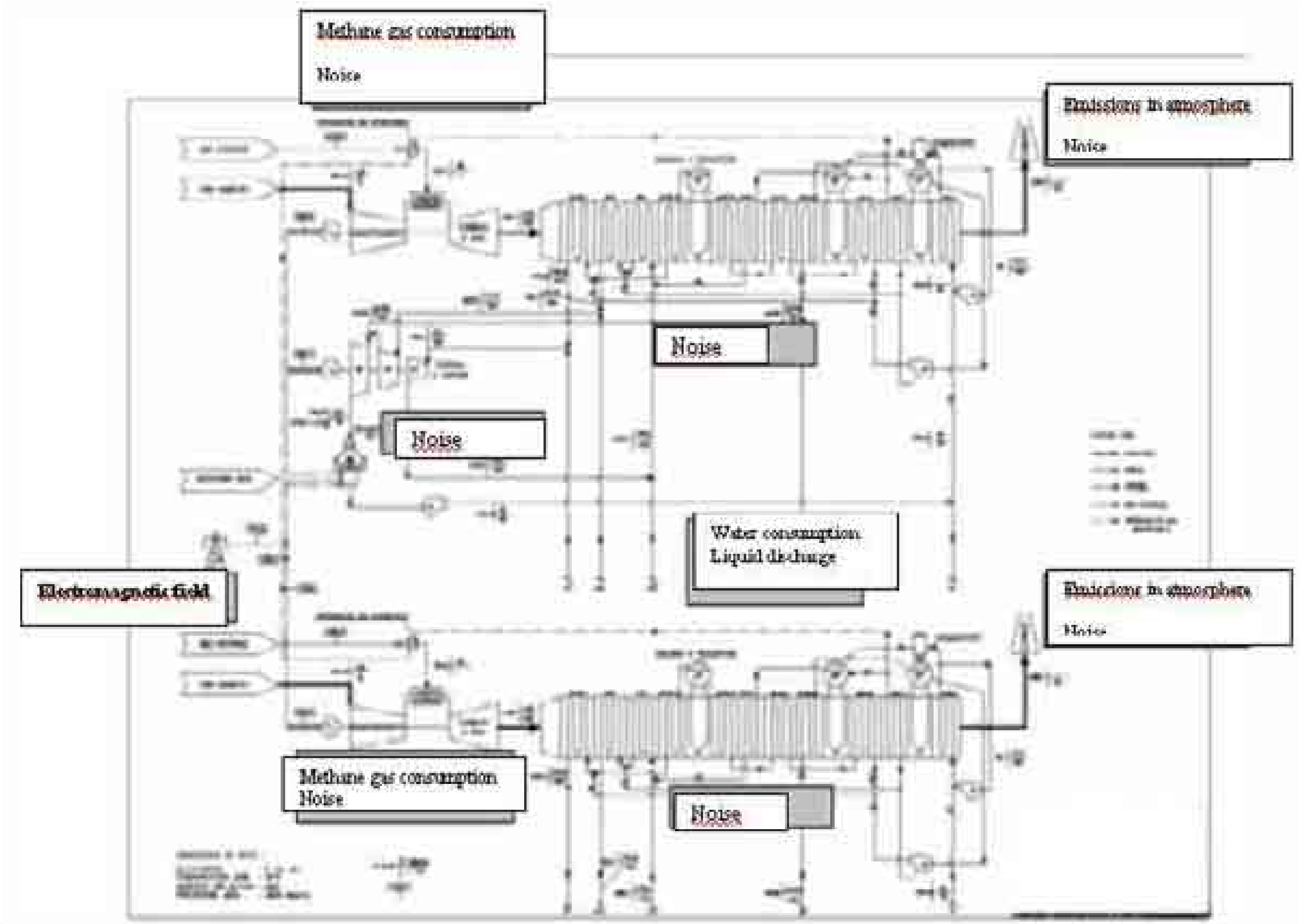
Main impact factors

The main impact factors of new thermal power plan projects that operate on combustible fossil fuels are as follows:

- air emissions (excluding CO2);
- use of natural resources and green house gas emissions
- water supply and wastewater;
- noise generated by facility operations;
- storage and treatment of solid waste;
- location
- construction of new secondary infrastructures

(roads, power lines, gas pipelines, etc.).

Operational fase



Activity/ Environmental factor	Waters Drawing	Atmospheric Emissions	Water Discharge	Labor Employment	Solid Refusals	Plan Presence and Exercise
Atmoshere	N	P Gases discharge	N	N	N	N
Hydric environment	N	N	*, P Wastewater	N	N	N
Soil and subsoil	*, P Waters drawing	N	N	N	N	N
Vegetation, flora and wildlife - Ecosystems	N	*, P Pollutants relapse	N	N	N	N
Public health	N	P Pollutants relapse	N	N	N	N
Noise and vibrations	N	N	N	N	N	P Plant
Non ionizing radiations	N	N	N	N	N	*, P Non ionizing radiations
Landscape	N	N	N	N	N	P Plant visibility
Traffic	N	N	N	*, P Plants access	N	N
Socio-economy	N	N	N	+, P Job creation	N	N

Legend: **N** Zero impact; **+** Positive impact; * Non significant impact; **T** Temporary impact; **P** Permanent impact

	Closed Cycle Humid System (evaporative towers)	Dry System (air condenser)
Thermal yield	Better yield as a result of higher condenser vacuum and minor electrical auto-consumption (approximately 57% for this case study)	Lower yield as a result of minor condenser vacuum and higher electrical auto-consumption (approximately 1% less than for a humid system)
Absorbed electric power	Approximately 2-3 MW	Approximately 5-6 MW
Water consumption	Approximately 900 m^3/h (of which approx. 200 for compensating towers drainage and 700 for evaporation) for the size of the plant under examination	No water discharge
Water discharge	Approximately 200 m^3/h (towers drainage) for the size of the plant under examination.	No water discharge
Land use and visual impact	Height of approximately 20 m and surface of approximately 5.000 m^2 for the size of the plant under examination	Height of 19 m and surface of approximately 6.500 m^2, for this case study
	Possible creation of visible plume	No plume
Chemical products	Algae and mud removing	Not need
Noise	Standard values: Sonorous pressure level: 85 dB(A) at 1 m	Standard values: Sonorous pressure level: 85 dB(A) at 1 m, but higher source from the towers

Facility design

Facility design is composed of four technical disciplines: civil, structural, mechanical, and electrical engineering. Facility design review consists of several components including site preparation and development, structure design, mechanical systems, electrical systems, quality assurance/quality

control for both conceptual and prelminary designs.

Assesse whether or not site preparation and development can be accomplished in accordance with applicable laws and.

A complete and detailed final design review of the proposed facilities, including construction inspections, takes place after certification. Any significant environmental impacts uncovered during the final assessment would need to be mitigated.

Air quality

The staff assesses the potential emissions from the proposed power plant (including cooling towers) and related equipment, the potential emission control technology applicable to each piece of equipment, the estimated transport and fate of project emissions, and the proposed emission offset package.

This information is compared with the current status of ambient air quality, the current status of ambient air quality standards, the air quality management plan that applies to the area, the typical meteorological conditions, and the availability of offsets in the local area and surrounding areas.

The assessment examines construction, initial commissioning, operation and closure emissions during all operating profiles (startup and base load).

Analysis starts with a sound foundation of information describing the meteorological setting of the proposed project area.

1- Review recent meteorological data that accurately represents conditions at the proposed site. While a meteorological station located at the proposed site is preferable, nearby information can also be used as long as it is correlated to the project site. While each local air district has well-established rules on offset requirements, the many possible options provided may lead developers to proposed ineligible offset packages. Further, limited offset availability can be a hurdle in many areas. In this areas that are non attainment for ambient air quality standards, it must ensure that offset packages are fully accounted for so that the proposed project emissions do not cause any further degradation of the standards.

Classification of fuels and technologies

Fuel	*Technology & environment* →		
	Conventional	Short-term improvements	Medium-term improvements
Coal and petroleum residues	Pulverised coal boiler	CFB atmospheric boiler Staged combustion Supercritical thermodynamic cycle	IGCC (integrated gasification combined cycle) High temperature ultra supercritical thermodynamic cycle
Heavy fuel oils and petroleum-based products	Standard boiler	CFB atmospheric boiler Supercritical thermodynamic cycle	Gasification of petroleum-based products and combined cycle
Natural gas	Standard boiler Turbine	Critical thermodynamic cycle (boiler) Combined cycle (turbine)	

Factor 1: Air emissions (under normal operating conditions and excluding CO_2)

Pollutant	Emission factors	Measures to reduce emissions
SO_2	Sulphur content in fuels	Reduction of sulphur content in fuels Flue gas desulphurisation (FGD)
Particulate matter	Ash content in fuels Combustion technology	Reduction of ash content in fuels Choice of combustion technology Electrostatic precipitators, bag filters
NOx	Combustion conditions Nitrogen content in fuels	Smoke treatment (denitrification) Choice of combustion technology Burners/low-NOx combustion chambers Water or steam injection
CO	Combustion conditions	Control of combustion conditions Operating measures (including stack cleaning)
VOC	Fuel composition Combustion conditions	Control of combustion conditions Filters, smoke purification
Metals	Metal content in fuels	Reduction of metal content in fuels Upstream treatment of smoke (activated charcoal)
Ozone (O_3)	Indirect: photochemical reaction VOC/NOx	Reduction of NOx and VOC emissions

For thermal power plants with a total heat output of 300 MW or more, located within or near areas where the concentration of particulate matter, sulphur oxides, nitrogen oxides or ozone is over 0.8 times the WHO and World Bank standards for yearly averages, or those plants near an environmentally sensitive area, the concentration of pollutants in the air should be measured on a regular basis, in line with best practice standards.

Most countries have adopted regulations which aim to limit atmospheric emissions from thermal power plants. Compliance with these local standards and regulations, where they exist, is required

Compliance with these maximum emission levelsis required (reference level).

Given currently available technologies, nitrogen oxide emissions below 50 mg/Nm3 are considered best practice

Table 1: Maximum air emission levels defined in the World Bank guidelines

Pollutant	**Maximum emission levels (in mg/Nm³)**						*Other standards or comments*
SO_2	2,000						0.20 t/day per MWe + 0.10 t/day per additional MWe over 500 MWe (1)
Particulate matter	50						
NOx	Steam			Turbine (2)			(1) up to 1,500 mg/Nm3 if coal with a volatile content below 10% is used. (2) for 15% of O_2 and up to 400 mg/Nm3 in the event of technical difficulties and if NOx and ozone concentrations in the air are insignificant
	Coal	Fuel oil	Natural gas	Heavy fuel oil	Diesel oil	Natural gas	
	750 (1) (260 ng/J)	460 (130 ng/J)	320 (86 ng/J)	300	165	125	

Table 2: Maximum concentration levels defined by WHO guidelines

Pollutant	Maximum level [µg/m³]	Average over:
CO	100,000	15 minutes
	60,000	30 minutes
	30,000	1 hour
	10,000	8 hours
NOx	200	1 hour
	40	1 year
Ozone	120	8 hours
SO_2	500	10 minutes
	125	24 hours
	50	1 year

Table 3: Maximum concentration levels defined by the World Bank guidelines

Pollutant	Maximum level [μg/m³]	Average over:
Particulate matter	50	1 year
	70	1 day
NOx	150	1 day

Impact factor 1 - Atmospheric emissions – Summary table

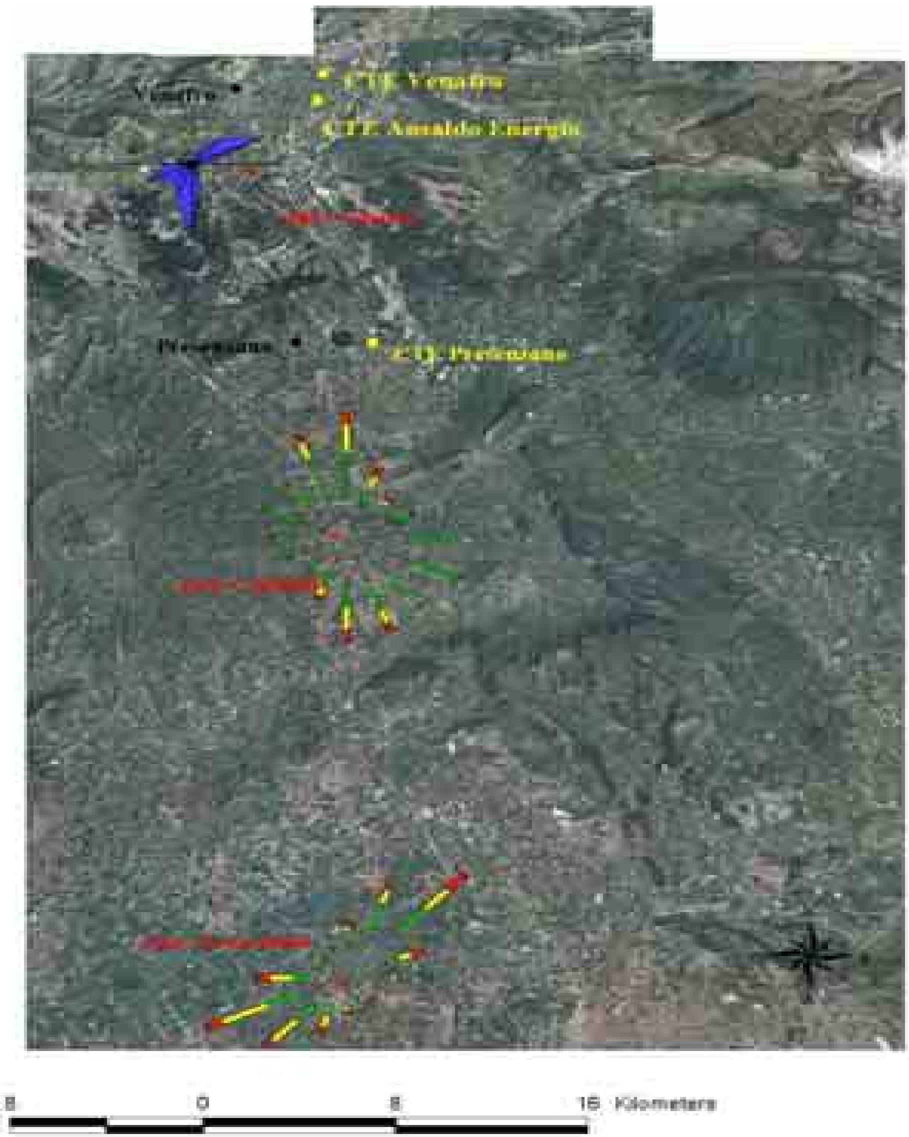
Reference criteria	*Target criteria*	*Best practice criteria*
Compliance with maximum emission levels defined in the World Bank guidelines (Table 1). Regular monitoring of the emissions of main pollutants.	For plants with a total heat output of 300 MW or more: - modelling survey of impact on air quality; - compliance with the yearly averages in terms of maximum air concentration levels set by the WHO and the World Bank and with hourly and daily averages in terms of maximum concentration levels for 95% of the time.	Nitrogen oxide emissions < 50 mg/Nm^3 Measurement of air quality on a regular basis for plants with a total heat output of > 300 MW that are located in sensitive areas.

Monitoring emissions and air quality

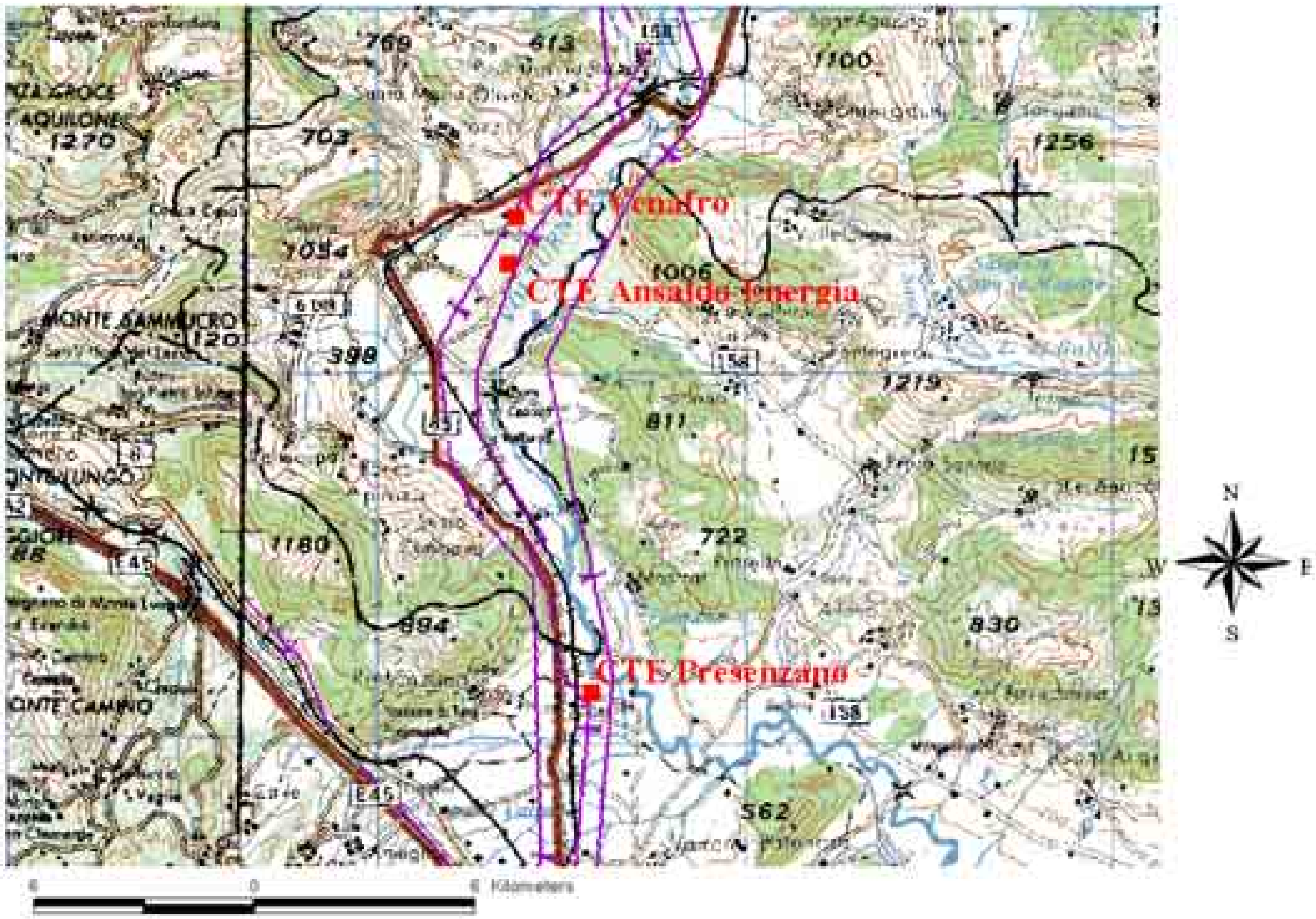
In addition to the control of combustion conditions in real time, required to ensure the best (and therefore most economic) energy output possible, regular monitoring of the emissions of the main pollutants is also required in order to ensure compliance with maximum levels.

With regard to sulphur dioxide emissions, monitoring can alternatively be based on the sulphur content in fuels (coal or fuel oil)

Localizzazione delle centrali e delle relative centraline meteo utilizzate per l'analisi della dispersione degli inquinanti in atmosfera

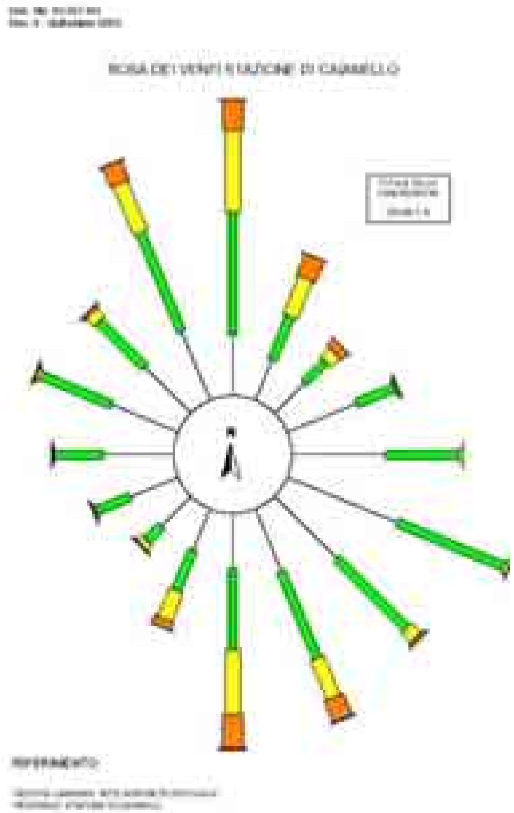


Siting for 2 plants A and B e

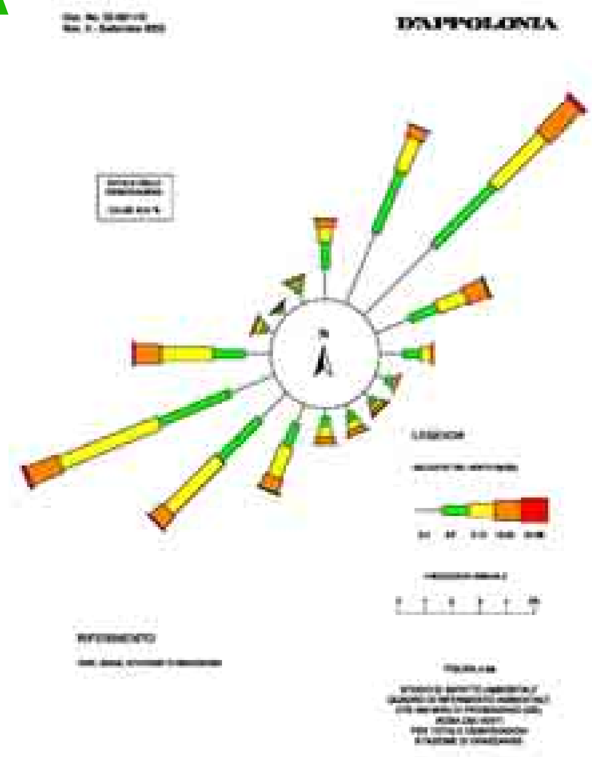


Rosa dei venti- for case A

Winds rose – Caianiello Village



Winds rose – Grazzanise village



- **Caianiello station**: predominant wind direction from North and NNW and from South and SSE. The winds are coherent with valley orientation. No wind calms detected

Grazzanise station: predominant wind direction from NE and NNE. Presence of a significant component from SWW and SW. Wind calms are detected (40,8%). To be underlined that the proponent relates in the EIS that the predominat wind, in analogy to the Caianiello station, is from NNE and there is a significant component from SW

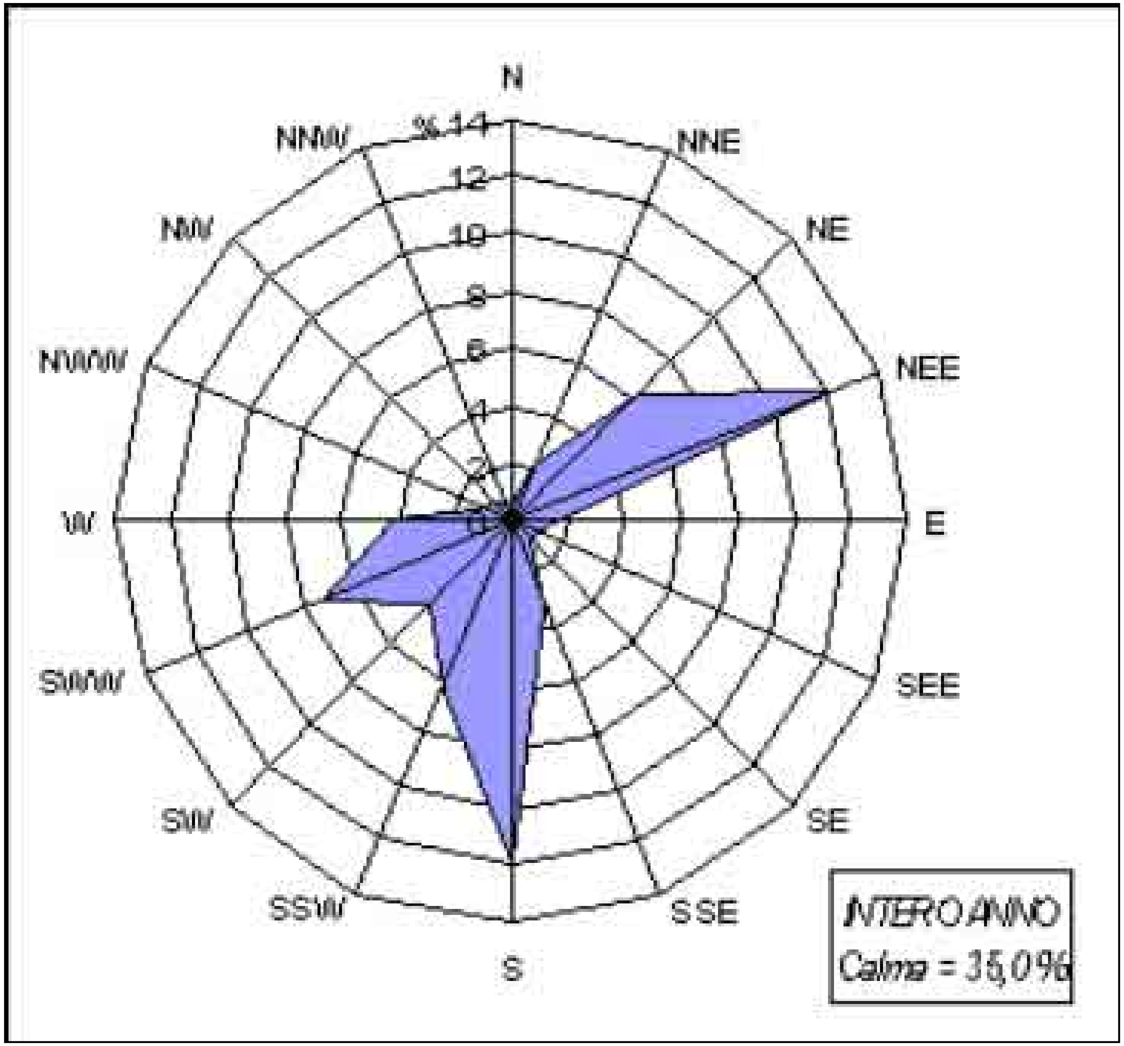
Winds rose-for case B

Predominant wind direction from South for

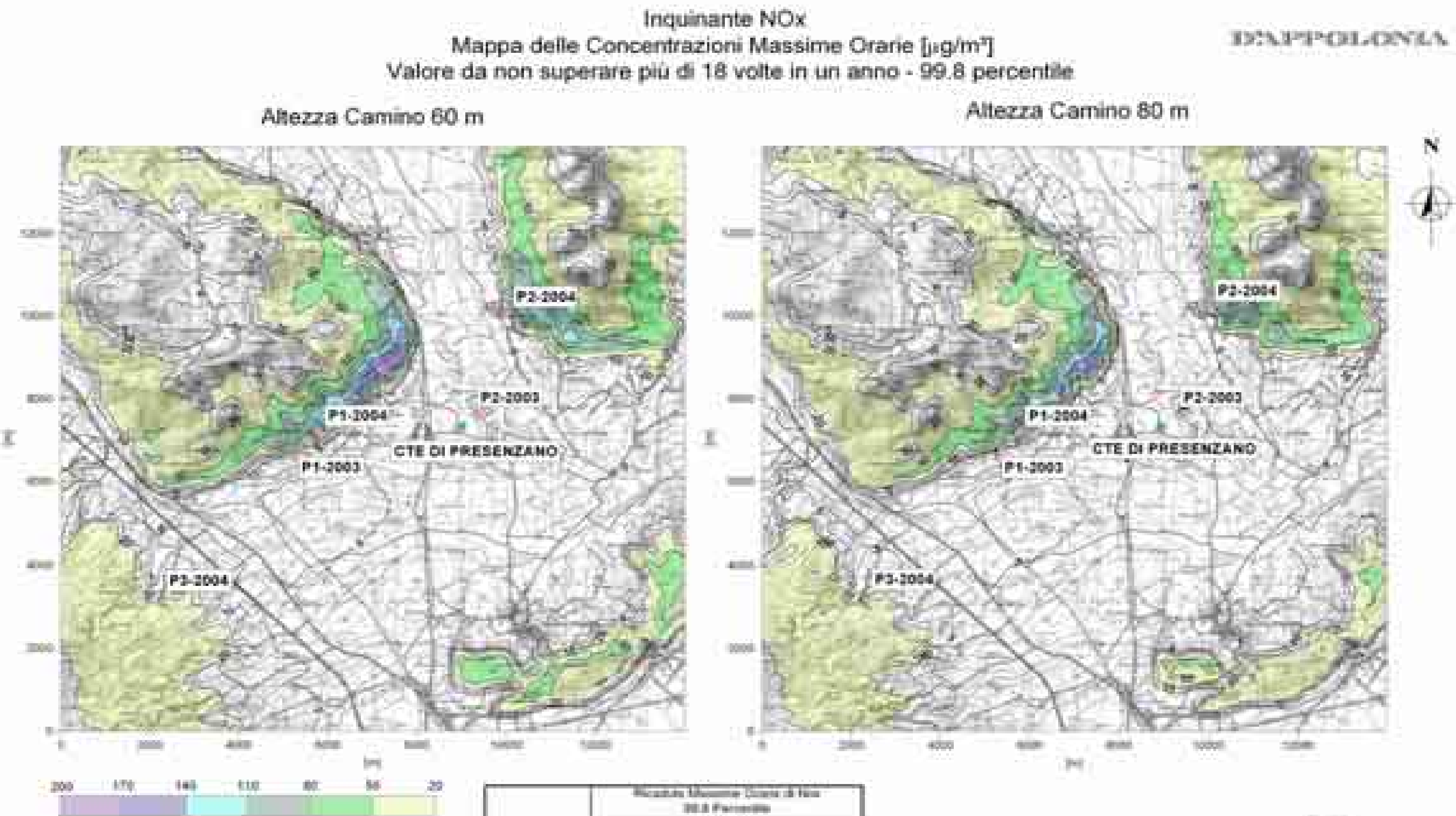
approximately 14% and from NNE

for approximately 10%,

following the valley orographic course



Results simulation with ISC Model (A)



	[illegible]	
	[illegible]	[illegible]
[illegible]	200	180
P1-2003	[illegible]	[illegible]
P2-2003	[illegible]	[illegible]
P1-2004	[illegible]	[illegible]
P2-2004	[illegible]	[illegible]
P3-2004	[illegible]	[illegible]

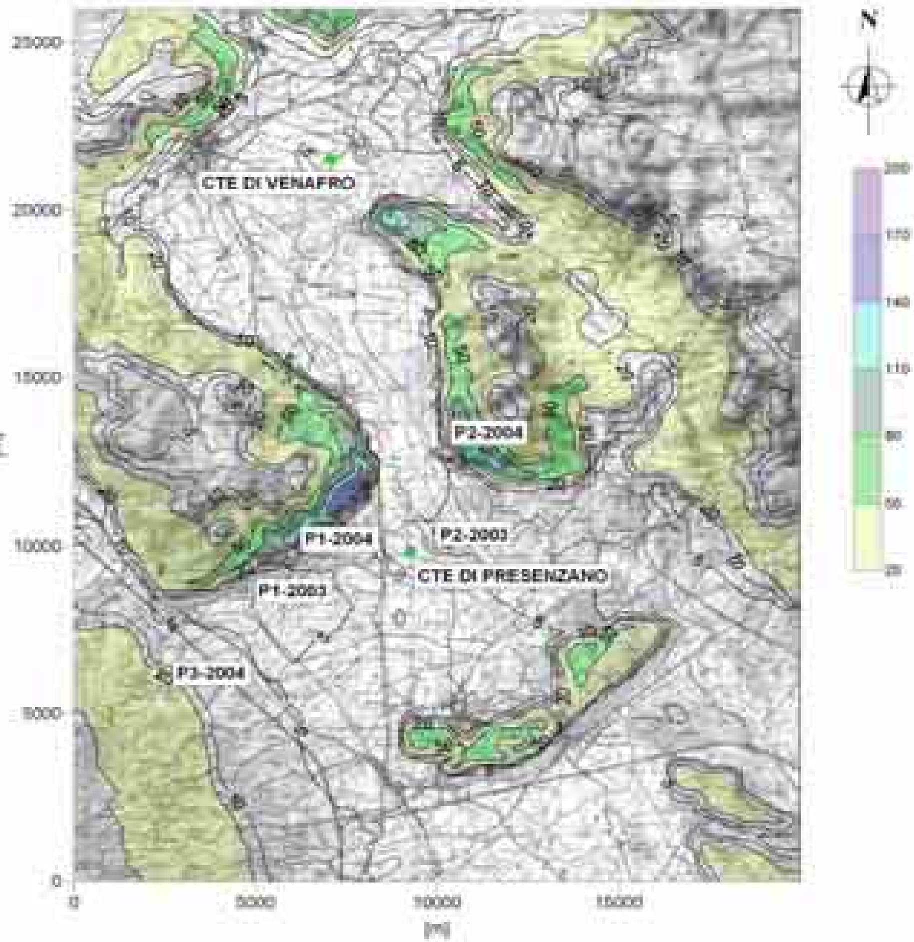
Conc.MAX stimate:

200 µg/m³ **180** µg/m³.

Simulation results with ISC Model (A + B)

Inquinante NOx
Mappa delle Concentrazioni Massime Orarie - 99.8 Percentile [µg/m³]
Ricadute Congiunte CTE di Venafro e CTE di Presenzano (Altezza camino 60m)

D'APPOLONIA

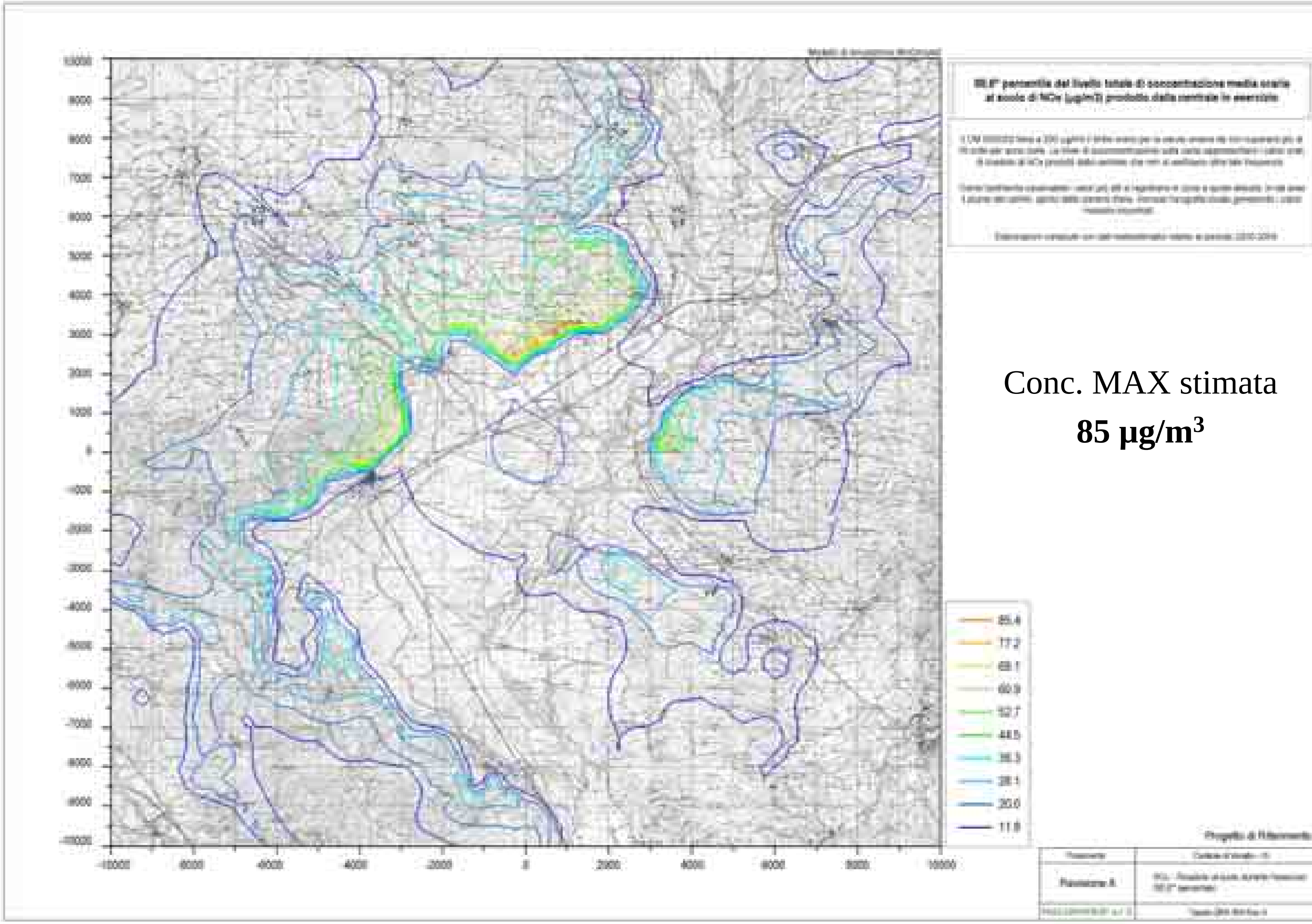


	Ricadute Massime Orarie di NOx
	99.8 Percentile
	[µg/m³]
	Altezza camino 60 m
Max nel dominio	200
P1-2003	4.5
P2-2003	5.0
P1-2004	75
P2-2004	25
P3-2004	25

Conc. MAX stimata:
200 µg/m^3

FIGURA 6a
RICADUTE CONGIUNTE CON LA CTE DI VENAFRO
CONCENTRAZIONI MASSIME ORARIE DI NOx
IN ATMOSFERA AL LIVELLO DEL SUOLO
ALTEZZA CAMINO 60 m

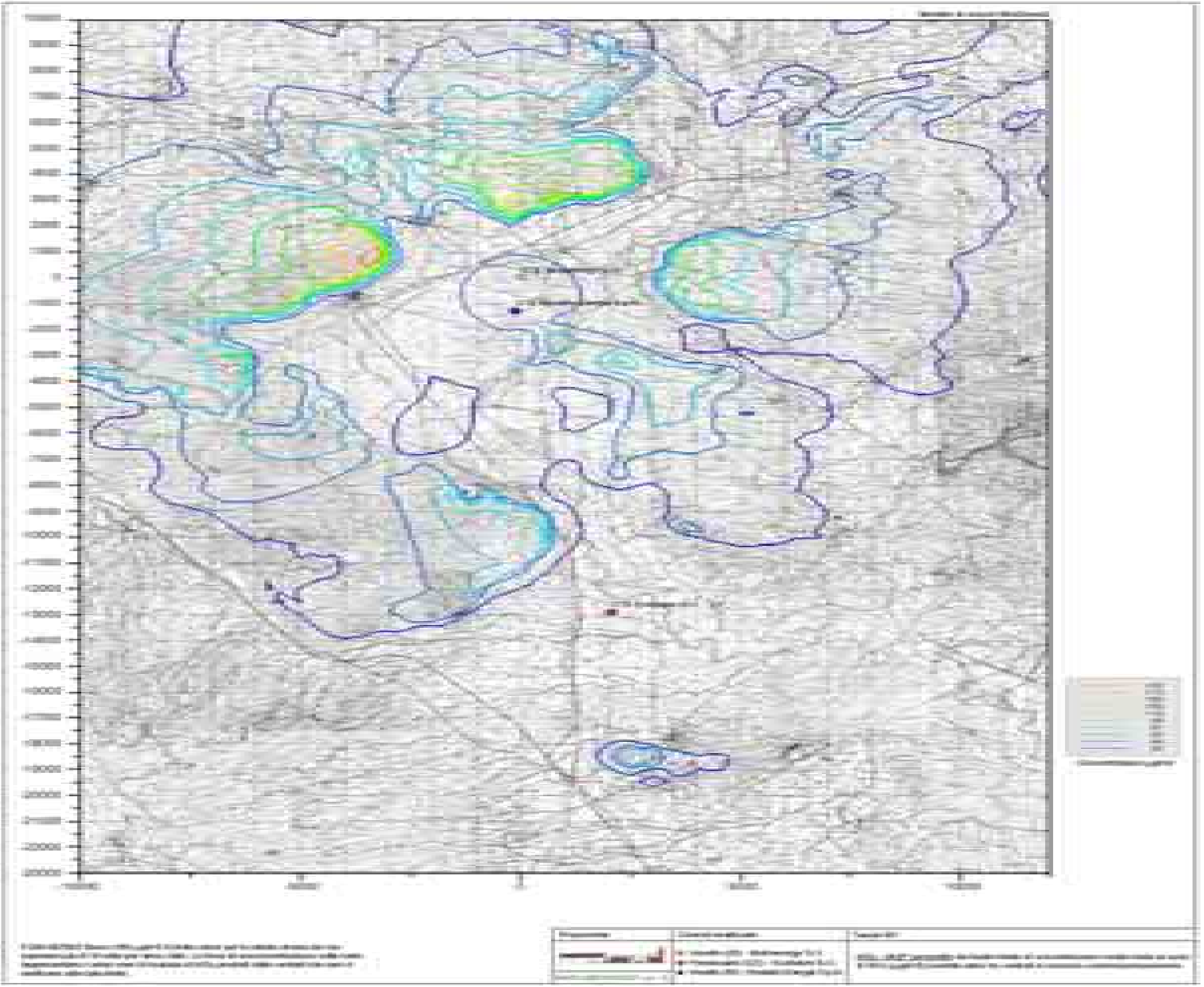
Results simulation with WINDIMULA2 model (A)



Conc. MAX stimata

85 µg/m^3

Results simulation wth WINDIMULA2 model (A +B +C)

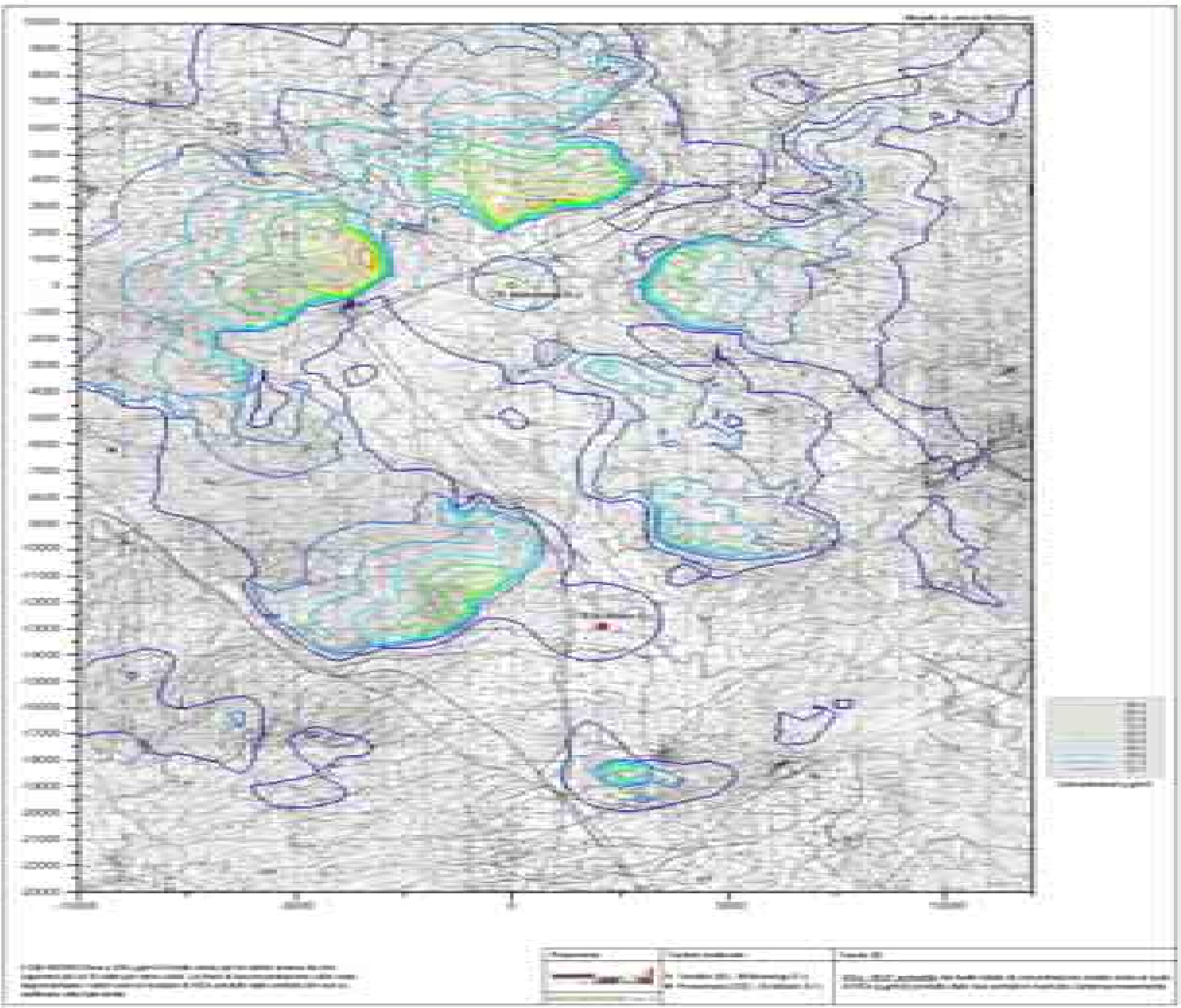


NOx 99.8 percentile of the hourly average

total level ground concentrations (µg/m³).

Estimated max concentration: 192 µg/m³

Results simulation wth WINDIMULA2 model (A+B)



NOx 99.8 percentile of the hourly average total level ground concentrations (µg/m³).

Estimated max concentration: **99 µg/m³**

Use of natural resources and greenhouse gas –(GHG) emissions

There are currently no national or international standards which define maximum CO2 emission levels (in mg/Nm3 or in gC/kWh produced).

Given current technologies and those being developed, a maximum emission level of 120 g/kWh produced is considered best practice.

Table 4 – Specific average GHG emissions

Fuel		Output	Specific emissions per kWh input (gC/kWh)	Specific emissions per kWh output (gC/kWh)
Coal	Conventional	30 – 45%	90 - 95	200 – 320
	Gasification	40 – 45%		200 – 240
Fuel oil	Steam	30 – 40%	74-76	185 – 255
	Turbine – open cycle	30 –40%		185 – 255
	Turbine – combined cycle	50 – 55%		135 – 155
	Cogeneration	30 –40% (electric)		135 – 205 (1)
Natural gas	Steam	35 – 40%	54	135 – 155
	Turbine – open cycle	30 – 40%		135 – 180
	Turbine – combined cycle	50 – 55%		100 –110
	Cogeneration	30 –4 0% (electric)		100 – 145 (1)

(1) computed, using the equivalent boiler method, per electric kWh produced.

Impact factor 2 - Greenhouse effect – Summary table

Reference criteria	Target criteria	Best practice criteria
	Review of alternative energy sources for plants with a total output heat of 300 MW or more.	• GHG emissions < 120 gC/kWh output; • promotion of the rational use of energy; • use of the clean development mechanisms (CDMs) outlined in the Kyoto Protocol

Water Resources

Water supply is assessed to determine the adequacy of proposed water sources to meet construction and operation al needs with out adversely diminishing or degrading local or regional water supplies; how the project is would meet emergency demands when the primary water supply is interrupted; an dany proposed fresh water conservation methods.

The assessment for water quality is site specific and addresses erosion and se dimen tat io n o f local waterways; impact of discharges on ground water quality; spill containment methods; potential for off -site waste disposal sites to degrade local water quality; and, treatment plan for spills and run off.

Flood hazards and drainage conditions associated with a project are also evaluated to assess the vulnerability of the energy facility to 100- year fre quency over land or overflow flooding, the adequacy of a facility to carry runoff; and the increased exposure o f down stream properties to flooding, erosion or sediment deposition.

Mitigation to reduce impacts to water supply, wate r quality and flood hazards are dependent upon the conclusions of the assessment .

However, some methods include management plans, sediment traps or catch basins, lined diversion ditches, berms or dikes, increasing the grade of the site.

Water supply and wastewater discharge

	Potential impact	*Measures to limit impact*
Net quantity of water used (incoming – outgoing)	Adjustment to hydrological flow, and therefore ecosystems and use.	Reduction in water intake for cooling systems.
Pollution discharged into the environment through effluents	Damage to the quality of the water. Changes in ecosystems and use.	Appropriate treatment of effluents before discharge. Optimisation of the use of reactives that are compatible with maximum discharge levels.

Table 5 – Parameters for effluent discharge in surface waters

Parameter	*World Bank guidelines (maximum level on an average daily basis, without dilution) [in mg/l, except pH and temperature]*
pH	6-9
Total solid suspension	50
Hydrocarbons (oils and grease)	10
BOD_5	50
COB	250
Chromium	0.5
Copper	0.5
Zinc	1
Iron	1
Temperature	Increase of < 3 °C at the edge of the zone where initial mixing and dilution take place

Impact factor 3 - Water supply and wastewater – Summary table

Reference criteria	*Target criteria*	*Best practice criteria*
Compliance of wastewater discharged into surface waters with maximum levels defined by the World Bank.	Avoidance of damage to the environment with regard to quality standards for its specific purpose, as defined by the WHO.	Compliance of effluents with the following levels[9]: - suspended solids < 30 mg/l - BOD < 30 mg /l - COB < 125 mg/ l

Noise

Evaluate the proposed facility to determine if it is in compliance with all applicable federal, state, and local noise laws, ordinances, regulations and standards, and also discusses any potentially significant resulting noise impacts.

Based on the conclusions of a project s noise analysis, staff could recommend mitigation measures to reduce noise impacts to which workers could potentially be exposed.

In evaluating community noise, staff first analyzes existing ambient daytime and nighttime noise. Typically, an individual's subjective reaction to a new noise is compared to the level of the existing ambient noise and its characteristics (tone and frequency), to which one has become accustomed, with the level of the new noise and its characteristics. Minimizing the exposure of the surrounding community to energy facility-induced noise can be accomplished by ensuring compliance with applicable local regulations and mitigation

Mitigation is recommended on a case-by-case basis and the type of mitigation required would depend on the level of noise associated with a given project.

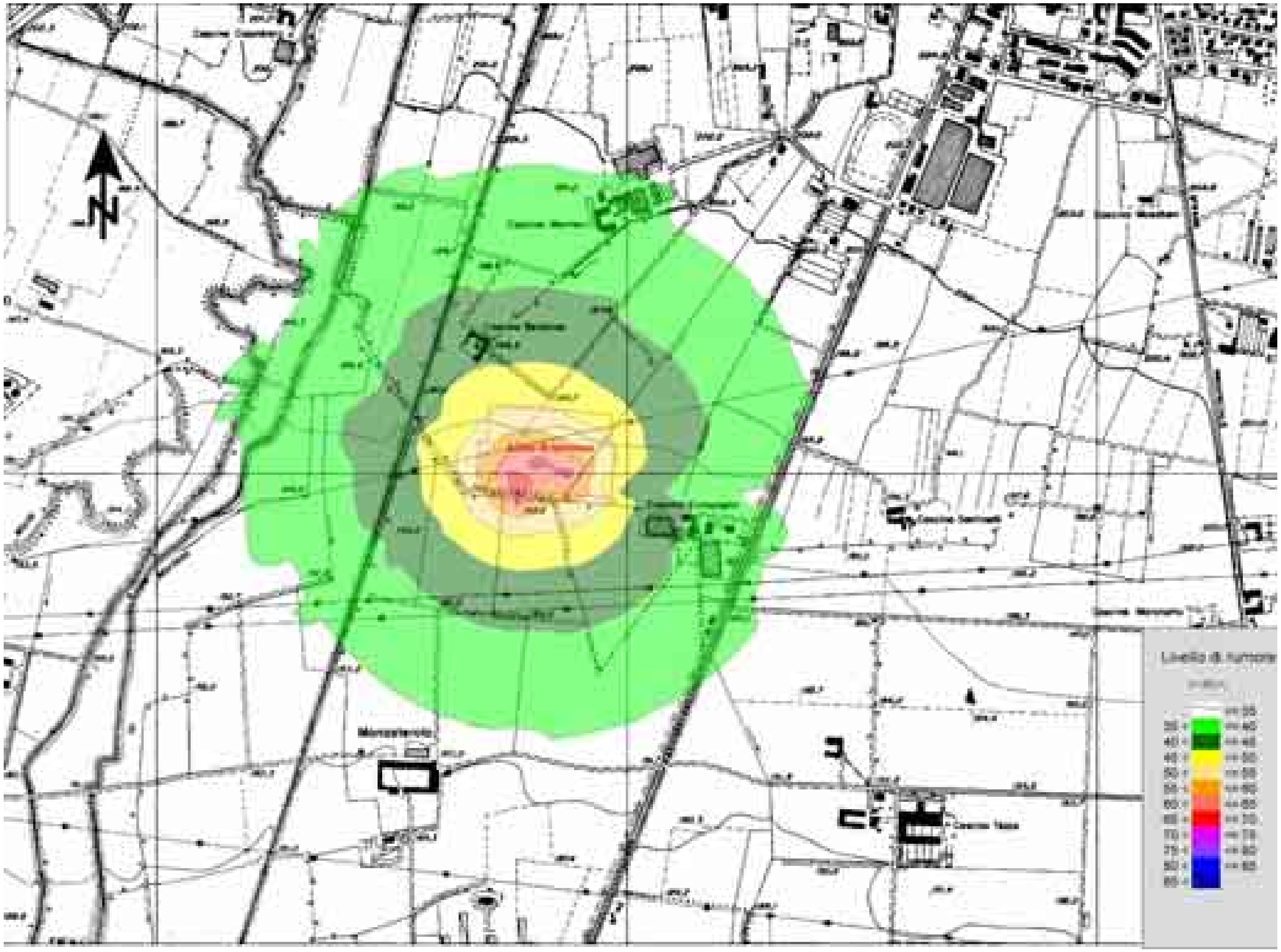
Noise generated by facility operations

Table 6: Maximum noise levels

	Day	Night
Residential, educational or institutional area	55 dB(A)	45 dB(A)
Industrial or commercial area	70 dB(A)	70 dB(A)

Impact factor 4 – Noise - Summary table

Reference criteria	Target criteria	Best practice criteria
Compliance with maximum levels recommended by the World Bank.		


Livello di rumore

Visual resources

Describe the various features of the existing visual setting, and the project s proposed visual characteristics including horizontal and vertical dimensions of structures, structure placement and color, and lighting.

Existing visual setting features include the topographic, vegetative, hydrologic, and cultural features of the landscape as it exists prior to construction of the proposed project.

Identifies the viewshed, determines the key observation points, and visual susceptibility. Factors considered include viewer exposure, relative project size, season, light conditions, quality, viewer sensitivity, visibility, exposure, contrast and dominance. The project is reviewed to determine if compliant with applicable

Standard level, and mitigation is recommended depending upon the level of the impact. When cumulative visual impacts are found to be significant, whether in relation to other proposed projects or to the host industry, recommend feasible mitigation measures to reduce those impacts.

The applicant may also provide mitigation measures, which are then refined, as necessary, based on staff review, other agencies, and the public. If members of the public in the project vicinity have expressed concerns regarding the appearance of the project, solicits their input regarding appropriate mitigation.

Mitigation can consist of several methods, including relocation, design, color/texture, landscaping, and lighting control, etc. The aim of such mitigation is to reduce the size, mass, bulk, line, and contrast of the proposed facilities in order to achieve closer compatibility with the setting.

Mitigation can be proposed by the project applicant, staff, an intervenor, an agency, or the public.

Ante operam

Post operam

Ante operam

Post operam

Cultural resources

Analyze three aspects of cultural resources: prehistoric and historic archaeologic resources and ethnographic resources. The extent of impact analysis varies from project to project, depending upon whether the area is known or likely to have cultural resources and the significance of those resources.

For a project located in an area where the site has been totally disturbed by previous development or where conditions indicate that previous human occupation or use did not occur, impact analysis may be limited to a map review, a literature and records search, contacts with knowledgeable archaeologists familiar with the site area, and preparation of documentation explaining that no potential exists for adverse impacts to cultural resources. If a project area is located near known sensitive cultural resources and is likely to impact the resources, mitigation would likely be required.

Mitigation of potentially significant impacts to cultural resources could range from avoidance of the resource area to full-scale excavation and recovery of materials and information if avoidance is infeasible. Avoidance is usually the preferred mitigation.

Land use

Start with the identification of the applicable land use laws, ordinances, regulations, and standards, evaluates the project's potential to adversely affect land uses, and describes measures to mitigate and/or avoid such potential impacts.

After identification of the applicable laws, prepare a consistency analysis including a zoning and plan (general, community and/or specific) compatibility determination to assess whether or not a project is compatible with adjacent and surrounding land uses. Clarify the applicable code, ordinance or plan, and/or a determination if there are significant inconsistencies between the proposed project and the local planning regulations. The applicant may need to obtain a General Plan amendment or zoning change from the local government.

The applicant can work directly with the local government to obtain these changes.

In making a compatibility determination, also considers whether or not the project would create a use that is out of context with existing development, stimulate precedent setting changes to existing land ownership or development patterns, or result in negative changes that cause decay of an area. If it is concluded that the project could result in land use impacts, staff may recommend that the project proponent comply with local site development standards, obtain the appropriate leases from other agencies to encroach upon public lands, and obtain appropriate entitlements necessary for property rezones.

Biological resources

Analysis starts with information provided in the application describing the biological setting of the proposed project. In areas where sensitive biological resources may occur, we require the Applicant to include the results of appropriate biological surveys be conducted at the proper time of year by suitably trained biologists. Surveys are necessary to ensure timely project review and a complete impact analysis and to assess the potential for biological mitigation of a proposed energy facility project. The cost of avoidance and mitigation of impacts to listed species and other sensitive biological resources can be substantial. If impacts cannot be avoided, we work with an applicant to mitigate a project's significant biological resource impacts.

When such a situation arises, the applicant must be prepared to discuss the availability of mitigation, including off-site mitigation and its costs.

Various mitigation approaches have been recommended in the past and can be explored in meetings with the staff.

Applicants may need state and/or federal permits if a rare, threatened, or endangered species is present at the site. The staff will work with the applicant to identify other necessary permits, however, it is up to the applicant to file for and obtain those permits

Location

	Potential impact	*Measures to limit impact*
Project location in or near an environmentally sensitive area (nature reserve, specific use, purpose in the balance of the ecosystem, etc.)	Damage to or disappearance of biotopes. Impoverishment of biodiversity and landscapes. Change in the lifestyle of local populations.	Choice of site location. Consideration of the site's uses by local populations. Rehabilitation of site after construction work. Consideration of the site's future at the end of the plant's useful life. Compensatory measures.

An environment is considered sensitive if:

- it is protected by national or regional legislation and regulation, or is listed as a IUCN-protected site;
- it is protected by international agreements (e.g. RAMSAR wetlands);
- it is listed as a world heritage site by UNESCO;
- it is located in a biosphere reserve listed by UNESCO, or has a vast biodiversity (primary forests, coral reefs, mangroves, etc.);
- is a particularly important site for endangered animal or plant species on the IUCN Red List;
- it has a special significance for ethnic groups,

Impact factor 6 – Location - Summary table

Reference criteria	*Target criteria*	*Best practice criteria*
Analysis of the environmental sensitivity of the plant site and its surroundings (assessment of use and functions, quality of fauna and flora, etc.). Appropriate mitigation and compensatory measures in the event of a significant impact on ecosystems or local populations. If necessary, a plan to compensate / resettle project affected people, in accordance with World Bank Operational Directive 4.30 / Operational Procedure 4.12.	Avoidance of environmentally sensitive sites. Reinstatement of the site after construction.	Definition, in collaboration with the authorities and local populations, of how the project can best be integrated within the long-term development of the site (including the future of the site at the end of the project).

Soil and agricultural resources

Begins by evaluating the potential agricultural productivity of the soil which is based upon the soil's Land Capability Class System.

A site assessment is also prepared that identifies five factors that affect the economic viability of the site for agricultural uses. The five factors include size of the project site, water availability, surrounding and adjacent land uses, protected resources lands, and constraints to agriculture.

These factors are then rated to determine their relative importance. Typically local agencies would develop the thresholds of significance for land converted from an agricultural use, thus, the thresholds can vary from project location to project location.

Although avoidance of productive farmland is the preferred mitigation, the use of development fees may be an acceptable mitigation method where conversion of farmland would otherwise be unavoidable.

Fees would be based upon the cost of acquiring a conservation easement or other development right over equivalent or better property.

Additional approaches to mitigating impacts from agricultural land conversion may be available for specific projects, mitigation approaches of which can be explored by meeting with staff and with the local government.

GEOLOGICAL RESOURCES

In order to evaluate potential hazards and impacts, begin by evaluating the geological descriptions included in an application, and supplementing that information as necessary by utilizing staff expertise and resources.

Some of the potential hazards that may be encountered at a project site include: fault rupture, seismic ground shaking; seismic ground failure, including liquefaction; seiche, tsunami, or volcanic hazard; landslides or mud flows; erosion, changes in topography or unstable soil conditions from excavation, grading, or fill; subsidence of the land; expansive soils; and unique geologic or physical features.

Review the overall foundation conditions at the site to determine, whether unstable soils exist at the project site. For example, if potentially unstable or deep soils are discovered they are evaluated to determine their extent and behavior during earthquake shaking. If the site is located in hilly or mountainous terrain, landslide conditions are evaluated both above and below the site.

Mitigation could include changes in the engineering design methods, rearrangement of the project, or pile foundations depending upon geologic conditions that exist at the site. However, if the potentially unstable ground is too extensive and/or the mitigation too expensive, the proposed site may not be appropriate for use as a power plant site, transmission line tower, or natural gas pipeline.

Waste and management of toxic substances

	Potential impact	*Measures to limit impact*
Storage of fuels and toxic substances. Management of waste from: - combustion (ash, soot), - smoke treatment procedures (particularly desulphurisation) and liquid effluents, - water treatment procedures prior to injection.	Contamination of soil and water. Accidental discharge into the environment.	Careful selection of fuel and control of its quality. Storage of waste, fuels and toxic substances with the appropriate safety and sealing measures. Waste reuse and/or treatment using the appropriate methods.

In compliance with the relevant generally accepted standards:

- the risk of soil and water contamination as a result of waste and the different toxic or hazardous substances stored on-site must be controlled;
- any waste generated by the plant requires appropriate treatment in order to ensure that its disposal will only have a very limited impact on the environment.

TRANSMISSION SYSTEM ENGINEERING

Analyzes the adequacy of design, as well as planning provisions to protect environmental quality, ensure public health and safety and the general welfare and the likelihood of conformance of the proposed facilities with applicable standard levels. The analyses can vary depending if the transmission

line proposed is by an investor owned utility, a municipal utility, a qualifying facility (QF), or independent power producer.

However, the focus of the analysis is to ensure adequate outlet capacity, reliable service to ratepayers, and high efficiency of operation at a reasonable cost to ratepayers.

Additionally, the analysis attempts to minimize environmental impacts while

avoiding adverse effects to interconnected utilities.

As part of the transmission engineering assessment, an engineering analysis and a system evaluation are prepared. The transmission engineering analysis covers design of the power plant switchyard, the outlet transmission line and the termination or connection to the utility system.

The transmission system evaluation is an assessment of the applicant's and host utility's planning proposals that would affect system performance and reliability. Also included in the assessment is a reconnaissance or preliminary analysis of potential transmission alternatives that compares cost and reliability.

Mitigation recommended is intended to ensure reliability, efficiency and adequate outlet capacity, and to reduce environmental impacts associated with the proposed facility.

TRANSMISSION LINE AND SAFETY

Investigates the safety hazards and nuisance impacts associated with transmission lines and assesses electric and magnetic field reduction criteria and guidelines relative to the proposed project.

Identifies potential negative impacts associated transmission lines and

categorizes them as either safety hazards or nuisance impacts, and then

compares the hazard/impact to the standards or threshold levels to determine the level of significance.

Any hazard or impact that is considered significant is further evaluated to determine the need for mitigation.

Identifies and recommends appropriate mitigation measures to reduce, or eliminate significant impacts.

- Analysis the following hazards or impacts associated with the project: electric and magnetic field (EMF) fire hazards at the base of or adjacent to the transmission line resulting from the accumulation of debris;
- hazardous shocks resulting from someone coming into contact with an energized conduction while in contact with either a ground connection or the earth; nuisance shocks resulting from an accumulation of static charges on an ungrounded surface in the vicinity of the facility (these shocks are non hazardous and do not cause physiological harm);
- audible noise generated by transmission lines; communications interference (e.g. radio, television);
- Make recommendations when they believe mitigation is necessary to ensure ensure that the project is designed in a manner that would protect the environment and the health and safety of the public.

Construction of new secondary infrastructures

	Potential impact	*Measures to limit impact*
Civil engineering works for the different connections needed for the smooth running of the plant (roads, sub-stations, power lines, gas pipelines, etc.).	Cut-off effects: impoverishment of biodiversity and landscapes. Change in the lifestyle of local populations. Risk of induced effects (parcelling out of land, etc.) on protected natural sites.	Integration of the project within existing infrastructures, and strengthening of these infrastructures if necessary.

Impact factor 7: Secondary infrastructures - Summary table

Reference criteria	*Target criteria*	*Best practice criteria*
Analysis of the environmental sensitivity of sites affected by the new infrastructures (assessment of their use and functions, the quality of the animal and plant life, etc.). Appropriate mitigation and compensatory measures in the event of a significant impact on ecosystems or local populations.	Integration of the project within existing infrastructures wherever possible, and the strengthening of these infrastructures if necessary. Avoidance of cutting off sensitive natural environments. Site reinstatement after construction.	

PUBLIC HEALTH

Identifies the fuels, chemicals and pollutants to be used at the facility and their expected concentrations that could pose a significant risk to public health.

Evaluates the toxic pollutant emissions by analyzing the chemical composition of the proposed fuels, water treatment chemicals and data obtained from emission tests conducted at operational facilities using similar types of equipment and fuels.

Identifies toxic chemicals used in plant operation and evaluates the feasibility of using less toxic alternatives. Once all potentially toxic pollutants associated with a proposed facility are identified, determines the types of health hazards associated with each pollutant. Exposure to toxic pollutants can produce various types of adverse health effects, such as respiratory irritation, carcinogenic effects, suppression of immune function, teratogenic effects, etc.

valuate the potential for cumulative effects, and the toxicity to different organ systems associated with a pollutant. The relationship

between exposure and adverse health effects for each toxic pollutant that would be emitted from a proposed project is also analyzed.

HAZARDOUS MATERIALS

Begins analysis by comparing all materials that are proposed for use in a facility with those materials classified as hazardous or extremely hazardous, to identify hazardous materials.

Analysis is based on factors that are both project- and site-specific.

Some of these factors include proximity of the facility to residences or other sensitive receptors (i.e. hospitals, daycare centers, etc.), the specific hazardous materials to be used, types of equipment, meteorology, external, seismic, and flood hazards. These factors all affect the degree of risk associated with the use of hazardous materials at a specific facility as well a the type and amount of mitigation that may be required.

Reviews preliminary design information to determine the potential for accidental release of each material, and any resulting public health impacts.

Avoidance or mitigation of accidental release potential can be accomplished through a variety of methods. However, some measures are known to provide greater certainty than others in accomplishing risk reduction.

recommends measures to reduce impacts are using non- or less- hazardous materials, engineered safety equipment, administrative control to prevent human error; and/or emergency response procedures.

Additional conditions have been recommended when it believed they were necessary to reduce any remaining potential impacts to public health to a less than significant level.

WASTE MANAGEMENT

Assesse both on-site and off-site waste management.

On-site management of wastes generated during construction and operation is assessed to determine if it can be accomplished in an environmentally safe manner

Off-site management, treatment, and disposal of project wastes is analyzed to determine if it would result in significant adverse impacts to existing waste disposal facilities.

The analysis compares the amount of construction and operational waste generated by the proposed facility to capacities of nearby landfills approved to accept the waste. When project wastes include hazardous contaminants, evaluate the need for appropriate measures to ensure safe handling of the hazardous material. Typically, the applicant has investigated a proposed site for existing contamination from previous uses. When contamination is found or suspected, the applicant would need to remediate the site it may propose mitigation that can include providing a waste management plan, describe the waste and its their origin, estimate of the amounts and frequency of waste, and any additional measures needed to ensure that the project is operated in an environmentally safe manner.

Impact factor 5 – Waste and management of toxic substances - Summary table

Reference criteria	*Target criteria*	*Best practice criteria*
- Compliance with the relevant standards in terms of the storage of toxic substances (containment capacities, sealing of containers and storage areas and, where necessary, the treatment of runoff waters, etc.). - Appropriate treatment of waste prior to discharge.	Treatment and recovery or containment in specialised centres for toxic or hazardous waste when possible.	Recycling of treated waste (in the facility or for other uses).

TRAFFIC AND TRANSPORTATION

Prepares an on-site assessment of traffic conditions that generally includes site access, parking, and internal circulation, potential off-site impacts to the roadway system, and impacts to the railway systems.

Typically on-site circulation, access and parking are regulated by the local authority. Evaluate the project to ensure it meets the regulations, and requires additional mitigation if necessary.

Off-site assessment of traffic conditions discusses the existing level of service on the roadways within the study area, and impacts on the roadways that would result from the project. Typically peak hour traffic is the most critical factor in determining the level of significant of impacts.

Levels of threshold can vary from project location to project location because they are set by the local jurisdictions. Roadway safety is also assessed in terms of hazardous materials to be shipped and the size of the vehicle to be used for the shipment. Permits may be required for some freight shipments, construction activities that encroach into a public right of way, and for the transport of hazardous materials. Railway system impacts are also discussed, particularly if an extension of a line is anticipated, or if numerous large shipments of supplies are expected from outside the project area.

Mitigation could be required depending on project related impacts, and will sometimes include requirements for transportation system management plans, roadway improvements, roadway maintenance agreements, and encroachment permits.

GENERAL CONDITIONS, COMPLIANCE, MONITORING

The project General Conditions, including Compliance Monitoring and Closure Plan, (Compliance Plan) are established as required

The Compliance Plan provides a means for assuring that the facility is constructed, operated and closed in conjunction with air and water quality, public health and safety, environmental and other applicable regulations, guidelines, and conditions adopted or established by the Commission

The Commission shall maintain as a public record, in either the Compliance file for the life of the project (or other period asrequired):

1. all documents demonstrating compliance with any legal requirements relating to the construction and operation of the facility;
2. all monthly and annual compliance reports filed by the project owner;
3. all complaints of noncompliance filed with the Commission; and,
4. all petitions for project or condition changes and the resulting staff or Commission action taken.

It is important to have a list of **Laws, Oridinances, Regulations, and Standards, on national or local levels used in EIS for all factors or environmental components investigated (air, water, biodiversity, land use ect..).**

Convention on Environmental Impact Assessment in a Transboundary Context

United Nations Economic Commission for Europe

ENVIRONMENTAL IMPACT ASSESSMENT CHECKLIST

CONSOLIDATED LIST

Project 2A - Thermal Power Stations and other combustion installations

Comments: If the fuel is treated by desulpharisation or de NO_x processes, the by-products from treatment processes should be considered under the EIA. Often by-product consists of sludge and water. This is to be further treated or disposed of in acceptable manners. Other by-products can consist of other chemical compounds resulting from the reaction of the unwanted by-product with another agent. The by-product is often a substance that can be used of in other processes.

CATEGORY	FACTOR	COMMENTS
AIR	ammonia (NH3)	greenhouse gas, aquatic life, flora, reference 1 & 3
	carbon monoxide (CO)	greenhouse gas, climate change, reference 1 & 3
	carbon dioxide (CO2)	greenhouse gas
	heavy metals	micropollutants, health and ecological problems, persistence, toxicity and bio-accumulation characteristics - reference 2
	lead (Pb)	
	mercury (Hg)	
	cadmium (Cd)	
	nickel (Ni)	
	chromium (Cr)	
	zinc (Zn)	
	arsenic (As)	
	copper (Cu)	
	selenium (Se)	
	methane (CH4)	greenhouse gas, reference 1
	non-methane volatile organic compounds (NMVOC)	volatile, climate change, flora, reference 1
	oxides of nitrogen (NOx) / N2O	acid rain, human health, flora, fauna, historical sites, reference 1
	oxides of sulphur (SOx)	
	peroxiacethylnitrates (PAN)	flora
	persistent organic pollutants	reference 4
	poly-aromatic hydrocarbons (PAH)	carcinogenic, hazardous waste, priority toxic pollutant, human health, fauna, aquatic life
	benzo (a) pyrene	most common, most hazardous PAH
	photochemical oxidants	ozone
	radionuclides	human health, fauna, water, aquatic life
	other hazardous substances	human health, flora, fauna
	particle emissions	climate change, human health, historical sites, soil
	oil vapour	historical sites, human health, flora
	odour	human health
	noise	
	vibration	
	steam	waste heat, climate change

WATER	heavy metals:	leachates - contamination of ground water and surface water - reference 2
	lead (Pb)	
	mercury (Hg)	
	cadmium (Cd)	
	nickel (Ni)	
	chromium (Cr)	
	zinc (Zn)	
	arsenic (As)	
	vanadium (Vn)	
	nutrients	water quality, aquatic life
	oil products	
	persistent organic pollutants	reference 4
	poly-aromatic hydrocarbons (PAH)	carcinogenic, hazardous waste, priority toxic pollutant, human health, fauna, aquatic life
	benzo (a) pyrene	most common, most hazardous PAH
	sulphates	water quality, aquatic life
	other hazardous substances	water quality, aquatic life, human health
	dissolved solids	water quality, aquatic life
	suspended solids	
	total solids	
	temperature	aquatic life
	change in pH	water quality, aquatic life

CLIMATE	changes in ambient air temperature	
	particle emissions	
	changes in humidity	
	greenhouse gas emissions, ozone	CO, CO2, methane, NOx, NxO, SOx

FLORA	changes in natural vegetation	pollutants, project location
	disturbance of plant habitat	
	disturbance of natural vegetation	
	decrease in biodiversity	pollutants
	impact of threatened species	pollutants, project location
	changes in species population	
	changes in mammal food web	
	impact on protected areas	
FAUNA	disturbance of wildlife habitat	pollutants, project location
	decrease in biodiversity	
	impact on threatened species	
	changes in species population	
	impact on threatened area	
	changes in mammal food web	

SOIL	soil acidification	heavy metals, other pollutants
	soil contamination	
	by-products / wastes	
LANDSCAPE	land use changes	
	visual aspects	
	physical composition	
	impact on sensitive lands	
HISTORICAL MONUMENTS	changes to historical sites	soiling, staining, acid rain

HUMAN HEALTH & SAFETY	changes in ambient noise levels	during project construction, operation
	changes in disease incidence	
	risk of spills	
	risk of surface water contamination	
	risk of ground water contamination	
	increase risk of accidents	
	risk of explosions	
CULTURAL HERITAGE	land use changes	
	way of life	
SOCIO-ECONOMIC	changes to well being of life	
	changes to quality of life	
	present use of natural resources	
	potential use of natural resources	
	employment opportunity	
	economic development - transboundary	

Project 2B - Nuclear Power Stations

Comments: Consideration should be given to de-commissioning of plants and disposal of spent fuel.

CATEGORY	FACTOR	COMMENTS
AIR	heavy metals:	reference 2
	cadmium (Cd)	toxic pollutant, hazardous substance, human health and aquatic life
	beryllium (Be)	carcinogen, hazardous substance, priority toxic pollutant, soil, flora, fauna, human
	radioactive isotopes	human health, fauna
	radioactive actinides	
	water vapour	climate change
WATER	heavy metals:	reference 2
	cadmium (Cd)	toxic pollutant, hazardous substance, human health and aquatic life
	beryllium (Be)	carcinogen, hazardous substance, priority toxic pollutant, soil, flora, fauna, human
	iodine	human health, aquatic life, water quality
	radioactive isotopes	
	wastes / by-products	human health, aquatic life, water quality, fauna, flora, soil
	temperature change	water quality, aquatic life, climate

CLIMATE	changes in ambient air temperature	
	changes in surface water temperature	
	changes in humidity	
FLORA	disturbance of aquatic habitat	project location, changes in water temperature
	disturbance of plant habitat	project location
	disturbance of natural vegetation	project location, emissions
	decrease in biodiversity	emissions
	impact of threatened species	
	impact on protected areas	project location, emissions
FAUNA	disturbance of wildlife habitat	after accidents - deformation
	decrease in biodiversity	emissions
	impact on threatened species	
	impact on threatened area	

SOIL	soil contamination	radio-isotopes
	wastes / by-products	disposal sites, spent fuel
LANDSCAPE	land use changes	
	visual aspects	negative connotations when one sees nuclear power plants
	physical composition	
	impact on sensitive lands	
	wastes / by-products	disposal sites, spent fuel
HUMAN HEALTH & SAFETY	changes in disease incidence	
	increase risk of thyroid cancer	radioactive emissions
	increase risk of leukaemia	
	risk of surface water contamination	
	risk of ground water contamination	
	risk of nuclear accidents	
	risk of explosions	
CULTURAL HERITAGE	cultural changes	acceptance of nuclear power
	land use changes	
	way of life	
	acceptance of nuclear power plant	not in my back-yard syndrome

CATEGORY	FACTOR	COMMENTS
SOCIO-ECONOMIC	changes to well being of life	
	changes to quality of life	
	wastes / by-products	economic and social costs of safe disposal
	present use of natural resources	
	potential use of natural resources	
	employment opportunity	
	economic development - transboundary	

References

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5. Recommendations to ECE Governments on the Prevention of Water Pollution from Hazardous Substances