

Impact of Rehabilitation and Compensation on Socio-Economic Status of Gas Victims

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ABSTRACT

The industrial disaster took place in Bhopal in the year 1984 was one of the biggest and worst industrial disaster mankind has ever seen which has killed around 5000 people, leaving thousands of morbidities and permanent disabilities among the people. The company, UCIL involved has given a compensation amount of \$470 million as relief after intervention of Supreme Court of India which was very less for the damage done. Government has instantly started relief and rehabilitation measures like medical facilities, supply of pure drinking water, training and skill development for the family members so that they can start some work or get some employment. Over a period of time it was assumed that the amount received as compensation and various relief and rehabilitation measures has helped victim families to overcome from disaster. This study has been conducted to know the impact of compensation and rehabilitation over socio-economic status of victim families by performing a field survey. This study shows that a lot of families now become economically sound but still lot of work has to be done for the people and people still suffering.

Key words – Methyl Isocyanate, Socio-economic, Rehabilitation, Disaster, Lifestyle

I INTRODUCTION

Bhopal, the capital of Madhya Pradesh, situated at an altitude of 505 Meter above the sea level covers a total area of 284 sq.kms with a density of population of around 2355.2/sq km. According to the 1981 census the population of Bhopal was 6.72 lakh and was divided into 56 Municipal wards. Presently there are 85 wards. On the midnight of 2nd and 3rd December 1984, more than 40 tons of methyl isocyanate gas leaked from tank no. 610 of Bhopal based pesticide plant of Union Carbide of India Limited, immediately killing at least 3,800 people and causing significant morbidity and premature death for many thousands more. A disaster of such great magnitude caused by sudden release of Methyl Isocyanate or rather a mixture of Methyl Isocyanate and other toxic reaction products called Toxic gas(s) into a thickly populated area is unparalleled in the history of mankind. The gas(s), on the cold winter night, entered the residential areas stunning the residents with unbearable respiratory symptoms, severe irritation of eyes, photophobia and blepharospasm. Immediately relief measures were provided. Situation was handled in the best possible way. The company involved in what became the worst industrial and environmental accident in history immediately tried to dissociate itself from legal responsibility. Eventually it reached a settlement with the Indian Government through mediation of country's Supreme Court and accepted the moral responsibility. It paid \$470 million in compensation, a relatively small amount of based on significant underestimations of the long-term health consequences of exposure and the number of people exposed. The state govt. also came up with immediate relief of pro-rata compensation to all those affected and introduced many rehabilitation packages to affected population so as to come over the disaster. Death compensations, compensations for chronic

illnesses have been distributed. Later on, several rehabilitation measures have been undertaken by the state government for the gas victim families so that they should overcome from the disaster and will become economically independent and come in the mainstream. The one question that needs to be answered is whether – (i) these compensation/rehabilitation packages has gone into the right hands ; (ii) whether these have really helped the people in the improvement of their living conditions, their occupational betterment, educational status, the improvement in the economy of Bhopal , an attempt through this study would be made to answer these questions.

II OBJECTIVE OF THE STUDY

The objective of this study is to assess the impact of rehabilitation, compensation and relief measures on the socio-economic status of the gas victim families over a period of 30 years.

(a) Hypothesis

Based on the objective of the study and literature reviewed, following hypothesis has been developed:

- (i) **H01:** There exist no significant differences in earnings of the affected families over 30 years of time.
- (ii) There exist no significant differences in the housing and infrastructure facilities of the affected families over 30 years of time.
- (iii) **H03:** There exist no significant differences in educational status of the children of affected families over 30 years of time.
- (iv) There exist no significant differences in health and treatment status of the affected families over 30 years of time.
- (v) There exist no significant differences in the possession of assets by the affected families over 30 years of time.

- (vi) There exist no significant differences in the economic status and savings of the affected families over 30 years of time.

III METHODOLOGY

The aim of this study is to know the impact of rehabilitation, compensation and relief measures adopted by the government over the socio-economic condition of the gas victim families over a period of 30 years. A sample of 200 severely affected and 200 moderately affected families has been drawn using quota and convenience sampling techniques and primary data has been collected through extensive field work and one to one contact with the families with the help of a self-structured questionnaire. The

questionnaire is designed on the basis of previous studies done for assessing the socio-economic status of the population, under the guidance of supervisor. Reliability and validity of designed instrument has been checked through pilot survey on 10% of the sampled population. The data collected is analysed with the help of statistical software SPSS 21.

IV ANALYSIS OF DATA & DISCUSSION

From the given table 1, it can be clearly observed that the sample population is skewed towards male population at about 64% indicating the greater participation by male diaspora whereas female respondents are only 35%.

Table 1
Demographic profile of the respondent (n=400)

	Particulars	Frequency	%		Particulars	Frequency	%
Gender	Male	257	64.3	Type of Occupation	Govt. Employee	89	22.2
	Female	143	35.8		Private Employee	171	42.8
Age	Upto 25	31	7.8	Self-employed	87	21.7	
	26-30	61	15.3	Others	53	13.3	
	31-35	87	21.8	Religion	Hindu	339	84.8
	36-40	168	42		Muslim	21	5.3
	Above 40	53	13.3		Christen	24	6
Marital Status	Married	248	62	Others	16	4	
	Unmarried	93	23.3	Social Status	ST	31	7.8
	Separated	25	6.3		SC	98	24.5
	Divorced	12	3		OBC	127	31.8
	Widowed	22	5.5		General	144	36
Primary	31	7.7	Nature of Family		Nuclear	284	71
High School	57	14.3		Joint	116	29	
Literacy	Higher Secondary	89	22.3	Size of the family	Up to 3 Members	52	13
	Graduate	174	43.5		4 - 5 Members	112	28
	PG & Above	49	12.2		5 - 6 Members	120	30
					Above 6 Members	116	29

It was also found that majority of the respondents are in the age group of 31 - 40 years (about 64%) and are married (62%) whereas as some are unmarried (23.3%) and very few are separated (6.3%), divorced (3%) or widowed (5.5%). The sample has also the largest chunk of respondents as graduate (43.5%) and higher secondary (22.3%) whereas some have education up to high school (14.3%) or primary level (7.7%) and very few of them have education level of PG & above (12.2%). The sample consist of majority of service class people in which around 42.8% people were in private jobs whereas about 22.2% were in government jobs and some were doing business (21.7%). Religion wise the study area is dominated by Hindus (85%) followed by Christen community (6%). Majority of group members belongs to General

category with 36% followed by OBC at 32%, SC at 24.5% and ST at 7.8%. Majority of respondents have nuclear families (71%) with family size of more than 4 members (89%). Overall the sample for study is a fair representation of the population since the study was conducted mainly among the households who were majorly affected in the disaster of 1984.

- (i) **H01: There exist no significant differences in earnings of the affected families over 30 years of time.**

Table 2 presents the monthly income aspects of affected people at the time of accident and today's scenario and a gradual shift in terms of raised income was seen clearly.

Table 2
Monthly income status of the people
STATUS OF MONTHLY INCOME

Before 1985			By 2015		
Particulars	Frequency	%	Particulars	Frequency	%
Below 15,000	338	84.5	Below 15,000	177	44.3
15,001 - 30,000	42	10.5	15,000 - 30,000	138	34.5
30,001 - 45,000	20	5	30,001 - 45,000	50	12.5
Above 45,000	-	-	Above 45,000	35	8.7

Wilcoxon rank test on income status at 1985 and 2015 was performed and it was found that none of the respondents moved to negative ranks whereas about 218 respondents were moved to higher ranks and about 182 respondents were on the same ranks.

This shows that income of 218 people has been raised significantly over a period of 30 years whereas income of around 182 people is still on the same level.

Table 3
Wilcoxon rank test (Earnings in 1985 and 2015)
Ranks

	N	Mean Rank	Sum of Ranks
Status of monthly income 2015 - Status of monthly income 1985			
Negative Ranks	0 ^a	.00	.00
Positive Ranks	218 ^b	109.50	23871.00
Ties	182 ^c		
Total	400		

a. Status of monthly income 2015 < Status of monthly income 1985

b. Status of monthly income 2015 > Status of monthly income 1985

c. Status of monthly income 2015 = Status of monthly income 1985

Table 4
Test statistics of Wilcoxon rank test (Earnings in 1985 and 2015)
Test Statistics^a

	Status of monthly income 2015 - Status of monthly income 1985
Z	-13.743 ^b
Asymp. Sig. (2-tailed)	.000

- Wilcoxon Signed Ranks Test
- Based on negative ranks.

By examining the final **Test Statistics** table, it was found that there is a significant change in earnings of the people over a period of 30 years ($p = 0.000$). Based on the change in median value (Pre = 1.000, Post = 2.000) and Z score statistics ($Z = -13.743$, $p = 0.000$) it was concluded that there is a statistically positive significant change in the earnings of people over 30 years of time from 1985 to 2015 which shows that people were earning much more money as compared to previous time.

(ii) H02: There exist no significant differences in the housing and infrastructure facilities of the affected families over 30 years of time.

On assessing the status of the ownership of the house in past and current scenario by the affected people, it was found that previously majority of people use to live on rent (51.5%) whereas some possess their own house (46.3%) and very few of them use to live in house of others. Over a period of 30 years, the scenario is found changed where majority of people now possessed their own house (59.8%) whereas some still lives in rental houses (37%) and in others house as well (3.3%). A change in percentage has been seen which may be the result of rise in the family monthly income.

Table 5
Ownership status of the house
OWNERSHIP STATUS OF HOUSE

Before 1985			By 2015		
Particulars	Frequency	%	Particulars	Frequency	%
Rental	206	51.5	Rental	148	37
Owner	185	46.3	Owner	239	59.8
Living in others house	9	2.3	Living in others house	13	3.3

Wilcoxon Signed Ranks Test and Chi-square is used to assess the changes in the ownership status of the house of the affected families over a period of 30 years. We can see from the table's legend that none of the respondents have been moved to negative rankings from higher rankings from the period of

1985 to 2015 whereas 58 people have found a positive significant in ownership of the house and 342 respondents were found with no significant change in their ownership status of the house from the period of 1985 to 2015.

Table 6
Wilcoxon rank test (Ownership of house in 1985 and 2015)
Ranks

	N	Mean Rank	Sum of Ranks
Negative Ranks	0 ^a	.00	.00
Positive Ranks	58 ^b	29.50	1711.00
Ties	342 ^c		
Total	400		

a. Ownership of house 2015 < Ownership of house 1985
b. Ownership of house 2015 > Ownership of house 1985
c. Ownership of house 2015 = Ownership of house 1985

Table 7
Test statistics of Wilcoxon rank test (Ownership of house in 1985 and 2015)
Test Statistics^a

	Ownership of house 2015 - Ownership of house 1985
Z	-7.390 ^b
Asymp. Sig. (2-tailed)	.000

- Wilcoxon Signed Ranks Test
- Based on negative ranks.

By examining the final **Test Statistics** table, it was found that there is a significant change in ownership status of the affected families over a period of 30 years ($p = 0.000$). Based on the change in median value (Pre = 1.000, Post = 2.000) and Z score statistics ($Z = -7.390$, $p = 0.000$) it was concluded that there is a statistically positive significant change in the ownership of house by the affected families over 30 years of time from 1985 to 2015 which shows that more number of families were living in their own house rather than living on rent or in others house.

(iii) **H03: There exist no significant differences in educational status of the children of affected families over 30 years of time.**

On analyzing the educational aspect of the affected family, it was found that majority of affected families have two or more children when this accident has took place (60.1%) whereas some families has only one child (15.5%). Among these 302 families who have children at their home, two or more children were studying in school and colleges (40.3%) whereas children of 43% families were not studying anywhere.

Table 8
Number of children in family and attending school/colleges

Particulars		Frequency	Percent
Children in family at the time of accident	Nil	98	24.5
	One	62	15.5
	Two	99	24.8
	More than two	141	35.3
How many of them were attending school/colleges at the time of disaster	Nil	172	43
	One	67	16.8
	Two	117	29.3
	More than two	44	11

While assessing the impact of disaster on the educational status of the suffered families, it was found that children of majorities of families were enrolled in government school and institutes (89%) whereas only few families will able to send their children in private school and institutes (11%). After some time of accident, majority of families has sent

their children to private schools and institutes for study (60.6%) whereas some families still continue to send their children to government school and institutes (39.4%). The reason behind this change can be the amount received by the suffered families in form of compensation which makes families able to give better education to their children.

Table 9
Education status of the children
EDUCATION STATUS

Before Accident			After Accident		
Particulars	Frequency	%	Particulars	Frequency	%
Govt. School/Inst.	203	89	Govt. School/Inst.	90	39.4
Private School/Inst.	25	11	Private School/Inst.	138	60.6

Wilcoxon Signed Ranks Test and Chi-square is used to assess the differences in the educational status of the children of the affected families over a period of 30 years. We can see from the table's legend that only 1 respondent have been moved to negative rankings from higher rankings from the period of 1985 to 2015

whereas 114 people have moved to positive rankings showing the significant changes in educational status of the children and 113 respondents were found with no significant change in the educational status of the children from the period of 1985 to 2015.

Table 10
Wilcoxon rank test (Educational status in 1985 and 2015)

		N	Mean Rank	Sum of Ranks
Where are they studying 2015 - Where are they studying 1985	Negative Ranks	1 ^a	58.00	58.00
	Positive Ranks	114 ^b	58.00	6612.00
	Ties	113 ^c		
	Total	228		

a. Where are they studying 2015 < Where are they studying 1985

b. Where are they studying 2015 > Where are they studying 1985

c. Where are they studying 2015 = Where are they studying 1985

Table 11
Test statistics of Wilcoxon rank test (Educational status in 1985 and 2015)
Test Statistics^a

	Where are they studying 2015 - Where are they studying 1985
Z	-10.537 ^b
Asymp. Sig. (2-tailed)	.000

- Wilcoxon Signed Ranks Test
- Based on negative ranks.

By examining the final **Test Statistics** table, it was found that there is a significant change in the educational status of the children of the affected families over a period of 30 years ($p = 0.000$). Based on the change in median value (Pre = 1.000, Post = 2.000) and Z score statistics ($Z = -10.537$, $p = 0.000$) it was concluded that there is a statistically positive significant change in the educational status of the children of the affected families over 30 years of time from 1985 to 2015 which shows that more number of families were now sending their children to private school and institutes for better education.

Analysis of medical treatment aspects reports that majority of people immediately after the accident by during the period of 1985 used to visit government hospitals for their treatments (67.75%) whereas some visit private hospitals (22.75%) and few used to get treatment either in private nursing homes (6.25%) or by private physicians at their clinics (3.325%). By 2015, a drastic change in the preferences of people have been recorded which may be the result of increase in family income and degrading quality of government facilities where only some people use to get treatment from government hospitals (21.75%) whereas as majority of people prefers private doctors either in private hospitals (24.5%), nursing homes (20.5%) or at the private clinics (33.25%).

(iv) **H04: There exist no significant differences in health and treatment status of the affected families over 30 years of time.**

Table 12
Medical treatment status
MEDICAL TREATMENT

Before 1985			By 2015		
Particulars	Frequency	%	Particulars	Frequency	%
Government Hospitals	271	67.75	Government Hospitals	87	21.75
Private Hospitals	91	22.75	Private Hospitals	98	24.5
Private Nursing Homes	25	6.25	Private Nursing Homes	82	20.5
Private Physicians Clinics	13	3.25	Private Physicians Clinics	133	33.25

Wilcoxon Signed Ranks Test and Chi-square is used to assess the differences in the health and treatment status of the peoples of the affected families over a period of 30 years. We can see from the table's legend that none of the respondents have been moved to negative rankings from higher rankings from the

period of 1985 to 2015 whereas 268 people have moved to positive rankings showing the significant changes in health and treatment status of the affected families and 132 respondents were found with no significant change in the health and treatment status from the period of 1985 to 2015.

Table 13
Wilcoxon rank test (Health and treatment status in 1985 and 2015)

		Ranks		
		N	Mean Rank	Sum of Ranks
Where do you normally visit for medical treatment 2015 -	Negative Ranks	0 ^a	.00	.00
	Positive Ranks	268 ^a	134.50	36046.00
Where do you normally visit for medical treatment 1985	Ties	132 ^c		
	Total	400		

a. Where do you normally visit for medical treatment 2015 < Where do you normally visit for medical treatment 1985

b. Where do you normally visit for medical treatment 2015 > Where do you normally visit for medical treatment 1985

c. Where do you normally visit for medical treatment 2015 = Where do you normally visit for medical treatment 1985

Table 14

Test statistics of Wilcoxon rank test (Health and treatment status in 1985 and 2015)
Test Statistics^a

	Where do you normally visit for medical treatment 2015 - Where do you normally visit for medical treatment 1985
Z	-14.429 ^b
Asymp. Sig. (2-tailed)	.000

- Wilcoxon Signed Ranks Test
- Based on negative ranks.

By examining the final **Test Statistics** table, it was found that there is a significant change in the health and treatment status of the affected families over a period of 30 years ($p = 0.000$). Based on the change in median value (Pre = 1.000, Post = 3.000) and Z score statistics ($Z = -14.429$, $p = 0.000$) it was concluded that there is a statistically positive significant change in the health and treatment status of the affected families over 30 years of time from 1985 to 2015 which shows that more number of families were now visiting to private physicians and nursing homes rather than visiting to government hospitals for their treatment.

(v) **H05: There exist no significant differences in the possession of assets by the affected families over 30 years of time.**

When assessing the economic status of the affected families in terms of possession of assets at the time of 1985 and 2015, it was found that number of people possessing various assets has been significantly increased by 2015 as compared to the time of 1985. McNemar Test and Chi-square is used to assess the differences in the possession of assets by the affected families over 30 years of time.

Table 15
Possession of assets by the people
POSSESSION OF ASSETS

Particulars	Before 1985				By 2015				
	Yes	%	No	%	Particulars	Yes	%	No	%
Own House	187	46.8	213	53.3	Own House	307	76.8	93	23.3
Land	87	21.8	313	78.3	Land	138	34.5	262	65.5
Other Property	38	9.5	362	90.5	Other Property	67	16.8	333	83.3
Jewelry	176	44	224	56	Jewelry	353	88.3	47	11.8
Vehicle (2 Wheeler/ 4 Wheeler)	95	23.8	305	76.3	Vehicle (2 Wheeler/ 4 Wheeler)	387	96.8	13	3.3
Electronic Appliances	128	32	272	68	Electronic Appliances	391	97.8	9	2.3
Home Appliances	82	20.5	318	79.5	Home Appliances	395	98.8	5	1.3
Furniture	311	77.8	89	22.3	Furniture	397	99.3	3	0.8

Table 16
Cross tabulation of Possession of assets by the people between 1985 and 2015

	1985	2015			1985	2015	
		Yes	No			Yes	No
Own House	Yes	172	15	Vehicle (2 Wheeler/4 Wheeler)	Yes	95	0
	No	135	78		No	292	13
Land	Yes	80	7	Electronic Appliances	Yes	128	0
	No	58	255		No	263	9
Other Property	Yes	38	0	Home Appliances	Yes	82	0
	No	29	333		No	313	5
Jewelry	Yes	176	0	Furniture	Yes	311	0
	No	177	47		No	86	3

From the cross tabulation analysis of possession status of various assets by the people in 1985 and 2015, it was found that majority of people has been moved to the positive ranks and none of them has moved to negative ranks means people who have not possessed assets in 1985 has possessed the assets by

2015 but none of the people who has already possessed an asset in 1985 has loosed its possession by 2015. This shows a significant positive and upward movement of the lifestyle and economic status of the affected families over a period of 30 years.

Table 17
Chi square of Possession of assets by the people between 1985 and 2015

	Own House 1985 & Own House 2015	Land 1985 & Land 2015	Other Property 1985 & Other Property 2015	Jewelry 1985 & Jewelry 1985	Vehicle (2 Wheeler/4 Wheeler) 1985 & Vehicle (2 Wheeler/4 Wheeler) 2015	Electronic Appliances 1985 & Electronic Appliances 2015	Home Appliances 1985 & Home Appliances 2015	Furniture 1985 & Furniture 2015
N	400	400	400	400	400	400	400	400
Chi-Square ^b	94.407	38.462	27.034	175.006	290.003	261.004	311.003	84.012
Asymp. Sig.	.000	.000	.000	.000	.000	.000	.000	.000

a. McNemar Test

b. Continuity Corrected

By examining the final **Test Statistics** table, it was found that there is a significant positive change in the possession of all the assets by the peoples 2015 (p = 0.000). Based on the Chi-square statistics it was concluded that there is a statistically positive significant change in the possession of all the assets by the affected families over 30 years of time and

more number of families now possessed all the assets by 2015 as compared to 1985.

(ix) H09: There exist no significant differences in the economic status and savings of the affected families over 30 years of time.

Table 18
Family income assessment of the people

Income Status group	No. of Families	Family Income	
		Average Monthly Family Income	
		1985	2015
Very Poor	122	2500	9300
Poor	55	3250	12750
Lower Middle Income	114	5150	21700
Middle Income	89	10700	33700
Upper Middle Income	20	15600	67500

As per the calculations of family monthly income done and presented in table 18, it was noted that there is a significant change in the monthly income of families belonging to all the income classes from

1985 to 2015 where families of all class were able to earn much more amount as compared to earlier times.

Table 19
Test statistics of Chi-square of Income in 1985 and 2015
Test Statistics

	Average income in 1985	Average income in 2015
Chi-Square	27.871 ^a	57.006 ^b
df	4	4
Asymp. Sig.	.000	.000

- 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 27.8
- 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 63.20

The pre (1985) and post (2015) pattern of income of the affected families were checked using Chi square 'goodness of fit' test and found statistically significant. The Chi square value of the income in 1985 was found $x^2 = 277.871$, $p = 0.000$ and income

by 2015 was found $x^2 = 57.006$, $p = 0.000$. Hence, it is concluded that there is significant differences in the income pattern of the affected families over a period of 30 years.

Table 20
Savings status of the people

SAVINGS

Income Status group	No. of Families	Savings	
		1985	2015
Very Poor	122	300	550
Poor	55	550	900
Lower Middle Income	114	300	1200
Middle Income	89	3200	4700
Upper Middle Income	20	3950	14000

As per the calculations of savings pattern of the affected families done after deducting all the household expenses and presented in table 4.21, it was noted that all the affected families, belonging to different income class, will able to save some money

in both the calculated times. A significant changes has also been observed from the table in the amount of savings done by all the income class families from 1985 to 2015.

Table 21
Test statistics of Chi-square of Savings in 1985 and 2015
Test Statistics

	Savings in 1985	Savings in 2015
Chi-Square	85.309 ^a	163.753 ^b
df	4	4
Asymp. Sig.	.000	.000

- 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 46.3
- 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 105.3

The pre (1985) and post (2015) patter of savings done by the affected families were checked using Chi square 'goodness of fit' test and found statistically significant. The Chi square value of the savings in 1985 was found $x^2 = 85.309$, $p = 0.000$ and savings by 2015 was found $x^2 = 163.753$, $p = 0.000$. Hence, it is concluded that there is significant differences in

the amount of savings done by all the income class of the affect families over a period of 30 years.

V CONCLUSION

An attempt has been made to know the impact of compensation, relief and rehabilitation measures provided by the government to the gas affected families over the period of 30 years. After reviewing all the social and economic aspects and role of rehabilitation schemes on the current status of the affected families, it was found that the compensation amount received by the affected families and rehabilitation schemes will help a lot to the suffered people from overcoming the disaster and in improving their social as well as economic conditions. Today majority of the suffered families were found in much better condition as compared to the condition at the time of disaster. Definitely, rehabilitation measures adopted by the State Government for the welfare of the gas victim families had played a crucial role in bringing these families to the current position. Still, a lot of people were found suffering and no major improvement in their past status has been seen. Hence, it is concluded that the job and responsibility of State government has not over yet and a lot of work has need to be done specially for the poorer section of people to bring them back to the mainstream. New policies need to be crafted for the victim families who till now were not become economically stable and sound.

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