

Assessing and mitigating health risks from puffed rice cluster – A case study of Davangere, Karnataka

Preliminary Activities and results
Pilot study



CONTENTS

- Clearance w.r.t Ethical issues
- Sampling of the pilot
- Social Diagnosis
 - Social Diagnosis Process
 - Tools used
 - Details of study area
 - Determinants of health – Results under each
 - Cost Benefit Analysis of puffed rice activity
- Environmental Diagnosis
 - Methodology
 - Results (Particulate conc.& exposures for HH's and Unit)
 - Limitations of pilot study
- Epidemiological Diagnosis
 - Methodology
 - Health status of community and workers
 - Health status of households
 - Health Status of unit workers
 - Health Status- Health Camps
 - Interlinkages - Chi square tests
 - Comparisons

CLEARANCE w.r.t ETHICAL ISSUES

Clearance with respect to ethical issues

- As per the ICMR guidelines, participating institute should submit application along with a clearance letter from Institutional review board (IRB)
- Generally minimum of 6 months-1year is taken to get the ICMR clearance
- Pilot study was started after getting IRB clearance

Research Ethics followed

- Presented study methodology to Institutional Review Board (IRB) and started the work after getting clearance from the IRB
- Eligible respondents were included after they agreed to the consent statement (Formal informed consent were taken from the participants).
- Voluntary participation
- Treatment of participant with respect to privacy
- confidentiality
(details in next slide)

Confidentiality

- In order to insure strict confidentiality, all data that were collected don't contain individual identifiers.
- Confidentiality of all records to be strictly maintained at TERI.
- Restricted access to data files and keeping hardcopy in locked files at TERI.

TERI ethical committee members

Name	Background	Position
Dr. A. Noronha Ferreira	Dist Judge (Retd)	Member
Dr. Francisco Couto	Associate Professor, Dept of Pathology	Member
Mr. Averthanus D'Souza	President, Goa Environment Federation	President
Dr. Udhay C Kakodkar	Doctor	Member
Dr. Sanjyot Pai Vernekar	Lecturer, Dept of Philosophy	Member
Ms. Anuradha Joshi	Social President, Society for Youth Development	Member
Dr. Asha V Savordekar		Secretary
Dr. Sangeeta Sonak	TERI	

PILOT SAMPLING

Sampling for the Pilot study

Pilot Sampling objectives

- Gather Socio-economic-health information through surveys
- To conduct Air pollution monitoring
- To assess health status

Sampling units: Households

Puffed rice Units

- 41 Households are selected on judgmental basis around the puffed rice cluster
- 10 Puffed rice units were selected on the basis of geographical location in the cluster

Data Collection: Household level

- Household common information Survey
- Household specific each individuals' survey – 278 nos
- Time Budget survey
- Detailed clinical history with special emphasis on respiratory symptoms
- General and systemic examination
- Pulmonary function tests
- Air Pollution monitoring PM_{10} , $PM_{2.5}$, CO at Kitchen, living room and ambient microenvironments

Data Collection: Puffed rice unit level

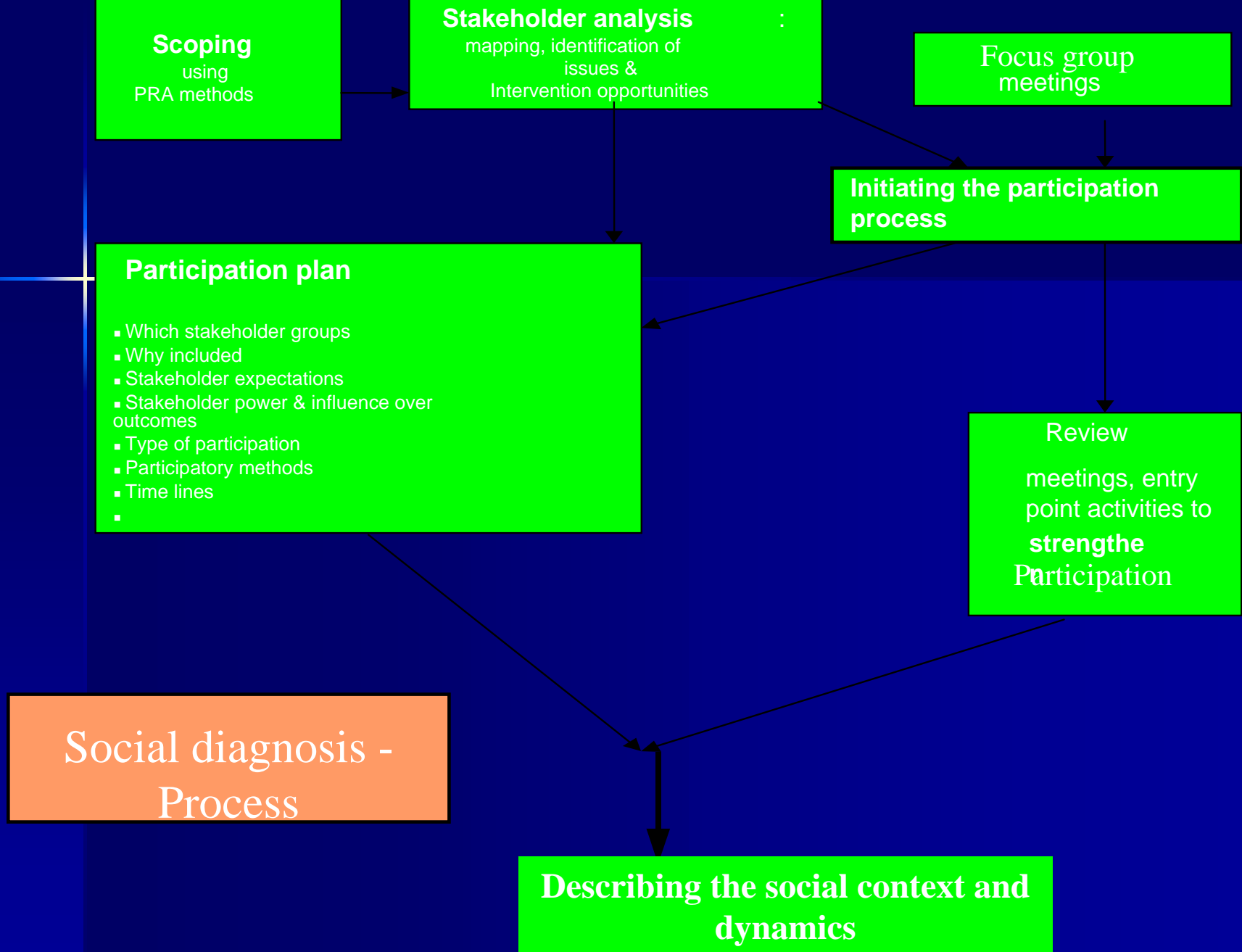
- Each workers' survey – 40 nos
- Time Budget survey
- Detailed clinical history with special emphasis on respiratory symptoms
- General and systemic examination
- Pulmonary function tests
- Air Pollution monitoring PM10, PM2.5, CO at Indoor and ambient microenvironments

SOCIAL DIAGNOSIS

Social Diagnosis

Objective of the component

To assess the social, economic, governance issues with gender prospective towards the health and well being of the puffed rice community using ecosystem approach.



Profile of study area and Davenagere town

	Study Area (Ward No. 18 and 19)	Davangere Town
Total No. of households	3200	71437
Total population	26396	364523
Male Literacy	48	84
Female Literacy	41	72
Sex Ratio	955 females/1000 males	939
% of main workers	34.82	31.41

Source: Davenagere District Census Handbook 2001

Literacy levels in the study area

Literacy	% literates
6-10 yrs	97
11-15 yrs	94
15-20	88
21-30	47
30-60	45
Above 60	50

100% of illiterates from 11-15 years are males

60% of illiterates from 15-20 are males

59% of illiterates in the age group of 21-30 are females

53% of illiterates in the age group of 31-60 are females

Source: Household Survey

Social Diagnosis

Identified 7 enquiry areas which are the socio-economic determinants of health :

1. Environment
2. Social Dimensions of Health
3. Economic
4. Access and control of basic requirements
5. Social Cohesion
6. Distribution of power
7. Regulatory framework/ Environmental Monitoring

1. Environment

1. Air

- 83% of surveyed households have reported high levels of pollution (smoke) from puffed rice sector
 - 69% sought help - Majority (50%) have approached municipality followed by ward councillor (35%)
- Air pollution a main issue of concern to the community
 - Minimum knowledge on the impacts of the air pollution
 - No monitoring stations for monitoring air quality
 - Higher incidence of respiratory problems in the study area

2. Water

- 70% surveyed households report shortage of water for domestic purpose
- public taps available + few private taps, water supply is very poor
- lack of awareness on water quality

2. Social dimensions of health

(Men, Women and children's health)

Health Matrix of the study area

	Cold/ Cough	Fever	Body ache/ joint pains	Diarrhoe a	Skin Problems	Eye Problems	Respiratory problems
Most Frequent during	Rains	Rains	All season	Rainy season	Winter/ Summer	All seasons	Summer/ Winter
Incidence in the study area	Very High	High	High	High	Moderate	Low	moderate
Age of infected	All/ Majority children	All age	Older population After 25 years	Mainly children	All age	Older population after 40 yrs	Older population (above 40)
Impact on work	Nil	2- 3 working days	Does not effect work but later on cannot take up hard work	Nil	Nil	Nil	Cannot work if severe
Cause	1. Rains, 2.Unhygienic conditions, 3.Bad water	Rains/Viral	Heavy work	Bad quality of water, Lack of sanitation facilities, Unhygienic conditions in the study area	Don't know	Don't know	Air pollution
Treatment sought	Private Doctors	Private Doctor	Take medicines from pharmacy/Private doctors	Private Doctors	Private Doctor	No treatment	Private Doctors

2. Social dimensions of health

Community: Percentage of respondents reporting illness

	Total	Males	Females
Reporting illness	96	99	92
Respiratory	71	75	66
Cardio Vascular	24	28	19
Eye related	63	67	59
Ears	24	25	24
Nasal	77	78	75
Throat	26	28	24
Skin irritation	36	40	33
Gastrointestinal	37	40	33
Musculoskeletal	36	35	38

2. Social dimensions of health

Reported health Problems in Community

- Majority (42%) of those reporting respiratory illness reported allergy to dust
- 43% reporting illness related to eyes have redness followed by watery eyes and blurred vision
- Among those reporting nasal problems majority (74%) reported cold
- 37% with skin problems reported rashes

2. Social dimensions of health

Workers: No of Surveyed reporting illness

	Total	Males	Females
Reporting illness	40 (100%)	39	1
Respiratory	38	37	1
Cardio Vascular	4	3	1
Eye related	12	11	1
Ears	1	1	
Nasal	35	34	1
Throat	2	1	1
Skin irritation	9	9	
Gastrointestinal	8	8	
Musculoskeletal	28	27	1

2. Social dimensions of health

Workers reporting health problems

- Most (62%) workers interviewed are 30 years and below, 29% are in the age group of 31-40
- 70% of those reporting respiratory illness reported allergy to dust
- 83 % reporting illness related to eyes have redness followed by watery eyes (50%)
- 94% of those reporting nasal problems have reported cold
- Among the 71% reporting musculoskeletal problems, 93% have back pain and 73% have joint pains

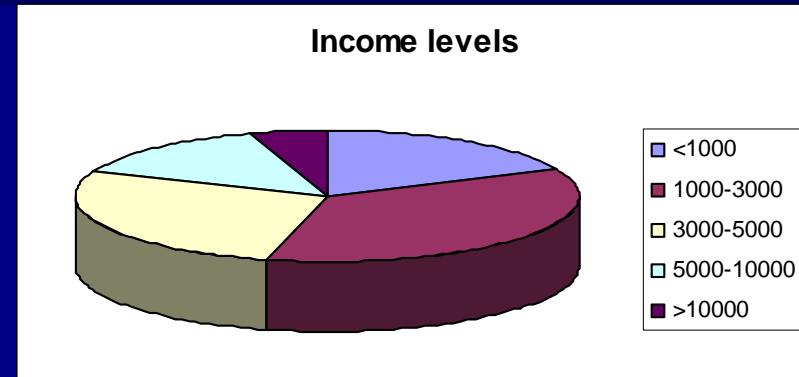
3. Economic

Income

Majority of the families fall in the income category of 1000-3000/month

BPL - 22% of surveyed households earn less than 17000 annual income_ (Families living in urban areas in Karnataka with less than Rs. 17000 annual income are considered below poverty line)

Families earning less than 1\$/day – 20%
Families earning less than 2\$/day- 49%



3. Economic

Expenditure

- Minimum Rs. 2500/month/ household of 5-6 members
 - Rs.1800/month only on food
 - Rs. 100/month fuel wood
 - Rs. 200/month rent + Rs100/month electricity
 - Rs. 200/month medical expense
 - Rs. 100 miscellaneous expense
- Minimum of Rs. 2000/ family spent to celebrate festivals
- Expenses are high on weddings and other celebrations

3. Economic

Diet pattern

Foodtype	Frequency of Consumption
Rice/ Jowar/Wheat/Ragi	Daily
Dal	Daily
Meat	Weekly
Fish	Once a month
Eggs	Once a week
Vegetables	Once a week

3. Economic

Ownership pattern

- Almost 50% do not own a house
- No ownership of land
- No savings

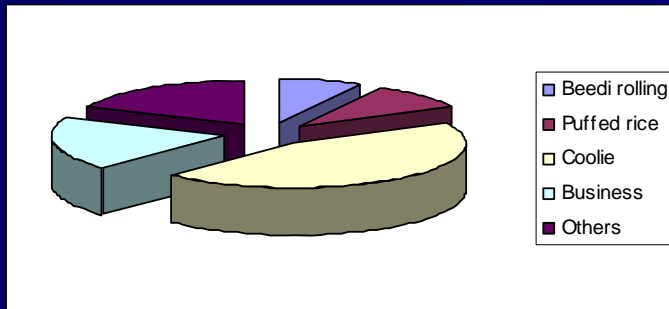
Access to credit

- Almost all households dependent on credit
- Borrow and spend for weddings, festivals and during crisis
- High dependence on money lenders and owners of puffed rice
 - units for credit

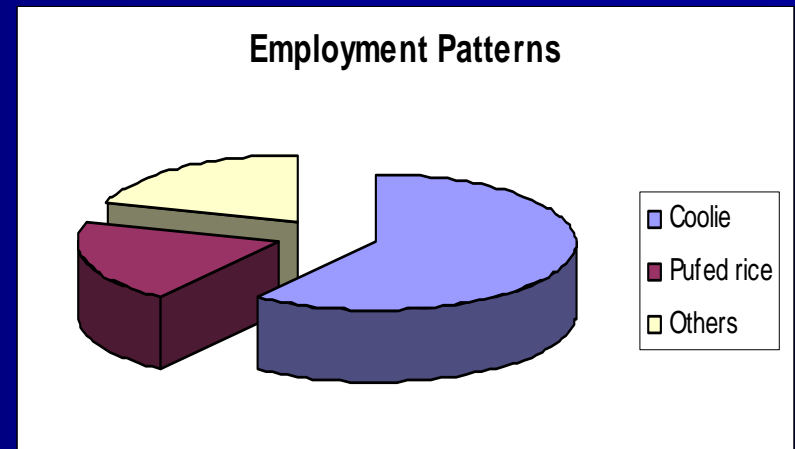
3. Economic

Patterns of employment

- 59% of the total surveyed population are workers
- 83% of male population working
- 29% of females population working



Household survey



FGD Result

3.Economic

Occupational structure -Gender wise (%)

	Male	Female	Total
Unemployed	17.5	70.7	41.9
Beedi rolling	0.0	9.8	4.5
Puffed rice	9.3	1.2	5.6
Coolie	37.1	13.4	26.3
Business	17.5	3.7	11.2
Others	18.6	1.2	10.6

Household survey

Wages

- Average wage per day in the study area is Rs.100
- Puffer in the puffed rice sector earns Rs.100-150/day)
- Women workers in the puffed rice sector earns around 50-70/day
- Women in beedi rolling earn Rs. 80/week

Socio-Economic Issues

- Loan bound labour
 - owners offer advance to the workers to attract them to the job
 - advance ranges from Rs. 5000 to Rs. 50000.
- Child labour
 - Girl children work in beedi rolling (one girl child surveyed of total 39, working in beedi rolling)
 - Boys below 14 do all kinds of jobs (4 boys out of 46 surveyed are working)
 - 50 children have been observed to be working in the puffed rice units
 - children earn around Rs.20-40 /day

4. Access and control of basic resources

- Most households live under unhygienic conditions in slums, lacking basic amenities
- Almost all houses are electrified
 - Electricity supply is erratic
- Most of the hamlets have no access to toilets
- Lacks adequate drainage facility resulting in severe water logging during the rains
- Inner roads connecting households are in bad condition
- Reasonably good public transport
- 2 government hospitals in the study area and around 20 private clinics – unsatisfactory facility in govt hospitals

4. Access and control of basic resources

Education

- Primary education is reasonably good in the study area (SA)
 - There are 6 anganwadis and 7 schools in the entire SA
 - There are many Madarasas imparting religious education

▪Water

- 78% depend on public taps only 17% have access to private taps
- 70% of the households suffers from acute water shortage

▪Fuel

- 85% use only firewood, 10% use firewood + Kerosene, 5% use LPG + Firewood

4. Access and control of basic resources

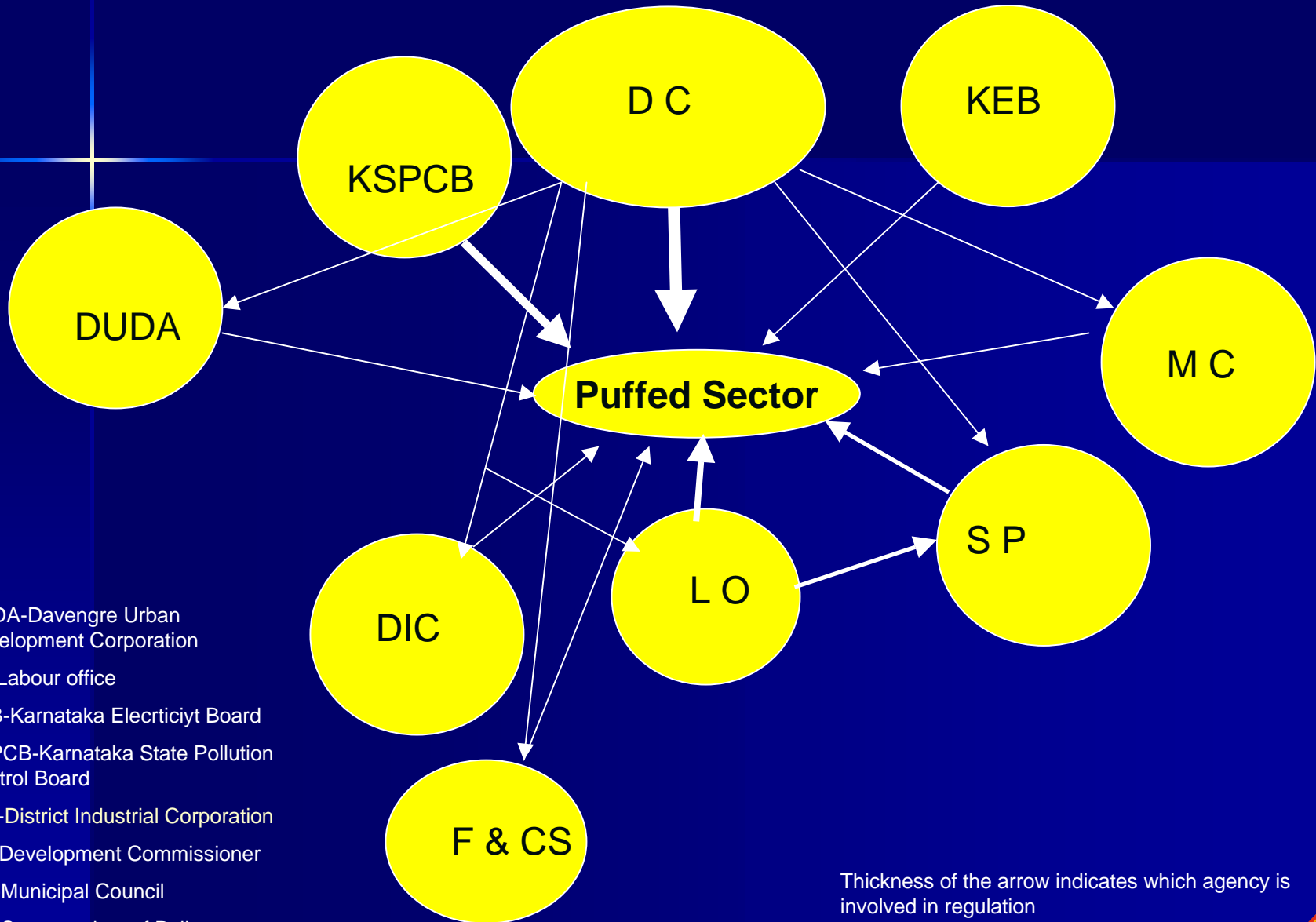
Data	Basha Nagar	Hegde Nagar	Parvathamma Nagar	Mandakki layout	Beedi Layout	Karl Marx Nagar	Devraj Colony	Sidhrameshwar
Total households	1000	300	300-400	180	500	300	200 approx	300-500
Type of toilets	25% out in the bushes. 75% own toilets	No toilets (100% hhs)	90% have own Rest open	Public toilets exists but not used as no water	50% have own toilets. Rest go outside	No toilets	50% private toilets 50% open	No toilets
Water facility	4 public taps. Few private taps in house		More than 15 public taps	Generally Buy water or fetch from other hamlets	Public water supply	Public water supply (Taps are outside)	Public taps. 10% within houses	No water have to go to other wards
Main problems as perceived by the people	1.Bad roads 2.Electricity-irregular supply 3.No proper bus facility 4.Drainage 5.Waste Disposal – all throw in the drainage	1. No drainage	1. Acute water shortage 2.Roads 3.Drainage 4.Electricity-irregular supply	1. Water shortage 2. No schools 3.Bad drainage	1.Pollution from Bhattis 2.Slums – very dirty 3.No Drainage 4.Bad quality of water	1.Drainage, 2.Toilets 3.No water 4.Drainage 5.Roads 6.Drinking water quality is bad	1. No roads 2. Drainage 3. Electricity - irregular supply	1. No. drainage 2. No toilets 3. No water 4. No street lights

5. Social Cohesion

- Majority (80%) of population belong to the Islam religion
- Families are male dominated
- Income of the families is dependent on these male members
- Women support the family in earning additional income
- Majority of the decisions are taken by the head of the households the male members
- household level, all members trust the male members and at the community level the religious leaders or elders/ financially sound people have a good say over matters
- Community leaders such as Maulanas play an important role in the community for influencing social changes.
- Conflict resolution is taken place locally in many places in most cases by local elderly/ financially powerful individuals. In extreme cases legal aid/police intervention is sought.

6 &7 . Distribution of power and Regulatory Framework

Mapping the various regulatory agencies and their interlink ages



- DUDA-Davengre Urban Development Corporation
- LO-Labour office
- KEB-Karnataka Electrcity Board
- KSPCB-Karnataka State Pollution Control Board
- DIC-District Industrial Corporation
- DC-Development Commissioner
- MC-Municipal Council
- SP=Supertendent of Police
- F & CS-Food and civil supplies

Thickness of the arrow indicates which agency is involved in regulation



Stakeholder analysis

STAKEHOLDERS	Importance of Stakeholders *	Stakeholders interest
Internal Stakeholders		
Puffed rice owners association	5	Social issue resolution
Puffed rice owners	5	Improvement of wellbeing of family
Workers	5	Better work condition
Community	4	Better air quality- health, better living
NGOs	4	Social commitment
Local Institutions	4	New social commitment
Community leaders	5	Social enhancement
External stakeholder		
Banks/money lender	3	Enhanced business
Raw material suppliers	2	Regular demand
Fuel Suppliers	2	Regular demand
Regulating stakeholders		
Political leaders	3	Political weight age, social upliftment
SPCB	4	Enhance their monitoring and maintaining std
Labour dept	3	Enhanced regulation
Dept of Health	3	Improved health care delivery systems
DUDA	3	Improve conditions – lessen their burden
Municipality	4	Better control and improved facility
DID	2	Regulating industry
DC	4	Overall improvement – health and wellbeing

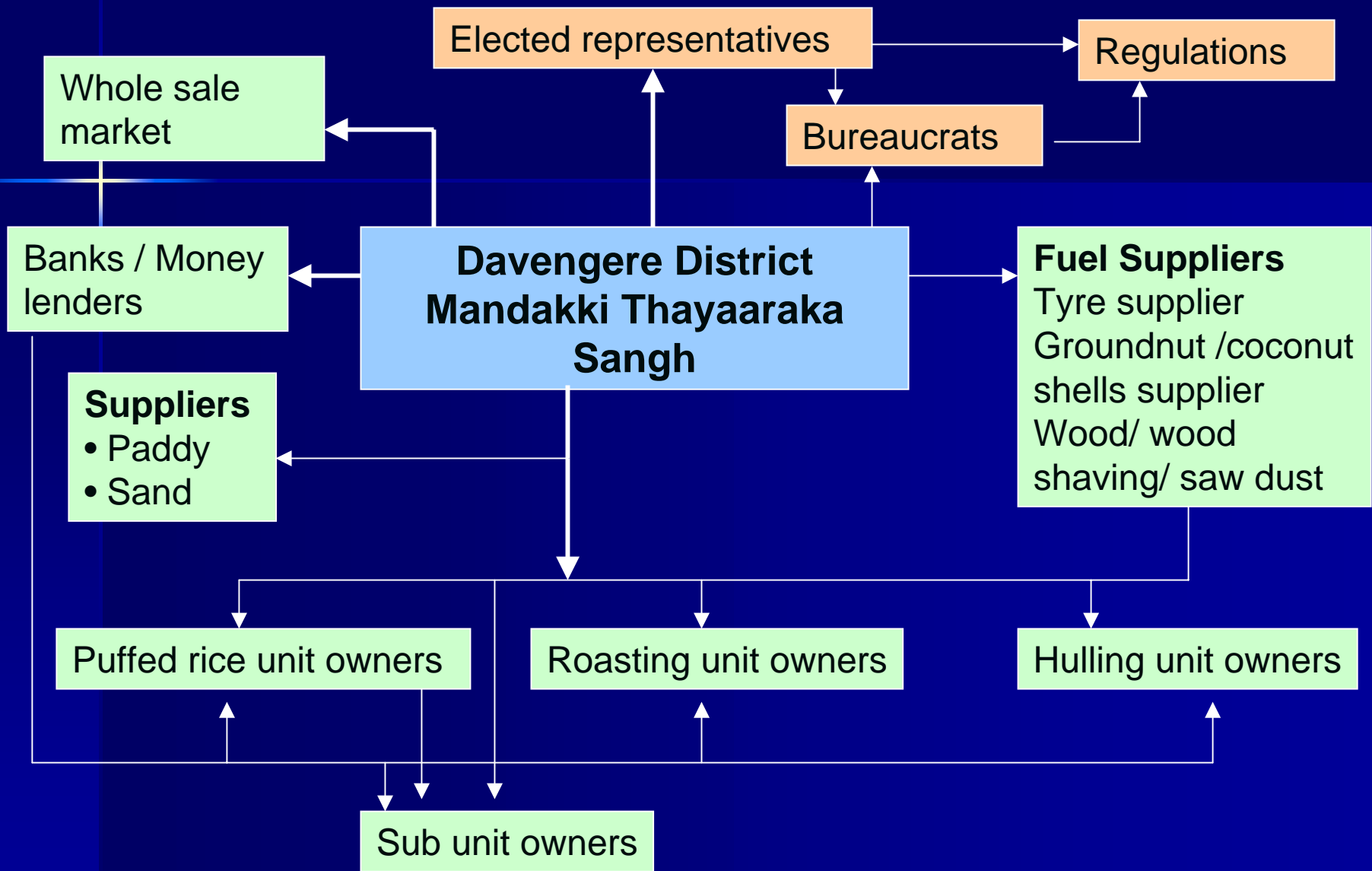
* 5- Most important 1- least important in this project



Distribution of power and Regulatory Framework

1. Absence of a clear policy dedicated to regulate the puffed rice sector: Thus there are too many agencies who can regulate the activity.
2. Agencies that are currently regulating are doing so from their narrow perspective
3. Unclear jurisdiction between with various agencies results in non-enforcement of rules and regulation.
4. Non enforcement of rules is also due to political pressures
5. Some of the constraints to enforcement are political pressures, ambiguity in rules and regulation, lack of manpower and political will.

Power dynamics in the Puffed Rice sector



Thickness of the arrow indicates the level of influence wielded by that association

Distribution of power and Regulatory Framework

- The actors can be broadly classified as regulatory, industry and community related actors.
- The regulatory actors manifest their powers through formal mechanism such as show cause notices, letters, fines etc
- The industry actors often manifest their powers informally through recommendations for loan sanction, granting of soft loans, control of prices over the industry actors itself
- With regard to them manifesting powers informally over regulatory actors is through political pressure and transfers of officials. The industry actors often collude with elected representatives to stall regulation in their favour.

Governing acts/ notification

- DC- Cr.P.C under section 133 of public nuisance- prevention of air pollution
- KSPCB- Environmental protection act - prevention of air pollution
- LO- Child labour (prohibition and regulation) act – to monitor and prevent child labour in this sector
- MC-Municipality act-waste and sewage disposal, supply of water.
- DUDA-(notification to procure) a planning agency which established the mandakki layout on the outskirts of Davangere prompting 80 percent of the units to shift in this area

Licensing agency

DIC which is involved in monitoring other small and medium industries is not involved in monitoring puffed rice units as they don't possess the necessary documents.

MC-registering authority for all trade activity within municipal area. So far only 15 units are registered.

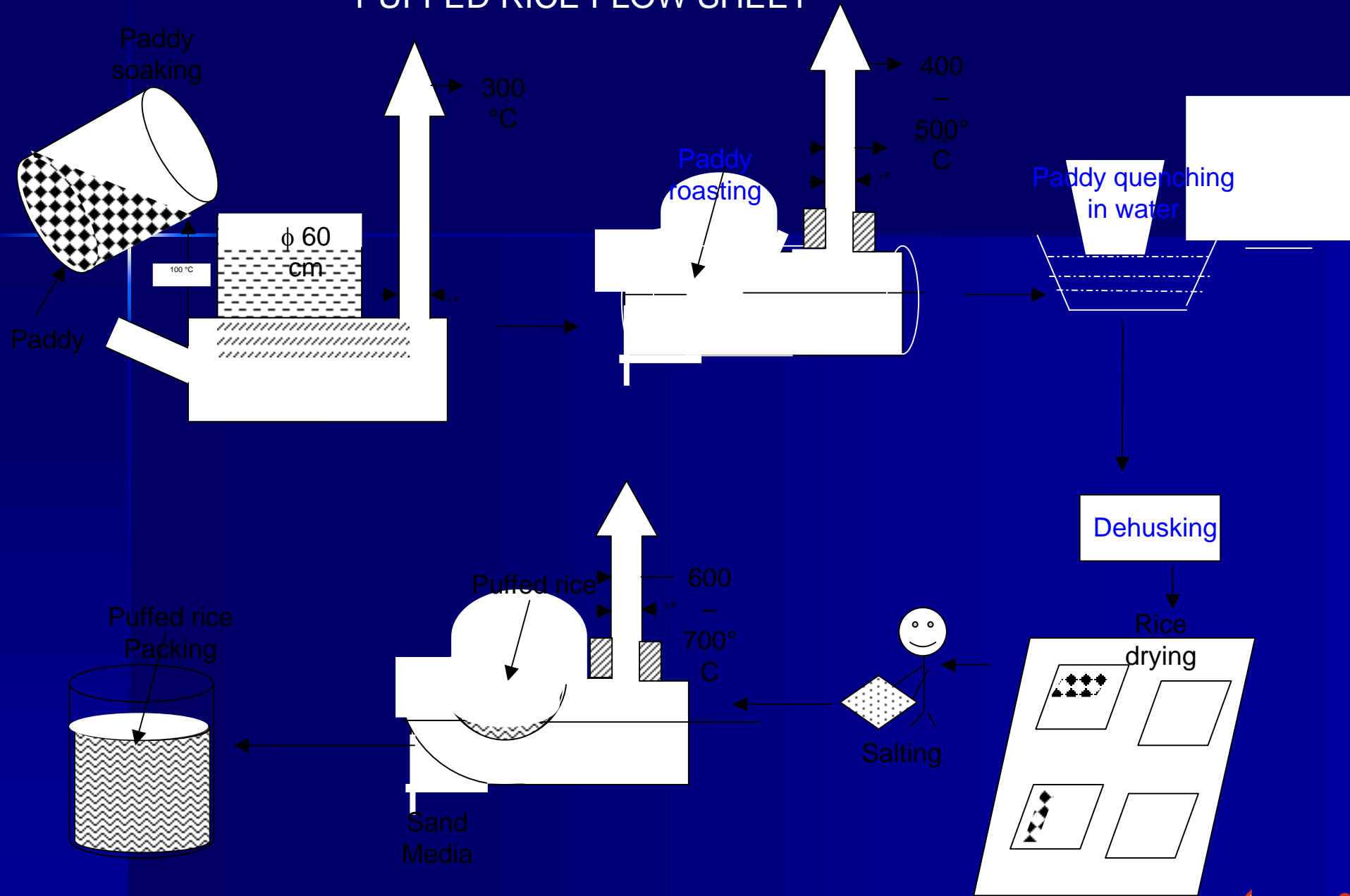
Most units are not registered



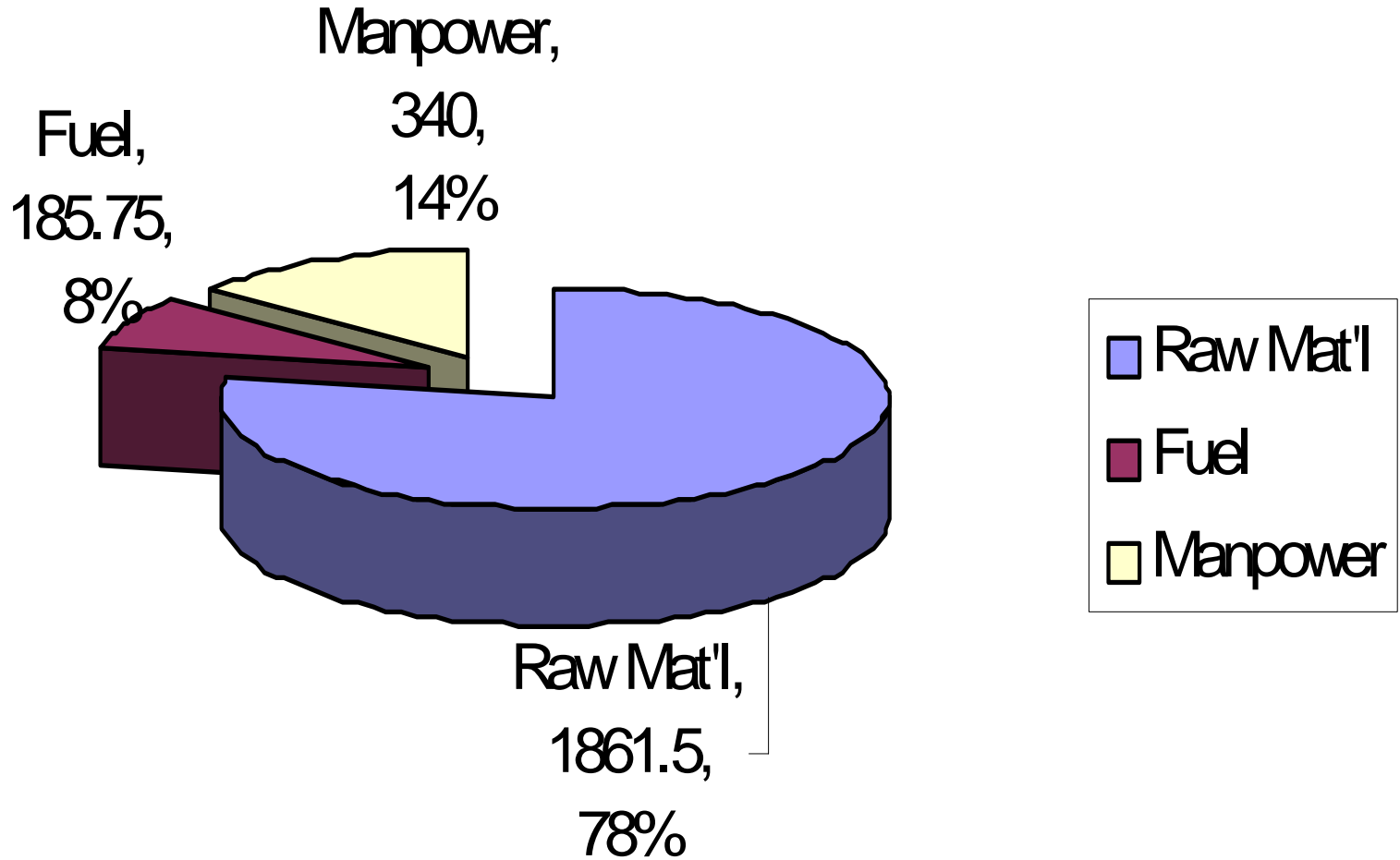
Work Conditions at the unit

- Bare flooring
- Cramped and Unhygienic - Average unit size is 10 ft * 15 ft
- Heat and smoke inside the unit
- Working hours involves physical work
- Low quality fuels
- No Pollution control system
- Complete absence of occupational safety

PUFFED RICE FLOW SHEET



ECONOMICS OF THE UNIT



VARIOUS SCENARIOS

	Scenario -1	Scenario -2	Worst Scenario
Per Batch	-1	-2	
Raw Material cost (Rs.)	1650	2250	2250
Produce cost (Rs.)	2800	2800	2520
Profit/Loss (Rs.)	412	-187	-467

Running of puffed rice units are completely demand driven and fierce competition exists and product price cannot be increased

WHY CHEAPER FUELS ARE USED

- The cost of Raw material (Paddy) and Produce is determined by Market and hence not flexible
- Labour expenses to certain extent and fuel costs are flexible for the unit owner
- To cope with such fluctuations in raw material costs and maintain the margin, use of cheaper fuels and depression in wages appears to be the ways out.
- The economics of the situation does not permit easy spaces for introduction of investment oriented technologies and institutions.

Expectations of the unit owners

- The single unit owners prefers very low cost interventions (preferably in the range of Rs.2000)
- No harassment from authorities
- For high cost interventions, subsidies are expected
- Month wise small contributions are preferred rather than one time expenditure
- Practical demos are expected for every intervention
- Ready to shift to other fuels if consistent supply is there at reasonable costs

ENVIRONMENTAL DIAGNOSIS

Methodology adopted

- Household & individual survey to assess the socio economic status
- Focus group discussion with major stake holders
- (Workers, Owners, Pollution control board authorities, Public, Municipal Authorities, Local leaders)
- Assessment of exposure to particulates
- (Micro environmental monitoring & Time activity survey)

Environmental monitoring

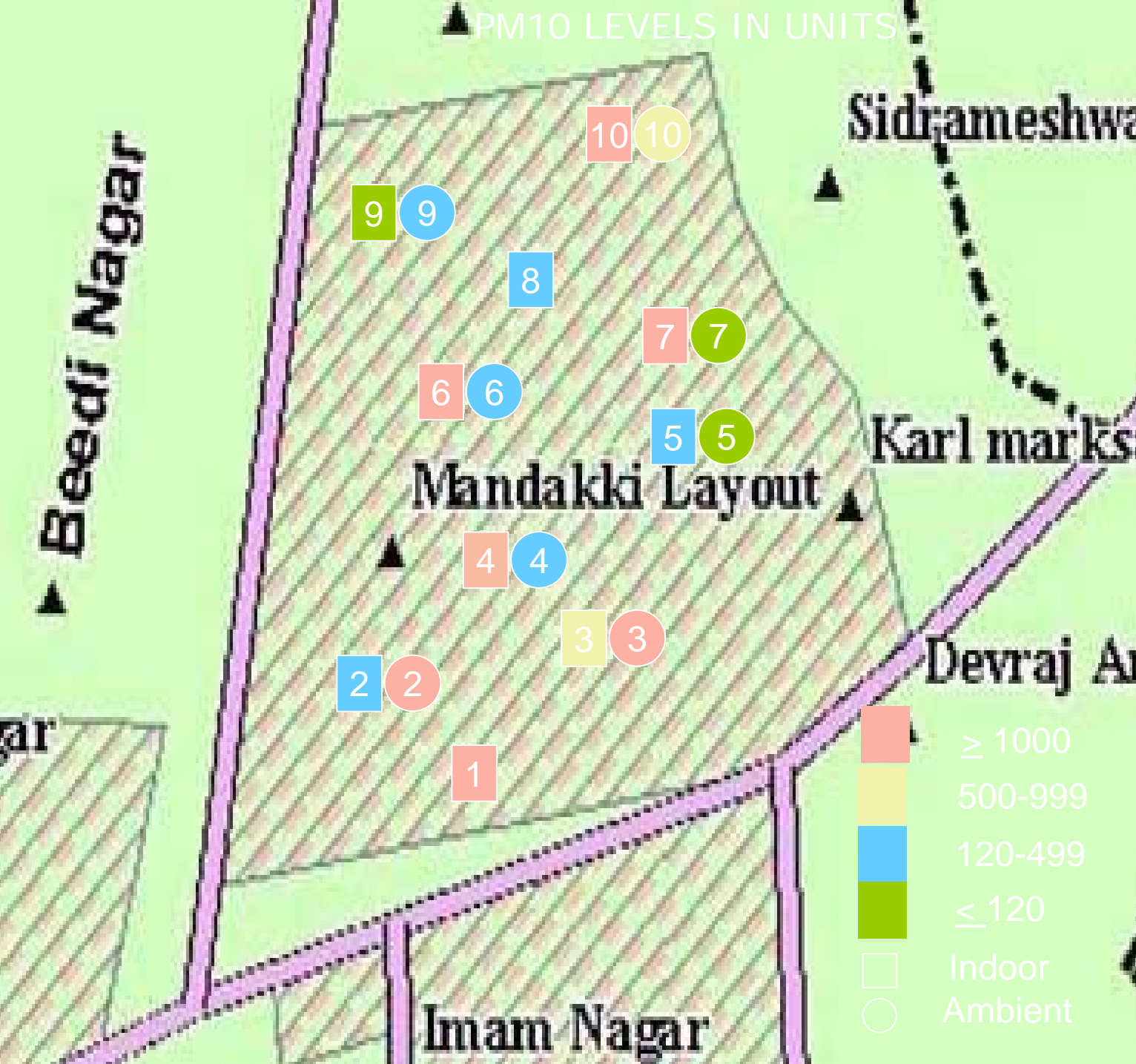
- Sample
 - Households (41 nos)
 - Unit (10 nos)
- Pollutant parameter:
 - PM 10:
 - CO
 - PM 2.5
- Instruments used:
 - PM 10: Personal sampler pumps for area wide monitoring
 - CO: CO monitors with data logger
 - PM 2.5: UCB monitors

Integrated exposure calculations

- **Micro environments:** studied were:
 - **Households:**
 1. Kitchen
 2. Living room
 3. Ambient
 - **Unit:**
 1. Inside the unit
 2. Ambient out side the units.
- **Integrated exposures:**
$$E_i = \sum_{j=1}^3 C_j t_{ij}$$

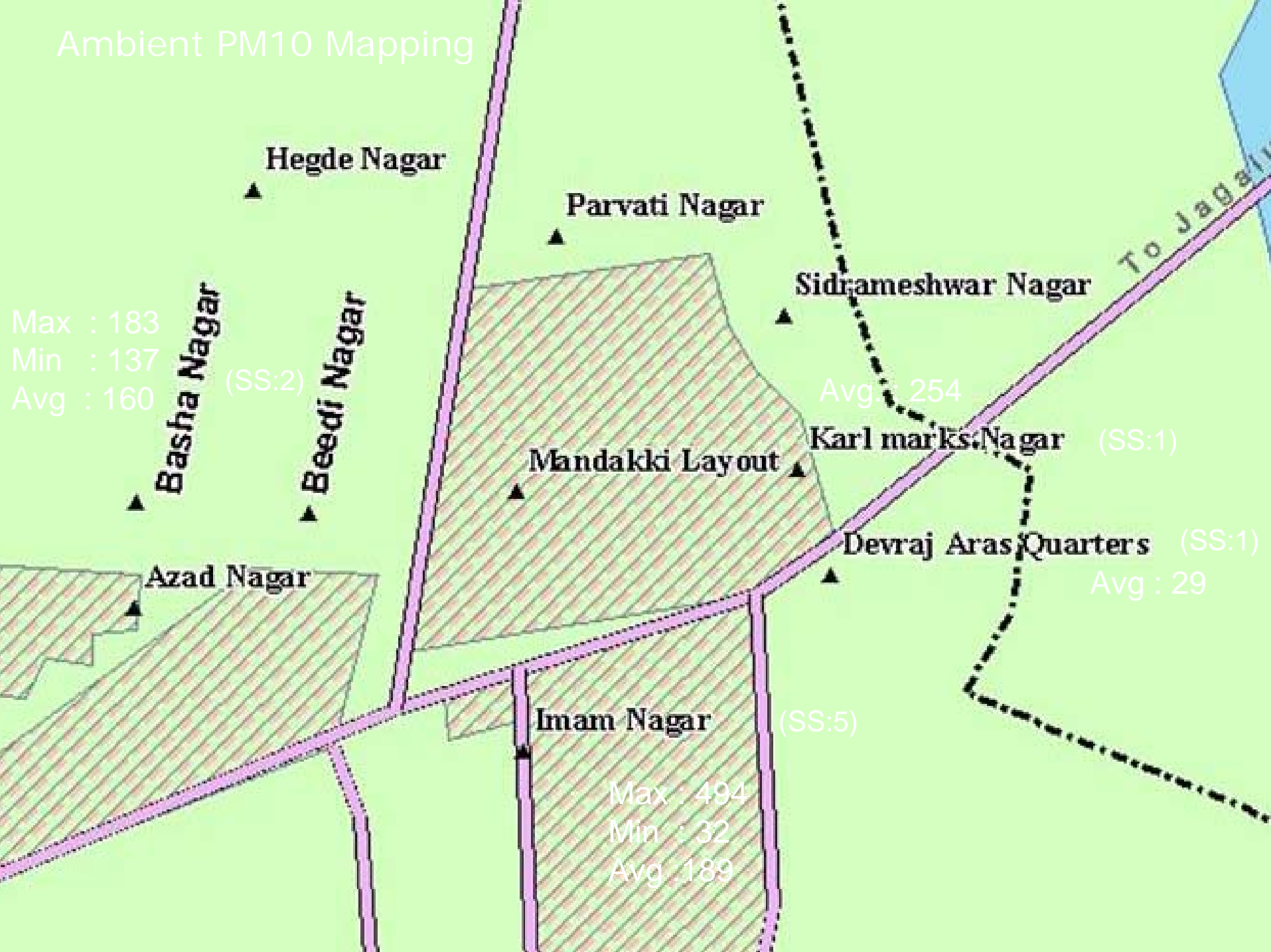
Where E_i is the daily integrated exposure of the i th age group ($\mu\text{g h m}^{-3}$), C_j is the concentration of RSPM in the j th microenvironment. and t_{ij} is the time spent by the i th age group in the j th micro-environment.

PM10 LEVELS IN UNITS



Unit	PM 10(ug/m3)	
	Indoor	Ambient
1	1237	NA
2	454	572
3	785	1000
4	1208	137
5	238	43
6	2868	297
7	1708	20
8	167	NA
9	123	186
10	1273	869
Av g	1006	510

Ambient PM10 Mapping

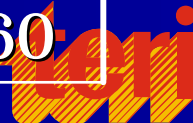


Particulate (PM10) Conc. Puffed Rice Unit

PM 10 Unit 2 micro Env:	Unit indoor (ug/m3)	Unit ambient (ug/m3)
Avg	<u>1006</u> (n=10)	<u>510</u> (n=7)
Max	2868	1000
Min	123	137
No of sample values deleted	-	2
NAAQS for residential areas		24hrs: 100 Annual: 60

Particulate (PM 10) concentration in Households (Community)

Pm 10 Conc. Community/HHs	Kitchen (ug/m3)	Living room (ug/m3)	Ambient (ug/m3)
Avg	274 (n=39)	275 (n=5)	130 (n=7)
Max	1039	436	276
Min	43	67	19
Initial No. of samples	40	6	9
No of sample values deleted	1	1	2
NAAQS for residential areas			24hrs: 100 Annual: 60



EXPOSURE RESULTS FOR UNIT WORKERS

Exposure ug/m3h	Puffer	Helper 1	Helper 2
Avg	442 (n=12)	450.69 (n=6)	426.84 (n=10)
Max	698.54	563.95	681.72
Min	219	354	250.65
Hours spent (hrs)	3.95 hrs	3 hrs	3.5 hrs
Indoor unit			
Outdoor unit	7.04 hrs	7 hrs	7.3 hrs
Indoor home	13 hrs	13.8 hrs	13.2 hrs

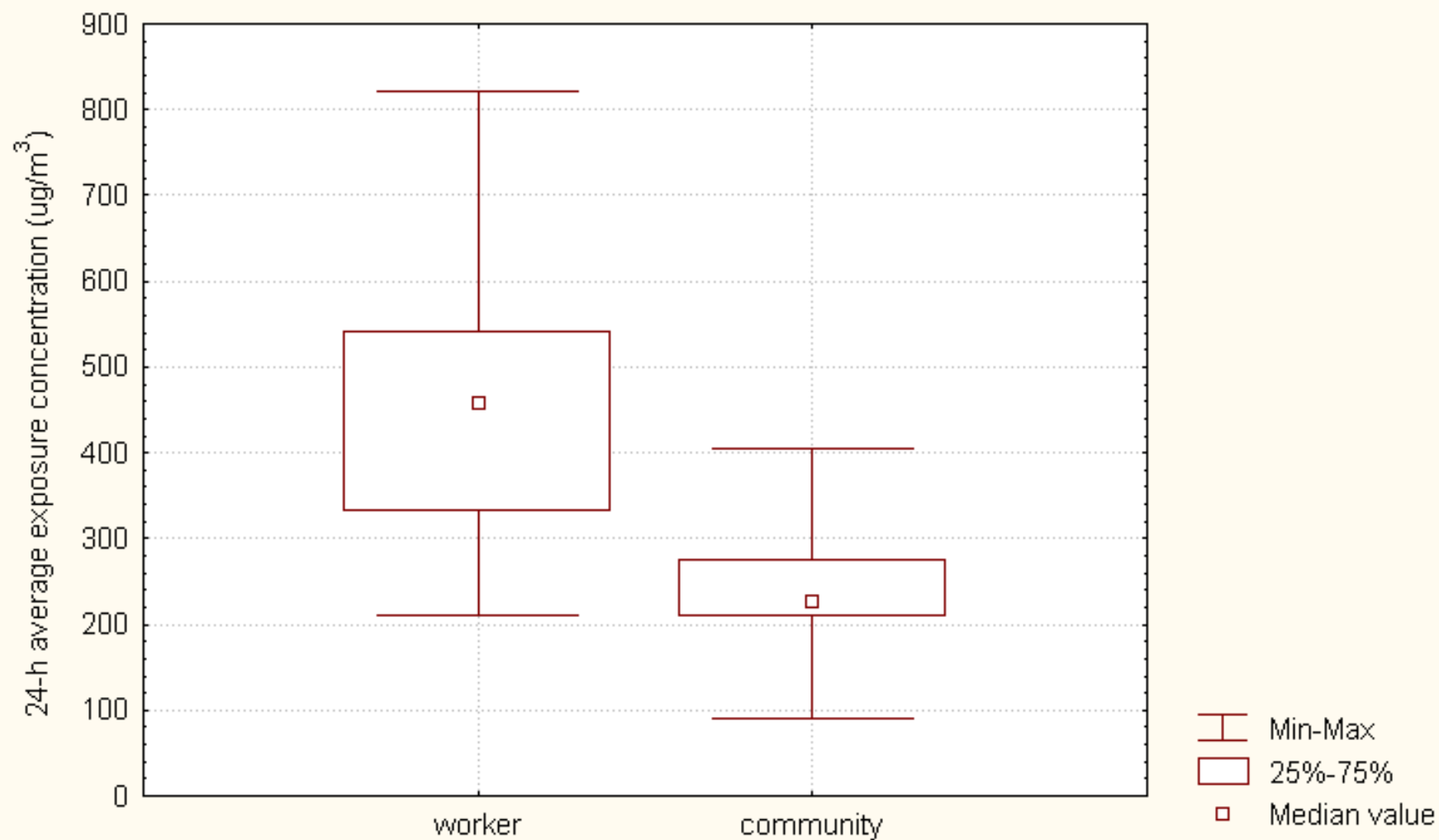
24 –h mean exposure concentration of RSPM

Age category	Mean 24h exposure concentration of RSPM ($\mu\text{g}/\text{m}^3$)	
	Male	Female
Workers		
<14 y	n=0	n =0
14-60 y	444 \pm 147 (n= 53)	493 (n=1)
>60 y	491 \pm 103 (n=2)	n=0
Community		
<14 y	227 \pm 39 (n=34)	239 \pm 29 (n=26)
14-60 y	214 \pm 43 (n=91)	264 \pm 49 (n=80)
>60 y	248 \pm 32 (n=4)	275 (n=1)

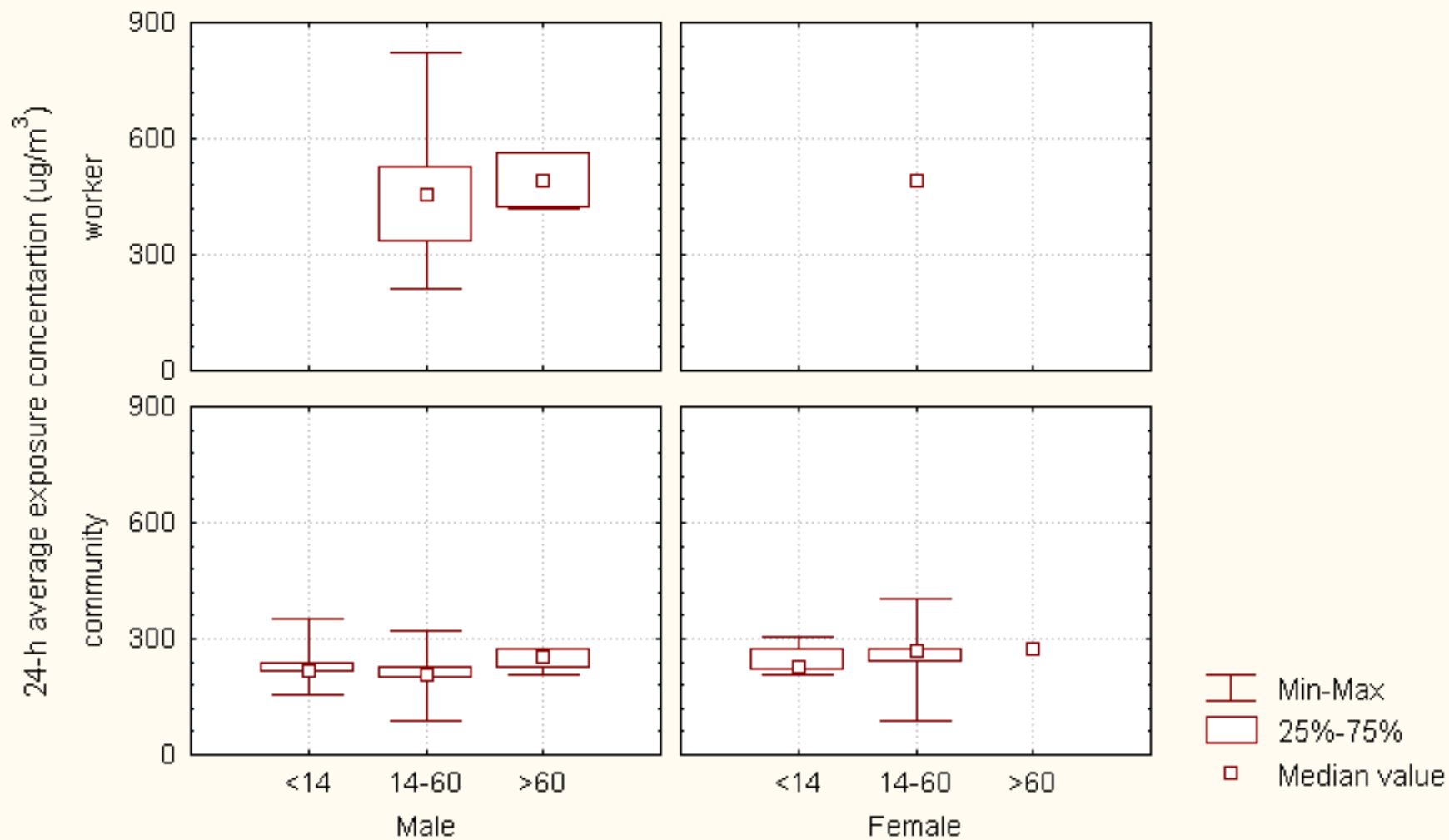
Values are mean \pm SD; n = sample size

Total sample size = 292

24-h average exposure concentration for worker & community



24-h average exposure concentration accross population sub categories



QA/QC procedures followed

Field Personnel:

- Qualified and trained field assistants were involved
- Regular reporting
- Maintain observation and log book
- Field assistants were trained and provided with Standard operating procedure (SOP)

QA/QC contd...

- In the laboratory:
- Standard protocol for operation and maintenance
- Proper calibration of air samplers
- Conditioning and weighting of filters in the lab
- Standard coding of filter and cyclone
- Two blanks (field and lab blank) for a batch of 20 filter
- Minimum of two weights for each filter weighing
- Weighing done in a micro balance with 1 μ g accuracy
- Balance calibrated with standards
- Maintain filter weighing data entry in a log book
- Spot checks on filter weights done
- Filter stored in a filter cassette and transported

QA/AC contd...

- In the Field :
- Flow rate measurements and checks carried out
- Air samplers were calibrated before and after each experiment
- Follow set protocol in placing equipments
- Maintain log book and observation notes
- Use of standardized questionnaire
- Fill in the monitoring log sheet when placing the equipment.
- Post monitoring log book and time activity budget carried out.
- Data entry were cross checked and cleaned before analysis

Limitations in exposure assessment

- Only 4 micro environments namely SME workplace, kitchen, indoor living and ambient were considered
- Cooking exposure is done for 24 hours due to logistics; however in reality cooking is done for a shorter period (2 to 4 h/per day). As a result reported cooking micro env concentration and women exposure are on conservative side
- Other micro environment namely schools, and Jobs other than SME were not measured; so ambient values were used as surrogate

Limitations of pilot study

- Short duration of the study
- Small sample size but significance shown
- Focus on air pollution specifically on particulates.
- Limited information on other risk factors
- Certain important parameters like heat, Silica & Ergonomics was not included in the pilot
- Some of the other worker groups like the common huller units and roaster units were not monitored for their pollution levels and associated exposures.
- No data on real time monitoring so peak exposure not captured
- Baseline information collected for a small exposure assessment study
- Risk management could not be covered in the pilot study

EPIDEMIOLOGICAL DIAGNOSIS

Epidemiological Diagnosis

Objective of the component

To assess the status of health and thereby health and well being of the puffed rice community using ecosystem approach.

Methodology:

- Detailed clinical history with special emphasis on
 - respiratory symptoms
- General and systemic examination
- Pulmonary function tests

Health status of community & workers

- Health status of the households
- Health status of the Workers in Puffed rice units
- Common health problems of the community (As observed in the health camps)

Health status of the households

- Locomotor system(19.29%)
- Respiratory system(17.54%)
- Gastrointestinal system (12.28%)
- Eyes(4.67%)
- Skin (2.33%)
- Cardiovascular system(1.16%).

Health status of the households

Respiratory disorders

- Common respiratory disorders : Chronic bronchitis, COPD
- Respiratory disorders were highest in the age group 15-30 years (39.1%) followed by 0-14 years (34.8%)
- Upper respiratory infections were common among children
- Chronic bronchitis, COPD were common among adults in the age group of 15-45 years

Health status of the households

Other problems

- Among individuals with anaemia, 53% is constituted by children
- About 60% of gastrointestinal disorders are seen in children

Respiratory disorders were seen among 5.6% of cases among women

- Among the individuals with disorders who work in bhatti, 60% had disorders of locomotor system

Health status of the households

Pulmonary function tests

- 23% had restrictive pulmonary function
- Among individuals with restriction, 17.2% had mild restriction, 2.2% had moderate restriction, 1.1% had severe restriction and 3.25% had combined obstructive and restrictive defect
- Among 22 individuals who had restrictive function, 14 individuals (64%) were females.

Health status of Unit workers

- Locomotor system(18.8%)
- Respiratory system(12.5%)
- Eyes(6.25%)
- Skin (6.25%)
- Cardiovascular system(4.2%)
- Gastrointestinal system (4.2%)
- 33% workers were apparently healthy

Health status of Unit workers

- Larger proportion of workers with locomotor system disorders in the age group of 15-30 years..
- 30-45 years is the most affected age group for respiratory system
- The common disorders affecting respiratory system were chronic bronchitis, pulmonary tuberculosis.
- Anaemia was found to be another common disorder (12.5%) among the workers. Male workers and female workers are equally affected by anaemia.
- Common skin disorders observed were pyoderma, fungal disorders, nutritional deficiency disorders etc.
- Disorders of cardiovascular system, (6.3%), Eye (3.1%) and central nervous system (3.1%) were less common.

Health status of Unit workers

- Gender wise distribution of medical disorders show that disorders of locomotor system, skin diseases, disorders of cardio-vascular system are exclusively seen in males.
- But disorders of respiratory system and anaemia are seen in both males and females.
- Physical strain and increased activity might be responsible for the disorders exclusively in males

Health status of Unit workers:PFT

- Pulmonary function tests were done on 47 puffed rice sector workers
- 17% of workers had restriction in lung function
- 12.8% of workers had mild restriction
- 2.1% of workers had moderate restriction
- 2.1% had continued defect (obstruction and restriction)

Health status :Report from health camp(318 individuals)

- Respiratory system (32.2%)
- Gastrointestinal system (18.8%)
- Locomotor system (16.2%)
- Skin(5.4%)
- Cardiovascular system(3.5%)
- Eyes(2.9%)

Health status :Report from health camp(318 individuals)

- Majority of respiratory problems were seen in children (55.4%)
- Majority of locomotor system complaints in the age group more than 30 years (60.8%).
- Most of Gastrointestinal disorders which were seen in children (40.7%)
- Disorders of respiratory system were more common among females
- Disorders of locomotor system were more common in males

Interlinkages: Chi-square tests

- No statistical significant association between

 - Age groups Vs illness

 - Gender Vs illness

 - Occupation Vs illness and illness

 - Exposure level Vs illness

- Population Subgroups are very small in this sample

- Need for bigger sample size for identification of groups at risk for intervention plans

- Reported illness are much higher than the observed illness

Comparison in %	Hhs	Worker s	Health camp
Locomotor system	19.29	18.8	16.2
Respiratory system	17.54	12.5	32.2
Gastrointestinal system	12.28	4.2	18.8
Eyes	4.67	6.25	2.9
Skin	2.33	6.25	5.4
Cardiovascular system	1.16	4.2	3.5

- There is not much difference between community and puffed rice sector workers
- Locomotor system, Respiratory system and Gastrointestinal system are main problems
- Even with higher concentration of SPM, workers and community level respiratory illness similar