Name	Educational facility	Medical facility	Drinking Water facility	Communication (Post or	Transportation facility(Bus	Approach to Village	Power Supply
Rel	PS,MS	PHC	T,W,TK,TW	Phone	Bus	PR	EA
Janakpur	PS	No facility	T,W,TK,TW	Phone	Bus	PR	EA
Gurla	PS	No facility	T,W,TK,TW	Phone	No Service	KR	EA
Khan Ki	PS	No facility	W,TW,HP	Phone	No Service	KR	EA
Jhopdi	PS	No facility	T,W,TK,TW,R	Phone	No Service	KR	EA
Rajgarh	PS	No facility	T,W,TK,TW	Phone	No Service	KR	EA
Gurla	PS	No facility	HP	Phone	No Service	PR	EA
Ladwara	PS	No facility	W,TW,HP	Phone	No Service	KR	EA
Nagda	PS	No facility	T,W,TK,TW,R	Phone	No Service	KR	EA
Nagda	PS, MS	PMSuC	W,TW,HP	Phone	Bus	PR	EA
Bhojya Kheri	PS, MS	No facility	W,TW,HP	Phone	No Service	KR	EA
Bhojya Kheri	PS	No facility	T,W,TK,TW,R	Phone	Bus	KR	EA
Dugari	PS, MS	PMSuC	W,TW,HP	Phone	No Service	PR	EA
Theekariya	PS, MS	PMSuC	W,TW,HP	Phone	No Service	PR	EA
Palaytha	PS	No facility	W,TW,HP	PO	Bus	PR	EA
Gopalpura	PS	No facility	T,W,TK,TW,R	Phone	No Service	KR	EA
Gulab Pura	No facility	No facility	W,TW,HP	Phone	No Service	KR	EA
Amalsara	PS	No facility	T,W,TK,TW,R	Phone	No Service	PR	EA
Bamoolya Mataji	PS	No facility	W,TW,HP	Phone	No Service	PR	EA
Antah (M)	PS,MS	PMSuC	T,W,TK,TW,R	PO, Phone	Bus	PR	EA

Note:

PS= Primary School, MS= Medium School, PMSuC= Primary Medical Sub Centre, PHC= Primary Health Centre, HP= Hand pumpT= Tube Well, W= Well, TK= Tank water, R= River water, PO= Post office, KR= Kaccha Road,PR= Paved Road,EA= Electrical Supply,NEA= No Electrical Supply

3.12.2. Amenities

273. **Education:** Out of 72 villages, 41 villages have primary schools, 23 villages also have middle schools while 8 villages do not have any schooling facilities. People have to go to outside for higher education.

274. **Medical:** Out of 72 villages, 56 villages have no government medical facilities. Rest 16 villages have primary health centre or some other medical facilities. People have to travel distances for getting medical facilities.

275. **Drinking Water:** All villages have some type of drinking water facilities.

276. **Communication:** Only six villages have post offices. Nearly all villages have phone facility (either land line or mobile).

277. **Transportation:** Bus service is available to sixteen villages only. Only thirty four villages have got pucca road facility. People in other villages have to travel distances for getting bus or train. (Many village have got communication and transport facilities since then)

278. **Power Supply:** Only one village Bhauran do not have electricity. (now power supply has come to the village) Rest all have power supply.

3.12.3. Socio-Economic Survey

279. To visualize the scenario with the project and its impacts on the environment a socio-economic survey was conducted on limited scale (9 villages) with the help of pre-designed set of questionnaire (**Table 3.17**). The villages involved in the survey were Bambori, Darbiji, Kherli Mathadi, Bamoliya Mataji, Dugari, Ruggi, Bhojakhedi, Gadepan and Tikriya. Key observations from the survey were:

- Awareness about the CFCL among villagers is about 90%.They find the factory good in the sense as it gives benefits and employment (directly or indirectly) to villagers.
- All the villagers have irrigation facilities through canal or ponds or tube wells.
- All the villages have telephones or mobile phones.
- TV and transistor are easily observed in villages.
- Most of the respondents from all the villages surveyed regarded CFCL as a project that has brought improvement in over all conditions of the villagers by increase in business opportunities, educational, health and transport facilities. They need some sanitation improvement.
- As for environmental impact, none of the villages close to the factory complained of noise and ammonia smell in the air. Further they did not find any adverse effect on the agriculture activity.

Table 3.17 : Social Survey conducted in some of the nearby villages of the study area.

Social Survey

Name of the Village:	Danhori	Dallbhpura	Khan Ki jhopdi	Dhoja Khedi	Dugari	Tikaria
Distance from project site	8 km	3 km	7 km	24 km	12 km	12 km
Direction from project site						
Population:	6000	500	1000	4000	1000	800
No. of Families:	1000	100	150	300	150	125
Power Supply (for Agriculture):	Yes	Yes	Yes	Yes	Yes	Yes
No. of Houses with Electicity:	900	95	140	250	140	120
Time (Power Supply)	10	10	10	10	10	10
Education:						
Male-						
Engineers / Doc.	---	---	2	---	---	---
PG	60		2	10	4	4
Graduate	70	2	5	25	8	6
Female-						
Engineers / Doc.	--	--	--	--	--	--
PG	10	--	1	--	--	2
Graduate	10	--	2	6	2	3
Occupation:				10		
Agriculture (Land owner)	950	90	130	200	100	110
Business	25	5	4	10	2	4
Employed	20	2	1	3	1	2
Labour	150	40	25	45	50	60
School / College:						
Primary	Yes	Yes	Yes			
Middle	Yes	Yes	Yes		Yes	Yes
High School	Yes	No	No	Yes		
College (Nearest distance)	35	36	27	35	45	40
Communication:						
Post Office (Nearest distance)	0	3 km	7 km	0	3 km	7 km
Railway Station (Nearest distance)	15 km	15km	15 km	10 km	5 km	4 km
No. of Telephones	20%	20%	20%	20%	20%	20%
Mobiles	80%	80%	80%	80%	80%	80%
Crops:						

Rabi	Gehu, chana, matar, Sarson,Soyabeen, Urd, Rice,	Gehu, chana, matar, Sarson,Soyabeen, Urd, Rice,	Gehu, chana, matar, Sarson,Soyabeen, Urd, Rice,	Gehu, chana, matar, Sarson,Soyabeen, Urd, Rice,	Gehu, chana, matar, Sarson,Soyabeen, Urd, Rice,	Gehu, chana, matar, Sarson,Soyabeen, Urd, Rice,
Kharif						
Zayad						
Houses:						
Kachcha	400	40	50	70	30	25
Pacca	600	60	110	230	120	100
Toilets	400	50	80	160	80	50
Irrigation:						
Well	Yes	Yes	Yes	Yes	Yes	Yes
Canal	Yes	Yes	Yes	Yes	No	No
Pond	No	No	No	No	No	No
Source of Drikning water	GW	GW	GW	GW	GW	GW
Approach Road:						
Kachcha					Kachcha	Kachcha
Pacca	Pacca	Pacca	Pacca	Pacca		
Nearest Bus Stop	**5 km**	**3 km**	**7 km**	**10 km**	**5 km**	**4 km**
Entertainment:						
Nos of TV in Village	50%	50%	50%	50%	50%	50%
Nos of Radio in Village	10%	10%	10%	10%	10%	10%
Nos of Transistor in Village	30%	30%	30%	30%	30%	30%
Health Centre (Govt)						
Nearest Hospital (distance)	15 km	3 km	5 km	10 km	5 km	4 km
Main Religious Festivals:	Dipawali, Holi, Dashara	Dipawali, Holi, Dashara	Dipawali, Holi, Dashara	Dipawali, Holi, Dashara	Dipawali, Holi, Dashara	Dipawali, Holi, Dashara
Average Family Income:						
Nos of family below poverty lines	Rs. 500/- pm					
Nos of families Income	Rs. 10000/- pm					
General Outlook of Village:						

4. IMPACTS ASSESSMENT AND PREDICTION

4.1. General

280. The possible impact on various components of environment due to the proposed expansion of existing CFCL plant can be assessed in terms of:

- Physical and Biological Environment and
- Demographic and Socio-economic Environment.

281. For proper assessment of significance and magnitude of environmental changes due to construction and operational phases of the plant, the impacts are analyzed on the 10 km radius study area divided in the two zones {Core Zone and Outer Zone} around the proposed plant site for each environmental parameter. Impact assessment study for the existing CFCL unit is carried out by predicting net contribution of pollutants (qualitative as well as quantitative) on overall qualitative assessment of various environmental indicators. Prediction of impacts is an important component in environmental impact assessment process. Several techniques and methodologies are in vogue for predicting the impacts due to existing and proposed industrial development on physico-ecological and socio-economic components of environment. Such predictions delineate contribution in existing baseline data for the operational project and superimpose over the baseline (pre-project) status of environmental quality to derive the ultimate (post-project) scenario of the environmental conditions due to the proposed project. The quantitative prediction of impacts lead to delineation of suitable environmental management plan needed for implementation during the construction, commissioning and operational phases of the proposed project in order to mitigate the adverse impacts on environmental quality.

282. Mathematical models are the best tools to quantitatively describe the cause-effect relationship between source of pollution and different components of environment

4.2. Air Environment

283. Prediction of impacts of the proposed expansion on air environment i.e. ambient air quality was carried out using computer based air quality simulation model known as 'Industrial Source Complex Short Term' (**ISCST3**).

284. In the present study, the mathematical model that has been used for predictions on air quality includes steady state Gaussian Plume Dispersion model designed for multiple point sources.

285. The impacts on air quality from any project depend on various factors like design capacity, configuration, process technology, raw material, fuel to be used, air pollution control measures, operation and maintenance. Apart from the above, other activities associated with any project, viz., construction phase (fugitive emission), Operation phase: transportation of raw materials and finished products, storage facilities and material handling within the plant premises may also contribute to air pollution.

286. The major air pollutants expected to be emitted from CFCL proposed expansion project are Nitrogen oxides (NO_X), Suspended particulate matters (SPM) and ammonia. The major sources of emission are Prilling Tower, HRSG

Stack and Ammonia Reformer Stack. Pollutants released are NO_X, NH_3, and particulate matters. **Table – 2.5 and Table – 2.6** shows the point source (stack) emission characteristics for the proposed expansion Project.

4.2.1. Micro-Meteorology

287. The hourly wind speed, solar insulation and total cloudiness during day time and wind speed and total cloudiness during night time were used to determine the hourly atmospheric stability classes (defined by Pasquill and Gifford as A to F, A being most unstable and F being most stable). The hourly stability classes were determined based on the technique suggested by Turner.

288. Turner's system used for determining the stability classes is as follows:

- For day or night: If total cloud cover (TC) = 10/10 and ceiling <7000 ft (2134 m), NR=0
- For night-time (defined as period from one hour before sunset to one hour after sunrise):

a) If TC<4/10, use NR = -2
b) If TC>4/10, use NR = -1

- For daytime: Determine insolation class number (IN)

a) If TC<5/10, use NR=IN
b) If TC>5/10, modify IN by the sum of the following applicable criteria

If ceiling<7000 ft (2134m), modification = -2
If ceiling>7000 ft but <16000 ft (4877 m), modification = -1
If TC=10/10 and ceiling>7000 ft, modification = -1, and let modified value of IN=NR, except for day-time NR cannot be <+1

289. During the study period stability calculated based on above mentioned Turner method gives average stability as F class during night, C & D class during morning and evening and A & B class during noon.

4.2.2. Air Quality Modelling and Predictions using the ISCST - 3 Model

290. The impact on air quality due to emissions from single source or group of sources is evaluated by use of mathematical models. When air pollutants are emitted into the atmosphere, they are immediately diffused into surrounding atmosphere, transported and diluted due to winds. The air quality models are designed to simulate these processes mathematically and to relate emissions of primary pollutants to the resulting downwind air quality. The inputs include emissions, meteorology and surrounding topographic details to predict the impacts of conservative pollutants.

291. The impacts of air pollutants were predicted using **Industrial Source Complex – Short Term (ISCST Version 3)** air quality model, which is selected on the basis of existence of multiple point sources within the industrial complex as well as the plain terrain at the project site.

292. The **Industrial Source Complex – Short Term Version 3 (ISCST-3)** model has been developed to simulate the effect of emissions from point sources on air quality. The **ISCST-3** model was adopted from the USEPA guideline models and routinely used as a regulatory model to simulate plume dispersion and transport from up to 100 point sources and 10000 receptors. **ISCST–3** is the state of the art model with USEPA and extensively used for predicting the Ground Level Concentrations (GLCs) of conservative pollutants from point, area and volume sources. The impacts of primary air pollutants are predicted using this air quality model keeping in view the plain terrain at the project site.

The micrometeorological data monitored at project site during study period have been used in this model.

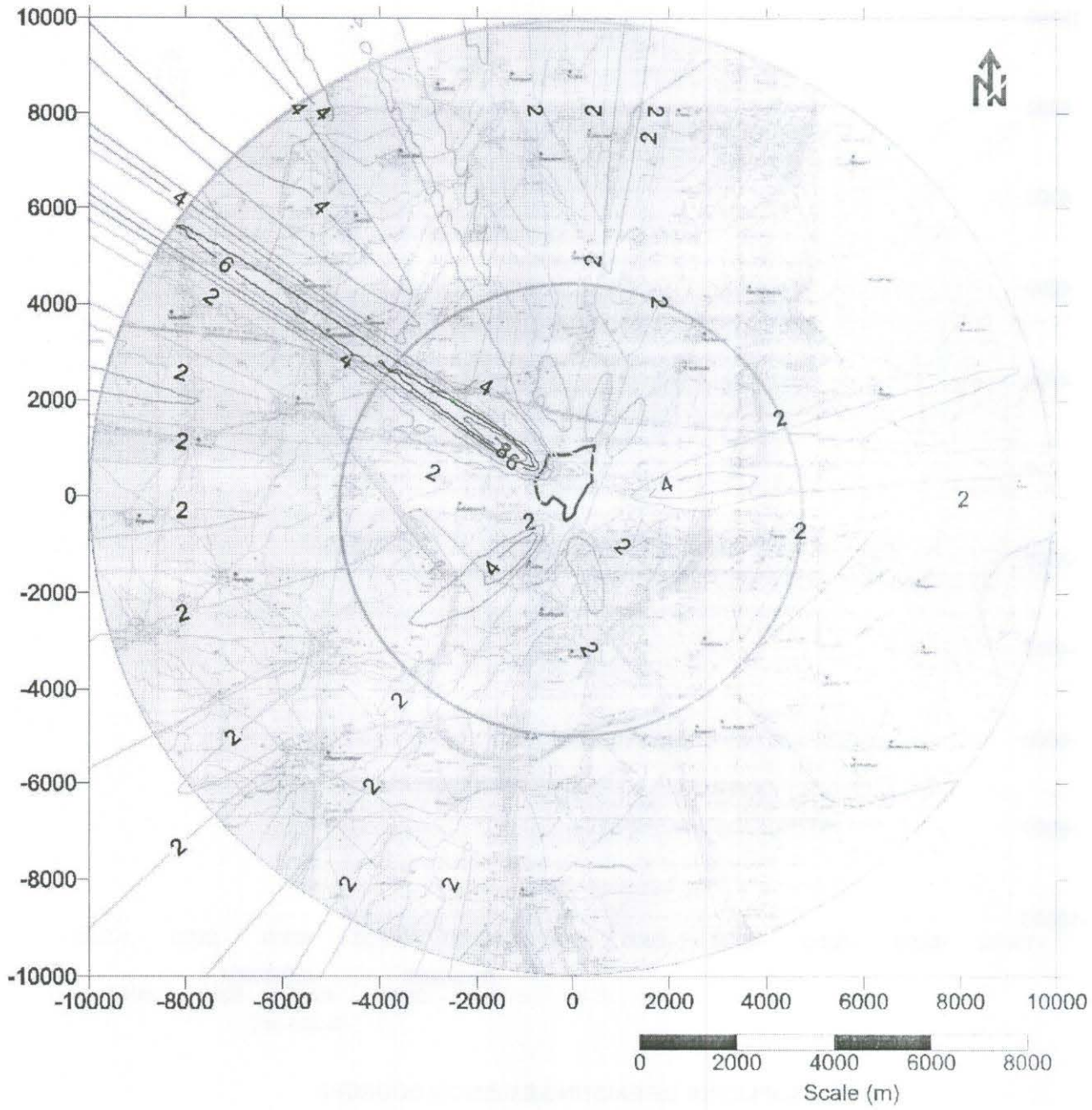
293. The **ISCST-3** model provides estimates of pollutant concentrations at various receptor locations. It is, an hour-by-hour steady state Gaussian model which takes into account the following:

- Terrain adjustments
- Stack-tip downwash
- Gradual plume rise
- Buoyancy-induced dispersion, and
- Complex terrain treatment and consideration of partial reflection
- Plume reflection off elevated terrain
- Building down wash
- Partial penetration of elevated inversions is accounted for hourly source emission rates, exits velocity, and stack gas temperature

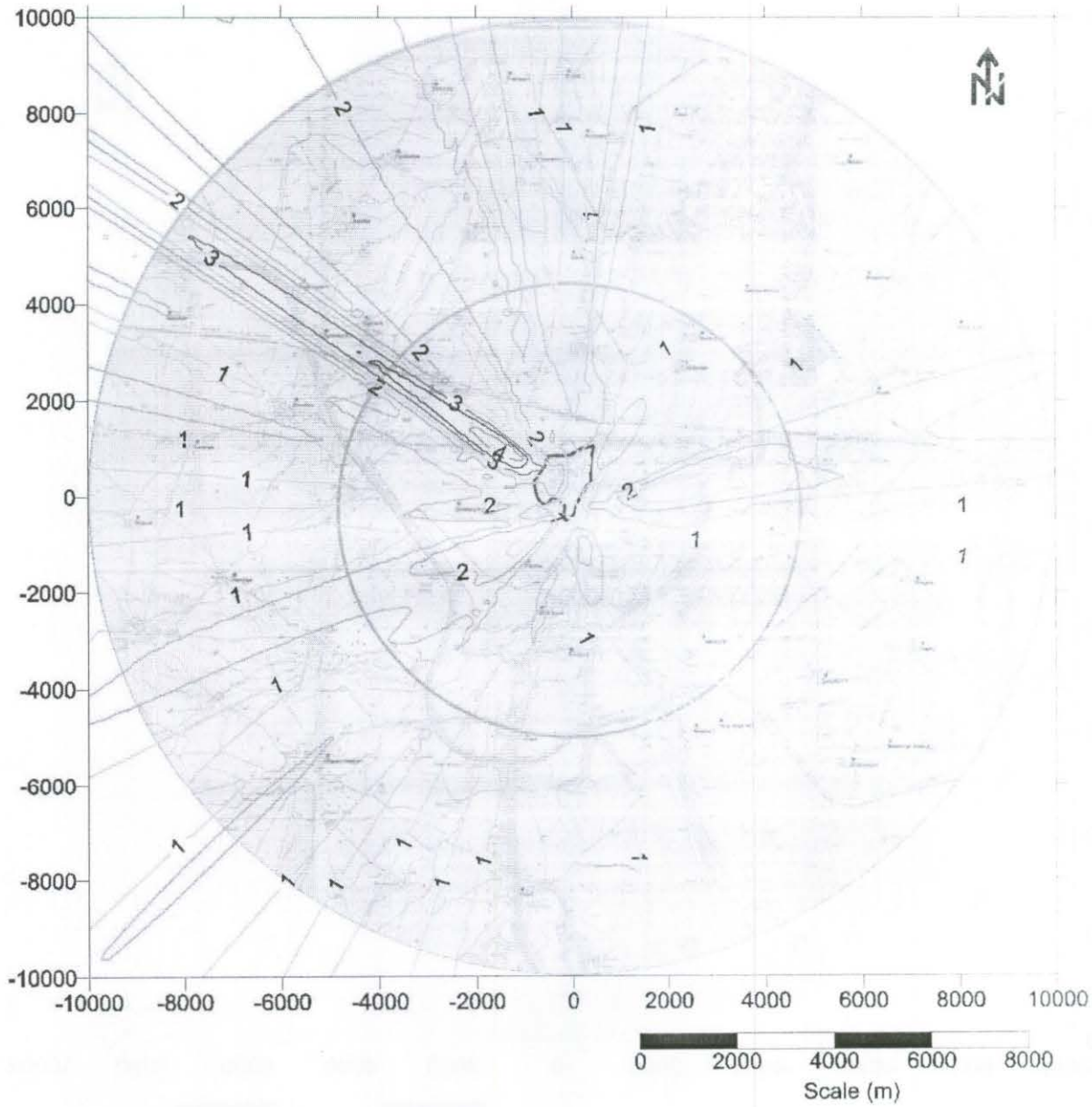
294. In the present case, prediction of impacts has been carried out for the winter season on 24-hourly basis in the entire study area of 10 km radius using the mentioned **ISCST–3** model.

4.2.3. Predicted GLC due to CFCL Expansion Project

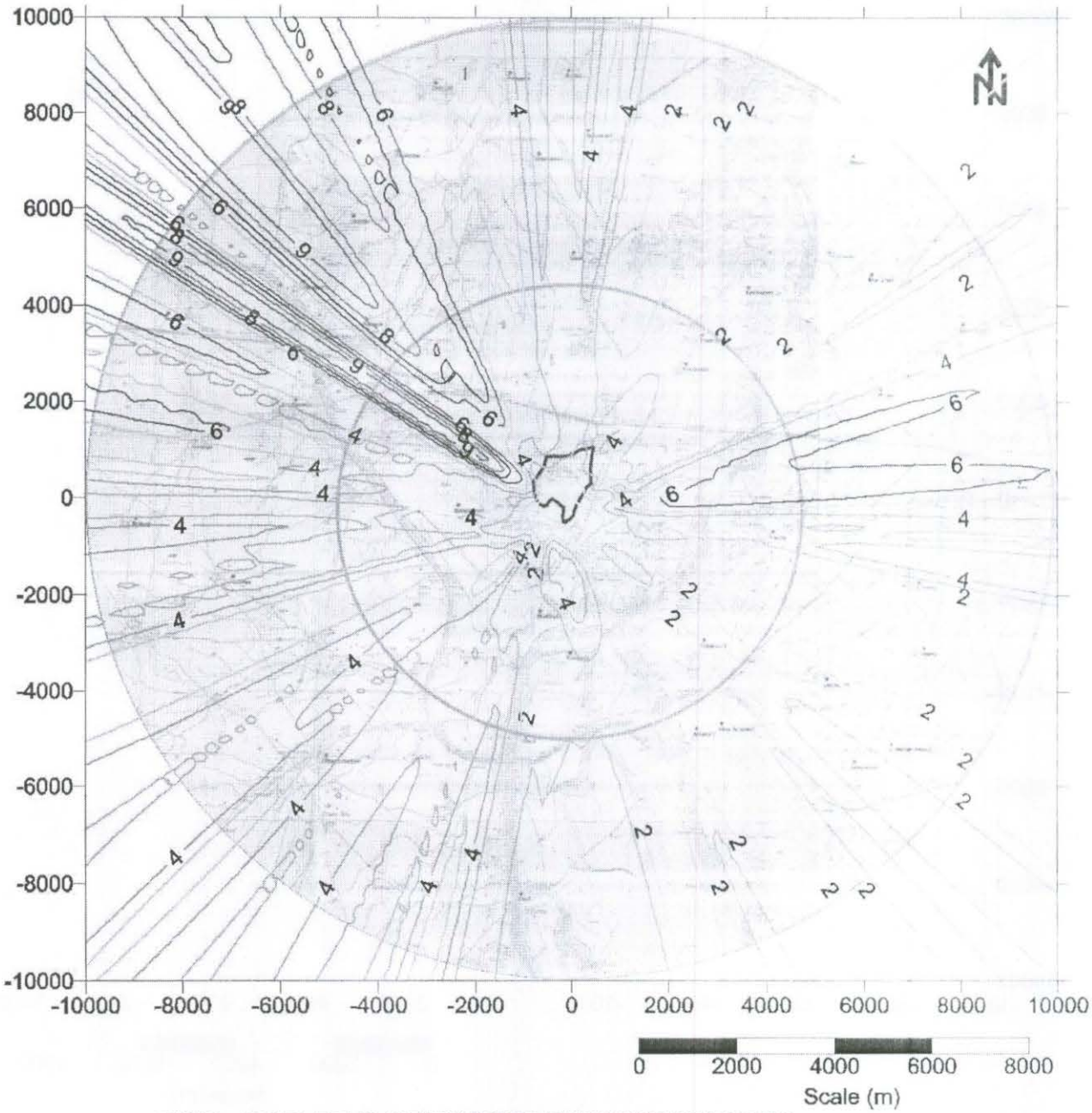
295. The contribution to GLCs for the pollutants i.e. NOx, SPM and NH_3 were predicted over the study area both due to existing plants (Gadepan I and Gadepan II) and also due to proposed expansion project considering the worst scenario. The emission load from existing plant (Gadepan I and Gadepan II) and also from proposed expansion project are given in **Table-2.7**.The prediction (maximum) is based on the expected total emission rate from each stack (existing scenario and after the CFCL plant expansion) and are given in isopleths **Figure-4.1 (A,B,C)** for existing units and **Figure-4.2 (A,B,C)** for proposed expansion project. The additional contribution to GLC is also given below in **Table - 4.1 and Table-4.2**:



(A) SPM ISOPLETHS OF EXISTING EMISSION SOURCES



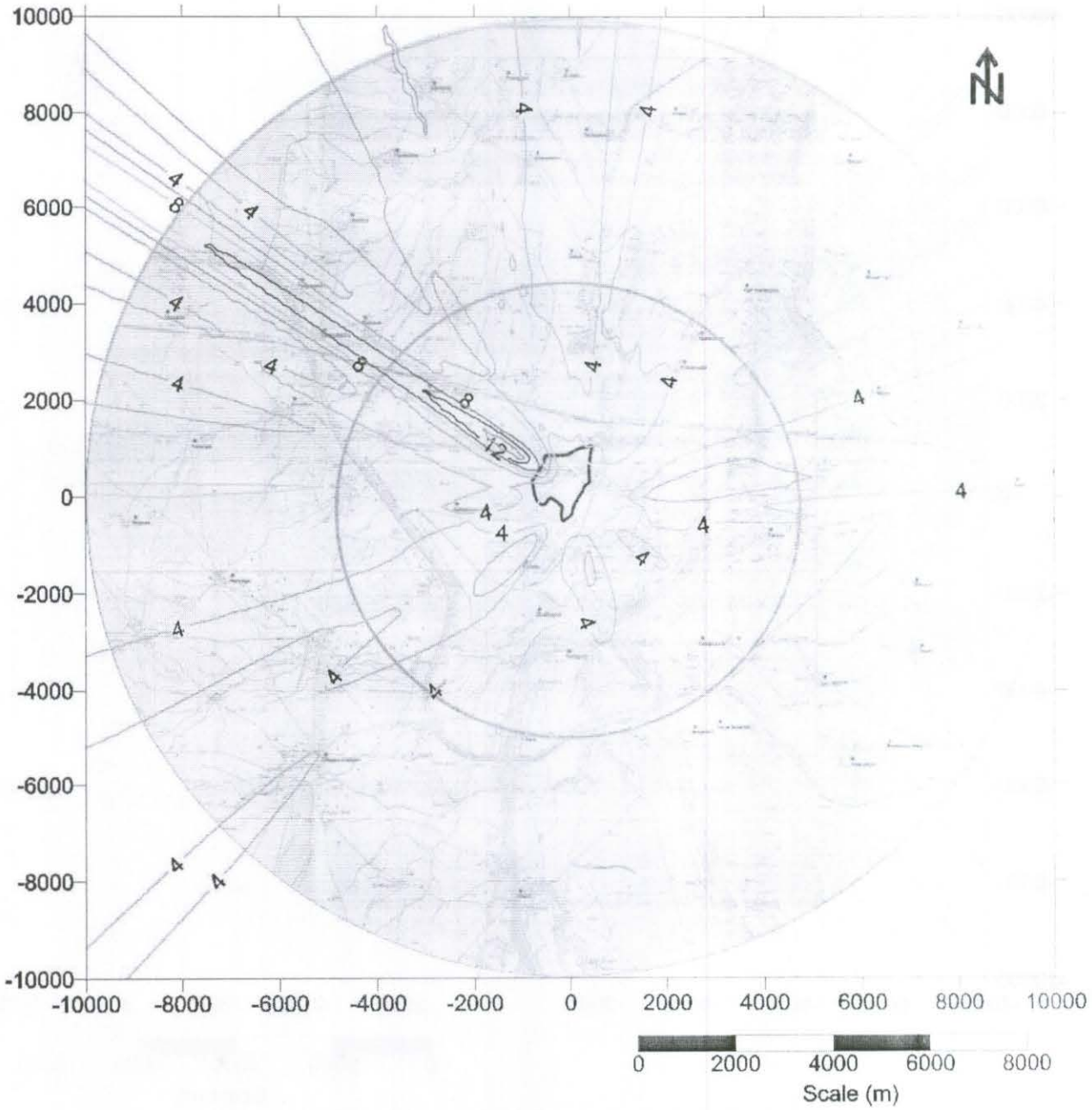
(B) NH_3 ISOPLETHS OF EXISTING EMISSION SOURCES



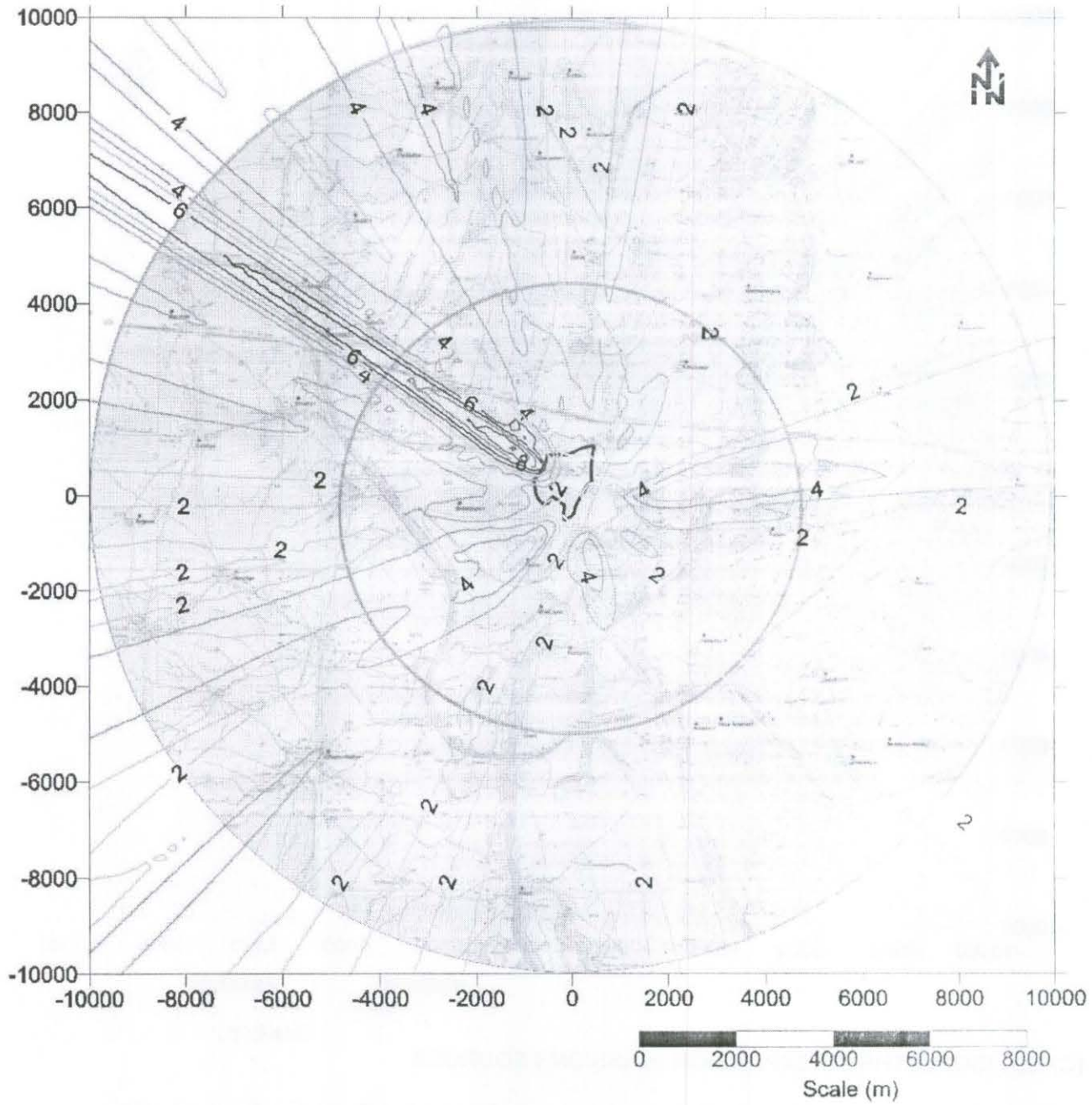
(C)NO_X ISOPLETHS OF EXISTING EMISSION SOURCES

Figure 4.1 : Isopleths (Contribution to GLC from Existing Emission Sources)

[(A-SPM),(B-NH3),(C-NO_X)]



(A) SPM ISOPLETHS OF EXPANSION EMISSIONS SOURCES



(B) NH_3 ISOPLETHS OF EXPANSION EMISSIONS SOURCES